

On the use of chloride of zinc in surgical operations and injuries, and especially in operations for the removal of cancerous tumours / by Campbell de Morgan.

Contributors

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Royal College of Surgeons of England

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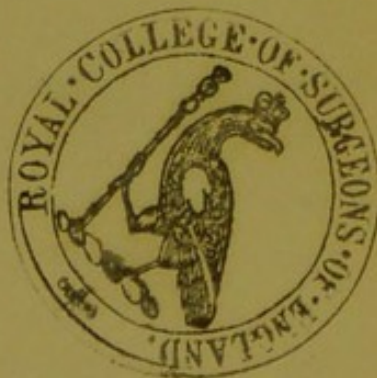
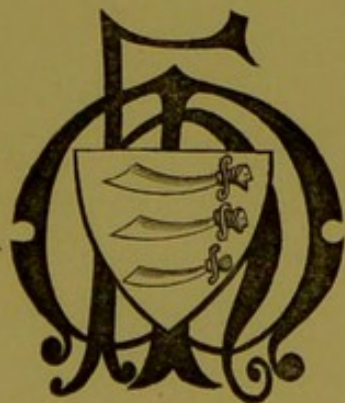
ON THE
USE OF THE CHLORIDE
OF ZINC

IN
SURGICAL OPERATIONS AND INJURIES,
AND ESPECIALLY IN
OPERATIONS FOR THE REMOVAL OF CANCEROUS
TUMOURS.

BY
CAMPBELL DE MORGAN, F.R.S.

SURGEON TO THE MIDDLESEX HOSPITAL,
EXAMINER IN SURGERY TO THE ROYAL COLLEGE OF PHYSICIANS.

*(Reprinted from the British and Foreign Medico-Chirurgical Review
for January, 1866.)*



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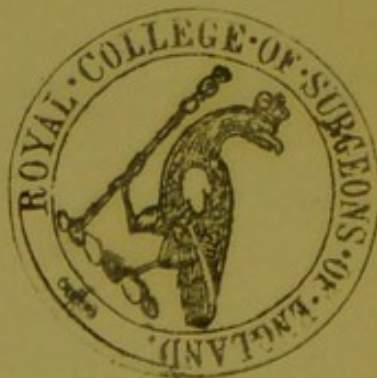
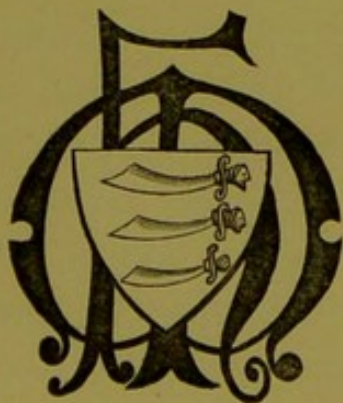
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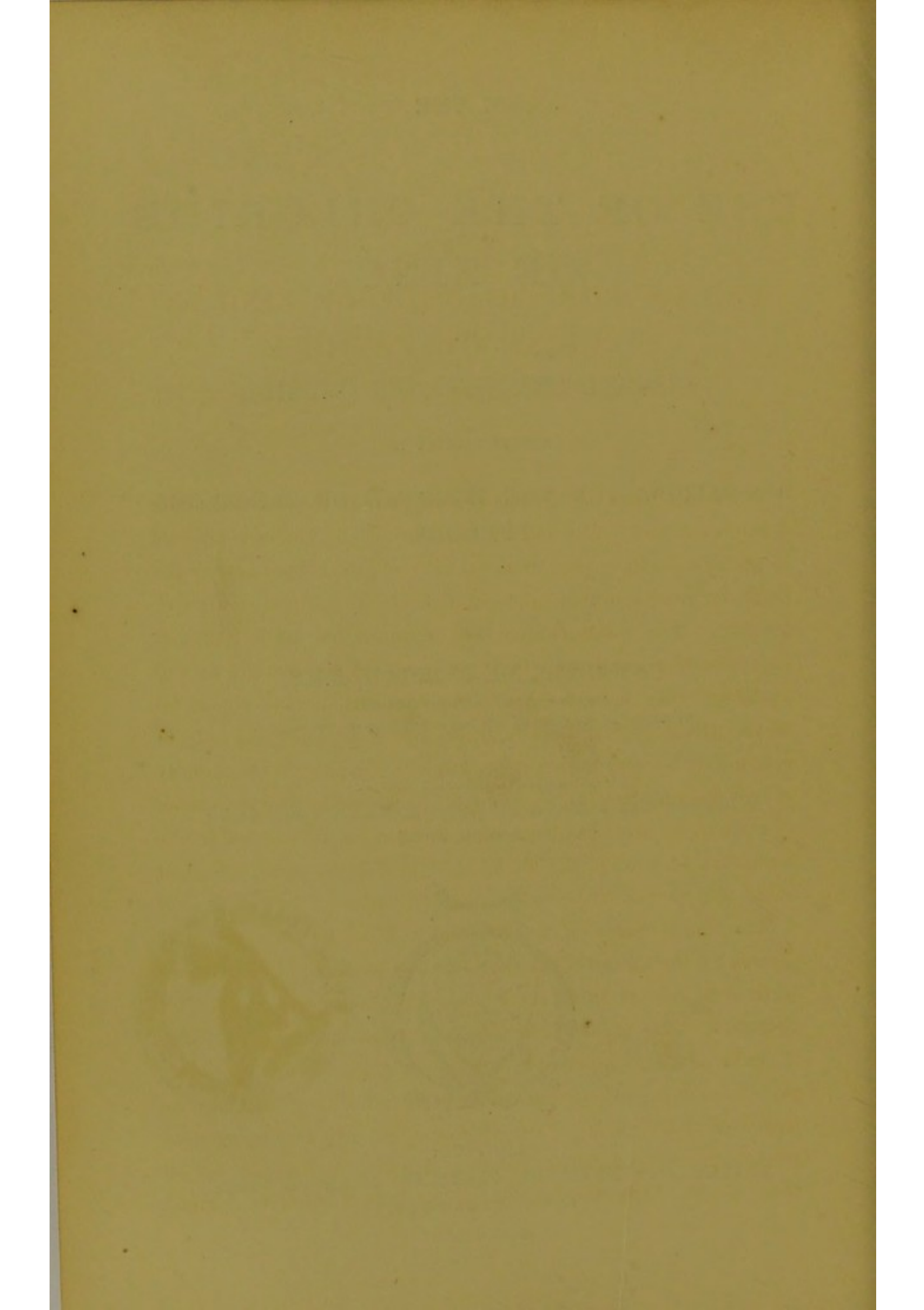
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ON THE
USE OF THE CHLORIDE OF ZINC IN
SURGICAL OPERATIONS,
ETC.

THE subject treated of in this communication is presented under a twofold aspect. The use of the chloride of zinc was adopted in the first instance after removal of malignant tumours by the knife, for reasons which apply exclusively to operations on such growths. The results which were obtained led me to resort to its application in all wounds, those produced accidentally as well as those made in operations. Whether the special object for which it was at first used is attained even partially can only be determined by very long experience, but the general effects have proved so immediately and uniformly beneficial in a large number of cases in which it has been applied, as to satisfy me that in the treatment of wounds the chloride of zinc is an agent of great value, well worthy of careful trial by surgeons.

The cancer wards of the Middlesex Hospital are constantly forcing on the minds of the surgeons the questions, Can nothing be done to remove this fearful disease? Is its recurrence after operation, in the majority of cases, an inevitable necessity? May it not be that the apparent return of the disease is but the continued development of germs which were left behind in the extirpation of the tumour? My colleague, Mr. Moore, has recently given expression to the conclusions at which he has arrived on these points. His conclusions are so important as to demand

the most careful consideration, and, if correct, will reverse the decision on the question of removal, at which a large number of the profession seem to have arrived. I think that his observations and the reasonings upon them are such as to justify to a great extent his conclusions, and to encourage the hope that we may yet, in cases admitting of operation, get a mastery over this hitherto unconquerable disease. Let surgeons, however, take what view they please, it is quite clear that they should endeavour in their operations to remove *thoroughly* every trace of the disease. Probably the fact first shown by Schroeder van der Kolk has not been sufficiently considered—viz., that the germs of disease lie scattered far beyond the apparent limits of the tumour. But in addition to this mode of dissemination of cancer, it frequently occurs that in operations parts of the tumour are cut through. In such a case it is probable that of the innumerable living cells which are set free and deposited in the wound some will find a nidus in which they will go on developing—they will be scattered like seed, in fact, and grow wherever they find a favourable soil. That this is very often the case seems to me to be shown by the rapid appearance of points of disseminated cancer in and around the cicatrix after operation. Were the return of the disease dependent solely on a constitutional tendency or peculiar condition of the blood, it is probable that the disease when it returned *in loco* would do so much as it appeared at first, in a single tumour, or that it would return in a part similar to that in which it first appeared, as in an opposite breast. But both are rare occurrences. I know not how far this view may be capable of proof, but every surgeon has seen cases which would be easily explained on such a supposition, and with difficulty on any other. It appears to me that it may be to this mode of dissemination and implantation of cancer-germs that we may attribute the wider and more rapid return of the disease in situations where there is much fat, and in the young, than

in elderly and spare persons. In the young, of course, the general activity of natural growth is shared by any morbid structure, and we should expect to find a wider area of disease radiating from the principal mass, in the manner described by Van der Kolk. But something may also be due after operation to the laxity of tissue, and the freedom with which imbibition and infiltration may occur in early life. In the case of malignant tumours forming in the neighbourhood of fat, it is probable that the wide-spread and rapid recurrence of the disease may be owing to the laxity of tissue alone, and its consequent power of readily absorbing and transmitting minute particles of matter.

A case occurred at the Middlesex Hospital which, at the time, impressed me strongly with the notion that cancer could be thus propagated by implantation. A stout, and in all respects very healthy woman, aged fifty-six, was admitted in December, 1863. She had been operated on by my colleague, Mr. Lawson, in the previous September, for a large encephaloïd tumour on the upper and anterior part of the thigh, which she had noticed for the first time only five weeks previously. The mass was adherent to the fascia lata, above which it was embedded in fat; part of it had to be dissected away from the fascia after the principal mass had been removed. The wound healed rapidly, and she went out apparently well on the 13th October. On the 23rd November she noticed a return of the disease. On her admission the second time in December large nodules were found lying below the skin in the course of the cicatrix, and several smaller ones scattered about above and below. She had had no pain; had gained flesh since she went out; had a quiet pulse, a good appetite, and showed no appearance whatever of constitutional disturbance. The growth was removed the day after her admission, with a large quantity of the great mass of soft fat in which it was imbedded. The outgrowth had again to be traced piecemeal, but it had now penetrated through the fascia and between the

muscles. On examining the part removed I was struck by observing that extending widely through the fat were numerous small deposits of the morbid structure, quite distinct from one another, and varying in size from the smallest pin's head to a large grain of wheat; some of them were at least $2\frac{1}{2}$ inches distant from the central masses, and they may possibly have extended still further. But the point of interest was, that while the masses which occupied the situation of the original tumour were large and spreading, these little scattered deposits were small and of comparatively uniform size. The impression conveyed was, that while the larger portions had grown from palpable masses which had not been reached by the knife in the first operation, the smaller ones had originated in minute germs, which had been scattered broadcast, as it were, in the soft structures around, and had permeated them to various distances through the delicate lax connective tissue. Of course, the disease rapidly returned, but still the parts took on a healthy action after the operation, nor was there any indication of cancerous cachexia for some months.

I remember, too, a case which occurred very many years ago in the practice of Mr. Mayo, at the Middlesex Hospital. He removed a small tumour from the sole of the foot. At that time there was no appearance of disease elsewhere. In the course of three weeks little nodules of cancer appeared over the whole leg and thigh up to the groin; there were at least fifty of them. The glands in the groin enlarged at the same time; the man soon became cachectic, and died. Now, which of the two explanations is admissible? That which maintains that we had merely evidence of a cancerous diathesis, intensified by the irritation of an operation? or that which presumes that in the operation germs were set free, were carried by the lymphatics or veins, or in the areolar tissue, and becoming arrested here and there, took root, as it were, and were developed into new tumours?

It is a fact, too, which is worthy of note, that while primary cancer is uniformly single, secondary cancer is most frequently multiple. It is not a little strange that Rokitansky, though writing from a post-mortem point of view, cites this as a proof of the existence of a cancer "dyscrasia." He admits that "carcinomata originate and subsist not rarely as local evils;" but he adds: "Far more commonly, however, they are associated with a dyscrasis, which, in point of fact, often precedes and engenders the cancer. Hence the multiple appearance of carcinoma, as a sequel to a single one—as the sequel to the extirpation of a voluminous and hitherto solitary one. Hence, in other cases, the original appearance of cancer in several organs simultaneously, or in rapid succession."¹

This *original* appearance of cancer in several organs simultaneously can never be proved. But surely the multiple appearance of the disease after the development or the extirpation of a single tumour points to the setting free and dissemination of germs rather than to a "dyscrasia." And a little further on he states himself that "the highest grades of cancer crasis originate through infection—that is, through the reception into the lymphatics, or more especially into the bloodvessels of cancer-cells, or of cancer-blastema, of a lax, soft, semifluid character." And these cancer-cells and blastema are, he says, derived from an original tumour, which has ulcerated, or has penetrated into the canals of the bloodvessels.

If the highest grades of cancer crasis arise from infection from an original tumour, and are indicated by the production of multiple growths, why assume a dyscrasis which precedes and engenders the original tumour?

Nothing, in fact, can more resemble the secondary occurrence of cancer than the deposits and secondary formations consequent on purulent infection. The mode of distribution of these two

¹ Rokitansky: *Pathol. Anat.*, Sydenham Soc. Edition, vol. i. p. 255.

forms of deposit in the lungs and liver are at times so like, that they might, at first view, be mistaken for one another, dispersed here and there in equal sized nodules; with larger nodules, perhaps, in one or two places. And when we find the same tendency to multiple reproduction in the neighbourhood of an original cancer growth, whether after operation or not, why, in the face of the fact which Van der Kolk pointed out, and which is now established, refer it to any pre-existing constitutional cause, which even a *constitutionalist* would hardly admit in the case of these lung and liver deposits, and which he would certainly deny in similar local deposits from purulent infection? My own conviction is, that in most cases of recurrence, where the tumour has even been to all appearance entirely removed, the recurrence has been due to the presence of minute cancer elements which have escaped the knife, or, as is perhaps as frequently the case, to germs being set free by section of the tumour or of diseased tissue around it during the operation, and their implantation into the newly-cut structures. That this is the case is, I think, shown by the fact that where a voluminous breast with only a small tumour embedded in it is removed, and the incision is consequently very long in proportion to the size of the tumour, the recurrence frequently takes place along the whole line of cicatrix, not especially in that part which corresponds to the site of the tumour.

Many surgeons, no doubt, admit that cancer is very often reproduced through the dissemination of pre-existing germs—but the large majority still hold that there is a cancer element in the system which will manifest itself in spite of any, even the most perfect, removal of a primary tumour. To this is due the decided objection which many surgeons still make to any attempt at the removal of cancers—and the hesitation, which is more frequent, in recommending an operation, until the disease becomes a source of suffering to the patient. So long, however, as this

belief in a cancerous diathesis is based mainly, if not exclusively, on the ground that a cancerous tumour is very prone to return after its removal, or to re-appear in distant parts when once formed, one may reasonably demur to such an opinion.

If recurrence *sometimes* depend on dissemination, it ought to be shown that, in any particular case, this cause of recurrence could not be in operation before we accept the notion of a pre-existing cancerous diathesis. It should be shown that before any tumour exists there is, in some cases at least, a special state of system which indicates the probability of its future occurrence. Such a condition has never been seen.

The fact that the re-appearance of a cancerous growth may be delayed for months, or even years, does not appear to me to militate against the view of the local nature of the disease. It does not necessarily follow that the tendency to growth shall be greater after operation than before; and we know that in many cases the growth of an original tumour will be held in abeyance for periods as long as those which have been found to elapse between the removal and the recurrence of a cancer. Nor must it be forgotten, that in a large number of these cases the recurrent tumour has already made considerable progress before the patient's attention is called to it.

If, then, the view which has been so ably advocated by Mr. Moore be correct, that cancer is a local disease which becomes disseminated from the point of its first invasion, the practice of early extirpation cannot be too much insisted on. A tumour, as soon as it is recognised as cancerous, should be removed, if practicable, at once. A few days, even, may make a difference in the probabilities of success; due not, perhaps, to any increase in the size of the tumour, but to the wider extension of its germs beyond its apparent limits. It would be better to extirpate doubtful tumours, some of which might turn out on after examination to be amenable to treatment, than to leave them to develop them-

selves, and then to find, too late, it may be, for help, the characters of malignancy becoming marked. These views, which had often been discussed amongst the members of the surgical staff at the Middlesex, encouraged Mr. Moore, in a severe case of breast cancer, to apply the solid chloride of zinc to a large portion of the surface of the wound made in its extirpation by the knife, as he had effectually done in a case of extensive rodent cancer of the face, which he showed at one of the meetings of the British Medical Association in London. This was done in April, 1864.

The patient was a spare, healthy woman, forty-three years of age. The right breast was the seat of a small cancer, with adherent skin, cherry coloured over the centre of the tumour. In the axilla was a cluster of enlarged glands, which formed a tumour a little larger than that in the breast. The mammary disease was only known to have existed for four months. Mr. Moore first detached all the axillary glands, and tying them above, cut them off. He immediately touched the stump with the solid chloride of zinc. He then dissected out the diseased mammary gland, and before closing the wound he lightly touched nearly all the exposed axillary tissue with the chloride. The case ultimately did well, but what was remarkable was, while the skin over the breast sloughed to a slight extent, and was inflamed for some distance, due in great measure, according to Mr. Moore's notes, to its being somewhat tightly held together by the sutures, there "was no tension or great discharge from the axilla," and after a fortnight there is a report that the axilla is well filled up. It was clear that, at any rate, the touch with the caustic did not retard the cure.

To me it occurred that one might obtain the desired object by using the caustic in a less active form, and that a strong lotion of the chloride of zinc applied freely over the whole exposed surface, after an operation for the removal of cancer, would penetrate to some extent beyond the limits of the section,

and would at least destroy any floating particles of the disease which might adhere to it without endangering the vitality of the whole thickness of the flap.

The first case in which I tried this plan was that of a lady, forty-one years of age, who had a cancerous tumour in the right breast. She was well nourished and healthy, and had noticed the tumour about a twelvemonth. In the axilla was a gland slightly enlarged, but not hard, and in all respects the case was a favourable one for operation. The operation was performed in March, 1865. The strength of the solution employed was twenty grains of the chloride of zinc to the ounce of water. The whole surface of the wound was well sponged with it. The blood which still oozed from the exposed surfaces was, as usual, rendered of a bright pink colour, and the contact of the solution at once caused a freer hæmorrhage; no other effect was at first perceptible. The lotion was thoroughly pressed in with the sponge, and in a little time the surface became soft and creamy in feel, and this softness extended to a slight depth—a line, perhaps. Here I stopped, not knowing how far I might venture without causing sloughing of the flaps of skin. My impression was that a superficial slough would form, and would be thrown off by degrees during the suppurating stage, which, I assumed, must of necessity ensue, and which, in fact, I rather desired. The edges of the wound were, nevertheless, put together with sutures, save at the outer part, which was left quite open, to allow of the free passage of the supposed inevitable pus. A compress was put over the wound to check the tendency to any further bleeding into the cavity. After recovering from the effects of the chloroform, she complained for two hours of smarting pain; not more, I think, than is usually felt, and from that time she was entirely free from all pain whatever. I thought it probable that on removing the compress, about eighteen hours after, the parts would be found swollen and angry, although the pain had been so slight;

but instead of that, the circumstance most noticeable was the absence of even the usual amount of fulness. It was evident that action, instead of being increased, had been diminished, one might almost say arrested, by the application. The skin, even up to the cut edge, looked and felt exactly like the skin of the other breast. Blood, in much about the same quantity as is usually found after such an operation, had oozed from the wound; but it was pink and creamy in character, and what was especially remarkable was the entire absence of the peculiar odour which is generally found in blood which has been pent up beneath a compress for some hours. There was, in fact, no animal smell at all. But what most struck me in the progress of the case was the absence of suppuration. The whole line of incision united in the course of forty-eight hours, except at the point where the ligatures were brought out at the outer angle, which discharged a *very* small quantity of the same pink, creamy-looking fluid for a day or two more, and healed so soon as the ligatures came away. The same absence of animal odour was noticed to the end. I certainly never saw a wound which did not heal absolutely by the first intention go through its process of cure so speedily or so quietly. The patient remains perfectly well to the present time.

In cases of cancer on which I have subsequently operated I have used stronger lotions. In this first case the strength was 20 grains to the ounce. I next tried 30 grains, and then 40 grains to the ounce. With the stronger lotion a more rapid effect is produced, and the blood exudes more abundantly, but this is only for a few seconds, otherwise the course of events during the early period has been the same as was observed in the first case. As to the subsequent progress of these cases, some have healed rapidly, in some there has occurred an after suppuration, but in none has any inflammatory action been observed.

In one case only have I seen any bad consequences from the

use of the lotion. In the early part of the present year I removed a cancerous tumour from the breast of a lady aged fifty-six. The structure was the densest which I have ever seen, but the tumour had latterly been growing fast. I applied the lotion, 40 grains to the ounce, rubbing it very freely, and for some time, into the skin, and into the muscle to which the tumour had been slightly adherent. She had no pain after two hours, but on removing the bandage the next morning about eighteen hours after the operation, the edges of the wound were found to be dead, and there was a small sphacelated spot about two inches above the wound. The sphacelation went on extending for four days, so as to destroy a small portion of the lower, and a considerable portion of the upper, flap, and the surface of the muscle took on the same action. The discharge has been free from odour, and the patient has had no pain or any untoward symptom. The slough soon separated, and cicatrization rapidly took place. As this was a case of cancer, I am not sorry for the result; it will, I believe, be most beneficial in eradicating the local disease. The case is so entirely exceptional that I feel satisfied that there was something in this patient's condition which induced the sphacelation, more particularly as the death of the tissue did not take place at once, as is usually the case when it occurs from the application of chloride of zinc, but went on extending day by day for many days. I have constantly used the lotion more freely, and to thinner flaps, without a trace of even the most superficial sphacelation.

What the effect of this treatment may be in limiting the tendency to return after extirpation of cancer, can only be determined by time and numbers. If the views of the diffusion and transplantation of cancer germs before expressed are based on truth, it cannot but be beneficial; for to some extent it certainly must alter the character of the exuded matters and of the remaining tissues. My own impression is, that in cancer it would be well to go beyond the point hitherto reached, and that this may be safely done, as the effect

of the chloride of zinc seems, as a rule, to be limited to the point with which it is brought into contact. It appears to produce no irritation beyond that point, so that it may be worked into the inner surface of the flap till the tissue is softened to within a few lines of the surface without risk to the vitality of the remainder. In the course of the last summer I removed a large cystic tumour from the breast of a lady. The skin was stretched over it, so that when the tumour was away, there remained two extensive flaps of thinned skin with scarce a trace of adipose tissue. I was almost afraid to use the lotion to these flaps, but I did so until the inner surface was softened. The whole wound healed in about twelve days, without anything that could be called suppuration, and with the same quiet inactive state of the skin as I have before described. So far as I have observed, I am well content with the *special* effect of the treatment, though the cases on which I have tried it are too few and too recent to justify the expression of any opinion. In three cases of breast cancer which have been operated on for more than eight months there is as yet no appearance of return. In another—a case in which the disease made such rapid progress that it had increased by at least a quarter of its size in a fortnight—where it extended beneath the pectoral muscle and ran close upon the axillary vessels, it reappeared in the axilla in six weeks. In this case, however, the disease could not be fairly removed, and I was obliged to content myself with detaching as much of the mass as I could towards the depths of the axilla, throwing a ligature tightly round its base and cutting it off. The operation was done in June last, and the improvement in general health and alleviation of pain which followed the operation fully justified its performance.¹

Another case was one of recurrent cancer in the breast a year and a half after removal. At the sternal part the disease was

¹ This patient remains well in general health, seven months after the operation, but the disease is making rapid progress in the axilla, and beneath the clavicle.

fixed to that bone. Towards the axilla there was a subcutaneous mass of the size of a small walnut. There were small subcutaneous tumours in the line of the cicatrix, but no deposits in the skin itself. The patient's general health was perfectly good; the axilla was free. I removed the whole of the disease, using the strong chloride of zinc lotion to all the soft structures, and destroying the sternal part, after cutting the disease away from the bone, with the actual cautery, and laying over it the chloride of zinc paste; the treatment was, in fact, precisely the same as has been so successfully adopted at the Middlesex Hospital, since Mr. Moore tried it in the case of rodent cancer of the face before referred to. All the wound healed rapidly and with scarcely any suppuration, except, of course, at the sternal part. She was at the end of six weeks seized with symptoms of pyæmia and died. The origin of this was clearly in the cancellous structure of the sternum; but on the most careful examination of all the tissues about the seat of operation, no trace of cancer could be found. The final result of this case may seem to invalidate the statement which has been just made, that no bad result has attended the use of the chloride; but it does not affect the question. The pyæmia took place long after all direct effect of the chloride had passed off. The bone was intentionally exposed to some extent below its surface to ensure the removal of all cancer germs which might have developed in it, and was liable ultimately to any accident to which such an exposure might subject it. My mistake here was in not using from time to time a weak solution of the chloride, so as to keep in an undecomposed and healthy state the matters which lodged in the cancelli.

From data so limited it would be hasty to form conclusions. I am myself so satisfied with the results at present obtained, that I am very desirous that a full and extended trial of this method of treatment should be made.

The singularly favourable way in which the wound healed in the

first case in which I tried this plan, satisfied me that it might be beneficially adopted in operations generally. There was one point which especially struck me, as giving it great value in hospital practice; the perfect purity of the discharges from the wound during the first few days after an operation. It is well known that the presence of decomposing animal matter tends to bring any dead animal matter with which it may be in contact into a state of rapid decomposition; and if this take place in a wound, it will certainly interfere for a time with the natural and healthy processes of cure, and will become a fertile source of erysipelas and pyæmia.

That this decomposition does usually occur is evidenced by the peculiar sickly animal smell which is perceived whenever a wound which has been covered for a few hours is opened. When, on the contrary, a wound has been fairly impregnated with the chloride lotion, there is invariably an absence of any animal smell whatever for two or three days; and, unless some diseased tissue remain in the wound, there will probably be none throughout the whole period of healing. Were this the only advantage, it would be a great one; I believe that in our hospital it has saved many a patient from erysipelas and pyæmia; certainly we have been for the last ten months entirely free from these diseases after operations in which the lotion has been used, while just before they were very prevalent. Highly improbable as such a notion appears to me, this yet may be an accidental coincidence merely, and time and experience can alone determine how much is due to the treatment. It is not, however, the only advantage. One of the most striking consequences of the application is the quiescence of the part. The action which one would imagine must of necessity follow the application of an escharotic so powerful as the chloride of zinc, is never to be seen. The parts, up to the very edges of the wound, retain their natural colour during the early periods after an operation. I can state this confidently after the use of the

lotion in varieties of operations, the removal of tumours, amputations, even those with extensive and thin flaps, as Syme's and Mackenzie's amputations, operations about the rectum, involving the mucous membrane, and in the perinæum, and in many others, as well as in accidental wounds. In many cases the wounds have healed in twenty-four hours, without the least fulness or swelling, and have left a line of cicatrix which after a short time could hardly be seen or felt.

Whether it would be practicable to use the lotion to the uterus after delivery I don't know; but I am quite confident that, if applied, it would not irritate the uterine walls, and that it would prevent unhealthy discharges, and so obviate, to some extent, the risks of pyæmia. In cases of retained placenta, the free and repeated injection of the lotion would be well worth a trial. I have applied it to the uterine walls and to the peritonæum without causing any irritation.

Several cases are at this moment under my observation. A short time ago, my colleague, Mr. Shaw, performed two operations. One of these was on a strumous subject who had sinuses in the neighbourhood of the heel, running towards one spot. No bone could be felt, but it was thought that there must be some caries keeping up these sinuses. The heel was laid open to its full extent from before backwards through the track of one of these sinuses, but no disease of the bone could be found. The wound was well bathed with a solution of twenty grains to the ounce, and healed by the first intention without pain, swelling, or discoloration.

Another case was one of necrosis of the lower end of the tibia, with sinuses on the outer and inner side of the ankle. On laying open the outer sinus the joint was found to be involved, and the astragalus could be felt in part rough and denuded of cartilage, which however still covered some portion of the articular surface. In the situation of the lower end of the tibia was a large

cavity, which communicated with the medullary canal, and in which lay several pieces of necrosed bone. The articular surface was gone. A portion of the shell of this cavity was cut away, and the necrosed bone removed. Here, by Mr. Shaw's permission, I used the forty-grain solution, sponging with it thoroughly and repeatedly the cavity of the bone and all the tissues surrounding the ankle-joint: the parts remained perfectly free from swelling, pain, or redness. There was scarcely any discharge, and what there was had no smell. The tissues about the inner ankle, which were very much infiltrated, and more than an inch thick, were also freely laid open, and gaped widely. They were put together with sutures; they did not unite, but were found next day to be covered with a thin layer of slough, which speedily peeled off, and left a healthy granulating surface below. There was throughout an entire absence of all inflammatory action. In such a case as this, there would, I believe, have certainly been a foul discharge for a little time at least after the operation, had the lotion not been used. The tendency to form a superficial layer of slough is seen in every case in which the skin is thus infiltrated from long-continued disease. It is due, probably, to the low state of vitality of the part. The slough separates very quickly, a healthy granulation covers the surface, and there is no inflammation of the adjacent textures.

Another and very striking case is now under the care of Mr. Nunn. He removed the head of the femur below the trochanters on the left side from a woman with hip disease. She is suffering also from considerable disease of the liver, and her general health is much impaired. The acetabulum was perforated, and the finger could be passed into a cavity beyond; but there was no carious bone to be felt in it. The lotion was very freely used. The operation has only been done three weeks, but the parts are quite covered with healthy granulation, and the discharge has almost entirely ceased. An unhealthy inflammation took place

in the right groin, over a large resonant swelling, and an abscess formed in the right labium, which was opened, and healed after discharging some very unhealthy matter. In this case the lotion was injected for some days into the cavity caused by the operation.

This singular absence of action in the wound is, as one might suppose, accompanied by absence of pain. That great pain sometimes attends the immediate application to a sensitive wound need not be mentioned, but this is not lasting. In most cases it subsides in from one to two hours; in some cases it does not occur at all. Where the application is made after an operation done under chloroform, the patient generally remains altogether free from pain. This is particularly the case when morphia has been subcutaneously injected, as Mr. Moore first suggested, immediately the operation is concluded, and before the effects of the chloroform have passed off. After this proceeding the patient often remains calmly asleep for some hours, and wakes entirely free from pain. When, however, the immediate pain of the application has once subsided, the comfort which the patient enjoys is very striking. I have seen cases in which the patients could not tell from their sensations after a couple of hours that any operation had been done. One can explain, perhaps, from observing the action of the chloride, why action and consequent pain should be lessened or altogether prevented. It is quite clear that the chloride of zinc does not act as an irritant beyond the point of contact. If its use is carried so far as to produce an eschar, the eschar will act as an irritating body, and there will be inflammation and swelling around it; but if applied short of this (and it requires a continued application of the solid chloride to make an eschar in the natural structures), it produces a peculiar pulpy state of tissue, widely different no doubt from the natural tissue, but certainly not an eschar, not a charred mass which *must* be removed by the ordinary process of separation

below and around it. Were the surface of a large wound converted into an eschar, it could not heal in twenty-four hours. And yet the tissue appears disintegrated; it is rapidly discharged as a creamy exudation, leaving the parts below perfectly natural in appearance. This can easily be seen when the lotion is applied to an open wound. In this creamy surface must be involved all the sensitive and vasculo-motor nerves, and their function must be arrested. With many escharotics, as the actual cautery, the acids, &c., the irritating effect is propagated along the nerves beyond the point of contact. Although the nerves exposed on the surface may be destroyed, the effect is carried beyond this point, and increased nerve action and inflammation are the results. It is not so with the chloride of zinc. From whatever cause it may be, the action terminates at the point of contact. The sensitive surface is destroyed, but no irritation is set up beyond the part directly acted upon. Hence there is no pain, no vascular action, no inflammation. Whether this be or be not the true explanation, the fact certainly is as I have stated it.

Of course I do not mean to assert that this immunity will be found in every case; but I can safely say that, as a rule, I have never seen the general run of cases go through so favourable a course as since I used this application. One case has been mentioned in which sphacelus occurred; it is the only one in which there has been the least tendency to such a result in apparently healthy tissues.

The mode of application has been described in connexion with the first case in which I tried the solution. The first effect is always an excitement of the small vessels and a general oozing of blood from surfaces which had been previously dry. The blood becomes pink and creamy by contact with the chloride. On further application of the solution the whole surface is softened and assumes the same pink colour. The blood will

continue to ooze out as long as the solution is applied, and for a short time after. Every part should be well saturated with the chloride—the edges of the skin, the adipose tissue, the spaces between the muscles, the medullary cavity, or cancellated structure of bone. At first I was afraid to touch bone with it, but I find now that so far from harm attending its application, there are no cases in which more real benefit arises in consequence of the matters lodged in the cancellated structure or in the medullary cavity being kept from putrefaction. In Mr. Shaw's and Mr. Nunn's cases before mentioned, the bone was very speedily covered with healthy granulation. In a long-standing case of abscess around the hip, the cause of which I could not for a long time detect, I found, after making an incision into a new point of suppuration, that a portion of the tuberosity of the ischium was carious. The diseased bone was cut away, and the lotion freely applied. In ten days the bone was covered with granulation, and the wound healed rapidly. In amputation, the bone has never been a cause of trouble. On the 17th of January in the present year, Mr. Moore and Mr. Lawson each excised a knee-joint. Mr. Moore's patient was a healthy labourer who had ankylosis at so inconvenient an angle that he could not work. Mr. Lawson's was a case of scrofulous ulceration of the cartilages of the knee with extensive abscesses. In both of these a thirty-grain solution was applied freely and repeatedly to the cancellated structure, which seemed to soak it up like a sponge. The lotion was applied a second time, when the limbs had been an hour afterwards put up in plaster of paris. The operations have been done now thirty days, but there has been no trace of animal odour from the first, the suppuration is slight, and there has been no pain. The surgeon need not hesitate to apply it even to thin and delicate structures. Those cases have done best in which it has been most thoroughly used. For wounded surfaces I generally use a solution of from thirty to forty grains to the ounce of water.

An objection has been raised to the use of the chloride that union by the first intention must be prevented, and that we are therefore throwing away a chance of obtaining the best and safest mode of cure after operation. Entire union by the first intention is, however, rarely, if ever, seen after operations of any magnitude. Parts of the wound may so heal, but not the whole; and were the objection valid at all, the question would be simply one of more or less. Supposing, moreover, that in one case in twenty entire union by the first intention did take place (I am still speaking, of course, of large operations), surely it would be well to forego the chances of that one, if we could ensure the safer and better healing of the remaining nineteen.

The objection, however, is really not valid. A wound will heal entirely in twenty-four hours when the solution has been freely used. It may do so in less time, possibly, but I have often seen a wound entirely healed at the end of that time. And, as a rule, I have found that wounds have healed more rapidly since I have used the application. After the experience I have had of its effects, I should have no hesitation in using it in a plastic operation in which, of all cases, one most desires kind and early healing.

There is, however, a difference in the effects of the chloride of zinc lotion on natural or healthy tissues, and on diseased or inflamed parts.

In the foregoing remarks I have certainly rather over than understated the amount of pain which is generally felt when the lotion is applied to a recent wound. I have been surprised, in many instances, at the very momentary character of the pain caused by the application of the lotion, and at its entire absence, even, in some cases, although no chloroform had been used. Under any circumstances the pain is very transient, and instead of two hours one may, I believe, put down half-an-hour as its general period of duration.

Nor is it ever severe. I had a personal proof of the small amount of irritation which a strong solution of the chloride may occasion when applied to the eye. One day I was injecting a sinus with a forty-grain solution, and a full jet came back into my right eye. Immediately there was a sensation of warmth over the whole globe, but so little was there of the pain which generally attends the introduction of an escharotic into the eye, that in a few seconds I opened it and went on with the operation. There was slight redness of the conjunctiva for a few minutes, and a pricking sensation at the caruncle. My dresser, Mr. Chaldecott, told me that the same thing had occurred to him a few days before, with the same result. A weak solution, I believe, gives rise to severe smarting.

Mr. Moore has favoured me with the note of a case in which he injected a solution of the chloride into the tunica vaginalis. The gentleman had a hydrocele which had been injected with tincture of iodine without effect. Mr. Moore drew off half a pint of perfectly clear fluid. He then injected three ounces of water containing a drachm of the chloride of zinc. "The first half," he continues, "partly flowed off in the intervals of my charging a syringe with about three drachms of the injection, and from the white flocculent deposit, which made the rejected fluid milky, I judged that the zinc had united chemically with a little remaining liquid in the sac. The latter half I left in the sac; indeed I do not know what became of it, for it did not escape again. Not the slightest pain was occasioned by the retention of this half drachm of chloride of zinc in the tunica vaginalis."

In a case of Cæsarian section which I recently performed at the Hospital, I applied the lotion (thirty grains to the ounce) to the inner surface and cut edges of the uterus, and to the peritonæum. The patient, who was suffering from cancer of the vagina, lived 41 hours after the operation, but she had no pain, and the only spot where any marked inflammation was found after death was

about one of the round ligaments, which had not been exposed to the action of the lotion.¹ There was no smell of decomposition in the parts involved in the operation.

It will be found, indeed, a rule that little pain attends the application of the lotion to a recently incised part, or to a natural structure. But the result is often very different when it is applied to inflamed or ulcerated surfaces. In such cases, intense and long continued pain frequently follows its application; not always at the moment, but after an interval of perhaps half an hour or more. It is not a little singular, too, that in some cases of extensive abscess connected with diseased bone in which the lotion has been freely used immediately after operation with great advantage and with little or no pain, yet when, after a time the injection has been repeated, with a view to hastening action or removing some odour, the pain has been intense and has lasted for hours. This has been noticed too often to allow of its being considered as accidental. The pain has been equally severe and lasting on the application of the lotion to foul ulcers and to phagedænic sores, though in both it often induces healthy action. In cancerous ulcerations, also, it usually cleanses the sore and corrects the fœtor, but it often gives rise to very severe pain.

It is not improbable that many substances are capable of producing the same effects as the chloride of zinc. Surgeons have, as is well known, tried various applications in the hope of preventing or lessening suppuration, or of warding off the evils which produce the large proportion of deaths after operations, such as erysipelas, pyæmia, and osteo-myelitis. Of these applications, the principal are strong alcohol, either pure, or holding in solution astringent or aromatic substances, or iodine. Alcohol and some of the aromatic tinctures I have tried; but though they act very beneficially in unhealthy wounds, I

¹ *Lancet*, Dec. 30, 1865, and Jan. 6, 1866.

have not found that they protect recent ones for any length of time from unhealthy action; nor do they seem to lessen inflammation or promote union. Aloes enjoyed a very high reputation during many centuries for its healing qualities. When applied externally, it was said to hasten cicatrization and repress hæmorrhage. I have often used it in the form of the compound tincture both to recent wounds and to old ulcers. In the latter, and especially in bad sores, it often does great good; but I never found any special benefit from its use in recent wounds. So long as it remains in contact with the wound, it prevents decomposition—as the spirit itself would—and it perhaps has a locally tonic effect on the tissues, but it requires frequent renewal, which could not be managed in a wound which it is desired to heal rapidly. The application of tincture of iodine in recent wounds was lately proposed by M. Pétrequin.¹ Finding that suppuration was never present when this fluid had been injected into cavities or into the tissues, he recommended and practised its application to wounds made in the removal of tumours, especially when situated in the face or neck, where it is very desirable to prevent the formation of scars. Whether it has been tried by others I do not know; but for many years I have been in the habit of adopting a treatment which was suggested to me by Mr. Hoffman, late of Margate, the introduction of small tents covered with the iodide of starch into strumous glands in the neck, even before suppuration has occurred in them; the effect has been very satisfactory, but considerable pain and inflammatory action have followed the treatment. Mr. Higginbottom has long recommended the application of a solution of nitrate of silver in recent wounds as well as in erysipelas, as a means of checking any tendency to suppuration. I have not tried it, nor do I know whether it has been generally useful. I doubt, from what I have seen of its action in slight wounds,

¹ Gaz. Méd. de Paris, Dec. 10, 1864.

whether the nitrate of silver could be applied as freely as the chloride of zinc; or whether, if so used, it would preserve the parts in a healthy state for so long a time.

We find, too, that Mr. Butcher advises the use of the actual cautery in some operations. He writes: "I have found its application in this way"—quickly brushed over the surface—"most serviceable after excision of the upper jaw, and other severe measures, in arresting unhealthy forms of inflammation, diffuse or erysipelatous, and arousing at once a reparative inflammation."

I have met with nothing which acts in so unmistakeably beneficial a manner as the chloride of zinc.

But there is nothing new under the sun. My colleague, Mr. Shaw, was speaking recently to Dr. Brown, of Sloane-street, on the subject of the use at the Middlesex of the chloride lotion, who told him that the subject was not new to him, as he had in earlier life seen Burnett's fluid used in recent wounds. Dr. Brown has kindly favoured me with the following account:

"When I was a young disciple of that most worthy chief of the medical department of Portsmouth Dockyard, James Henderson, a tank was erected in the ropery for saturating yarns, &c., in Sir William Burnett's fluid. Now, it was the duty of every man in the whole establishment to come and report at the surgery the slightest hurt he might receive in the course of his work; but soon after this tank was set up we found on several occasions that men in the ropery meeting with slight wounds and abrasions did not so report themselves, and upon being remonstrated with, they said they had gone directly to the tank and applied some 'solution' to the part, and it always got well very quickly. Practically, the men employed at the tank found if they had cuts about their fingers that they healed surely and speedily through dabbling in the solution, and the fact soon spread amongst their fellows. This presently so attracted the attention of my excellent and observant friend, that we had Sir W. Burnett's solution

brought into the surgery to be used in surgical treatment, and I am almost sure that at some time between 1842 and 1844 it was specially referred to in a Report to the Director-General of the Navy."

The Director-General of the Navy was so good as to have the reports of these years inspected; but he informs me that no mention of the external use of Burnett's fluid is to be found in them.

THE END.

10-9-28

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