Whether they supply the stimulus to growth is uncertain, though highly probable, but they doubtless supply the nuclein bodies which are so necessary for the nucleus of the now actively multiplying tissue cell. May not the cancer cell, therefore, receive its stimulus from and depend for its nourishment and growth on certain leucocytes, which by breaking down or actual conjugation supply the necessary nuclein? The induration around a cancerous growth is evidence of the infiltration of leucocytes, which, however, is hardly inflammatory in nature, seeing that it is not always accompanied by the cardinal signs of that condition. Pure blood plasma within the blood vessels does not contain nucleo-proteid (the progenitor of nuclein), which would produce intravascular clotting, but becomes coagulable lymph in the tissues by the addition of fibrin ferment derived from the breaking down of certain leucocytes. It seems legitimate, therefore, to suppose that certain leucocytes supply the nuclein bodies so necessary for the rapid mitosis of the cancer cell. Let us assume that this is the case; it will certainly account for some very significant facts connected with cancer growth. It is well known that malignant growths have been noticed to be benefited by an attack of erysipelas. Presumably in a diffuse spreading inflammation like this, within the lymphatic system itself, more leucocytes are concerned in repair than in an ordinary circumscribed abscess. The determination of leucocytes to the diseased area might rob the cancer cells of their normal requirements in the way of nourishment provided a sufficiently extensive surface is involved, and it is only natural to suppose that repair of an injury is of more vital importance to an organism and must take precedence over mere growth.

It is a significant fact that cancer tumours in mice remain stationary at a certain stage of their development, possibly when the limit of nutrient supply is reached, and it would be interesting to know whether metastases were more numerous with smaller or larger primary growths.

The difficulty of inoculating a second tumour after a primary growth of fair size is also explicable on the theory of a limited supply of essential food. The theory of immunity due to a toxin formation does not appear sound, because we are dealing with what might be called an abnormal physiological growth rather than a purely pathological process.

Quite recently¹ in this JOURNAL Dr. Mackay, followed by Dr. Sommerville, reported very interesting cases of amelioration of carcinomatous growths following pleuritic effusion. I did not accept the explanation there given as final, because it seemed to me the circumstances were capable of being explained otherwise. The pleural cavity may be regarded as an enlarged lymphatic space. In acute effusion, which these cases presumably were, innumerable leucocytes take part in the formation of the layers of lymph and adhesions which result; there is probably a general determination of leucocytes to this most extensive lymphatic space, and, as in the case of erysipelas, less important processes, such as growth, must wait their turn. Moreover, as the whole energies of the cancer cell seem to be spent in the function of reproduction, may not the suppression of this function by the absence of essential food endanger its very existence, for, as far as whole organisms are concerned, the young and growing are said to feel the effects of lack of nourishment first and most severely. When a growth is locally damaged it responds by increased growth, the damage having probably caused an increased determination of leucocytes to the damaged area. Similarly when ulceration of a large tumour occurs, cachexia and wasting, hitherto absent, soon make themselves evident. The acquired immunity to re-inoculation of cancer is on this assumption explained by the exhaustion of some particular nutrient material necessary for the growth of the rapidly-multiplying cancer cell, this essential consisting chiefly of nuclein bodies supplied for the most part by certain leucocytes.

If, then, nuclein is so important for rapid mitosis, would it not be possible to considerably modify this process by its withdrawal from the food altogether, or to so act upon it chemically as to alter its functional activity? The key to such chemical alteration might be supplied by the following considerations: From a chemical point of view nuclein is remarkable amongst organic bodies for its high percentage of phosphorus. Could we not substitute for phosphorus a chemical having somewhat similar

affinities? Turning to the periodic system of elements we find that the phosphorus group contains the well known bodies: Arsenic, antimony, bismuth, and three rarer elements.

Arsenic and antimony are already known to have a profound action upon epithelial tissues, probably because these are always multiplying, and, therefore, need much nuclein. Arsenic seems also to have an action on leucocytes, for it diminishes their number in leukaemia. Perhaps the action is due to the part substitution of the element used for the phosphorus of nuclein. Bismuth as ordinarily given in the insoluble form only acts mechanically. The internal administration of arsenic² has been praised in America, and has been said to have an inhibitory action on malignant growth. I should think the heavier metals of this group, if substituted for phosphorus in the nuclein molecule, would be more detrimental to its functional activity.

Now that the experimental investigation of cancer is possible in mice, and there is no question of human suffering, the experiments that naturally suggest themselves out of the foregoing considerations are as follows:

1. The action on carcinomatous tumours of a diet free from nuclein and its progenitor—nucleo-proteid. Such a diet in the case of man would correspond somewhat with the purin-free diet suggested for gout and its manifestations—and by the way, any observed associations between this disease and cancer would be extremely interesting. Cancer has much greater incidence among those taking a mixed diet than among vegetarians, and a vegetarian diet as well as a restricted nitrogenous diet has been extolled as beneficial in both external and internal cancer.² This plan "the nuclein-free diet" could also be tried in conjunction with the internal administration of arsenic or other member of its periodic group.

2. The action of a "phosphorus-free diet" with or without the internal administration of arsenic, etc., might be tried. Seeing, however, that phosphorus is such an important element in the nervous system of vertebrates, it is doubtful whether the living organism could withstand its entire withdrawal from the food, and it is possible a cancerous growth might still draw its necessary phosphorus from the nervous system, thus producing mental depression or other nervous state.

3. The production artificially of extensive inflammatory conditions far away from a cancerous growth with a view to withdrawing the leucocytes thereto and noticing the effect, if any, might prove interesting if of no practical importance.

In conclusion, the present helpless state of our knowledge of the cure of cancer behoves those engaged in cancer research "not to leave a stone unturned," so to speak, and alone justifies the trouble of any experimentation, even though based on purely theoretical considerations.

REFERENCES.

- ¹ BRITISH MEDICAL JOURNAL, July 20th and August 3rd, 1907.
- ² *Ibid.*, October 6th, 1906.

AN X-RAY METHOD FOR IMMEDIATE LOCALIZATION OF FOREIGN BODIES.

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WHILE recognizing the value of the various ways which have been suggested for the localization of foreign bodies by the x rays, not omitting the stereoscopic method, they all appear to present certain disadvantages; either they require somewhat complicated and expensive apparatus, or they involve rather elaborate calculations, or again they need the exposure and development of plates which with subsequent measurements, etc., involves much valuable time. Therefore a method giving a fairly accurate idea of the position of a foreign body such as a needle, shot, or piece of glass, in a hand, foot, or even a thicker part, from a simple fluorescent screen examination, and that at once, is, I venture to think, worth consideration.

The plan I am using, which is an elaboration of a suggestion of Mr. Shenton, is based on the principle that an upright thin plane, illuminated vertically from below, gives a linear shadow. If the illuminant be moved to a position on the same horizontal plane as it originally occupied and at right angles to the plane examined, then the shadow of the original thin plane becomes a figure

bearing a certain definite relation to the plane, and the parts of the shadow also bear a proportionate relation to the corresponding parts of the plane under examination.

In practice one requires only the ordinary *x*-ray couch, the tube being 18 in. below the position the screen will occupy, having a diaphragm, and being capable of longitudinal and transverse movement; a fluorescent screen, an aniline marking metal pencil, some lead foil, and some stamp paper. The lead foil is used for twisting into a thin wire—this is easily done by the fingers—the wire being afterwards cut or bent into stylets of the size and form required.

Taking the common case of a needle in the hand. Let the hand lie on the couch palm upwards, and with the screen search for the needle; manipulate the hand into such a position that the shadow of the needle finally lies transversely to the couch and in the centre of the smallest aperture of the diaphragm, the hand still lying flat on the couch. Now with a damped aniline pencil mark the shadow line on the palm. Cut a lead stylet so that one limb corresponds to the line, the other limb being short and at right angles. This piece at right angles is merely to make the palmar stylet distinctive. Fasten the appropriate limb to the marked line with stamp paper. Re-examine, when dry, with the screen, when the shadow of needle and stylet limb should register. Now place the hand palm downwards and again examine; make the lines register and mark on the dorsum of the hand with the pencil. Again attach as before a straight lead stylet, and now, on examining the hand palm upwards, the three shadows should register and appear as one shadow with a short limb at right angles. We now have fixed the vertical plane in which the needle lies.

To discover the depth and direction of the needle in this vertical plane, the tube is moved about 6 in. to one side, say the left, the diaphragm being much enlarged or removed. The original single shadow at once resolves itself into three, thus—

The left shadow is the palmar stylet, the right the dorsal, and in a variable position between is the shadow of the needle. The distance between the lead shadows corresponds to the thickness of the hand, and, for all practical purposes, the proportion of the distance which the needle shadow (or any part of its shadow) takes up represents its depth (or the part's depth) in the hand. In the above case the needle lies parallel with the palmar surface and about halfway between palm and dorsum, its exact depth being therefore one-half the thickness of the particular hand.

Suppose the three shadows are thus—

Here the needle is in a slanting direction, its head about one-third of the hand-thickness from the palm, its point about one-fourth of the hand-thickness from the dorsum; we know the plane it occupies; its true length may be estimated by constructing a four-sided figure, whose sides are the lengths of the stylets and the thickness of the hand, marking off one-third of the upper line and three-fourths of the lower, and measuring the distance between these points.

Modifications are easily suggested for a needle vertical to the palm—a shot, an irregular piece of glass, or a fragment of metal. It is quite easy to find the relation of the foreign body to a bone, for instance, by noting the relative displacement of the foreign body shadow as compared with the displacement of the spot (either on the bone or between contiguous bones) over which it was lying when the shadows were in register.

It may be objected that the method is not absolutely accurate; it is not. If *x* rays were parallel it would be quite correct, but the more divergent they are the greater becomes the inaccuracy. However, with a tube 18 in. from the screen, the rays are so nearly parallel that, when a hand is under examination, the results are near enough for all practical purposes.

Absolute accuracy is possible by plotting out on a sheet of paper a diagram having a central 18-in. line and two cross lines at either end. On the upper cross-line is measured the distance between the anterior right-angled stylet shadow and the shadow of the foreign body; on the lower cross-line is measured off 6 in. on the opposite side. On joining the points the depth of the foreign body is found on the central 18-in. line. It will be found how

near the method I have just described is to the truth. The tendency is for the depth to be slightly underestimated; for example, in examining the calf of the leg with a thickness of 6 in., the *mid-point* between the shadows of two stylets (anterior and posterior) corresponds to a real depth of 3½ in. instead of 3 in.

It affords great help to an operator to know the surface line *across* which he will make his incision, the depth he will have to go, the direction and length of the foreign body. These he can obtain as above at once. I have italicized *across*, as the difficulty of finding a needle is enormously increased if the incision is over or parallel to it. Local or general anaesthesia is very advisable, and an Esmarch's bandage to make the part bloodless is almost a necessity; but these are matters for the operating surgeon.

CASE OF RADICAL MASTOID OPERATION;

WITH SUBSEQUENT SEPTIC INFECTION AND RUPTURE OF THE LATERAL SINUS.

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The following case presents some features of more than usual clinical interest:

N. S., aged 21, a patient of the Manchester Eye and Ear Hospital, had been suffering from purulent otorrhoea of left ear for five years. Occasionally there had been pain in the ear or in the adjoining mastoid region. During the last six months the symptoms had become steadily worse and the discharge more profuse and extremely offensive. On examining the ear, the membrane and ossicles were found to be absent; bare bone could be felt with a probe in the region of the iter ad antrum. The hearing power was fair—medium voice 4 ft., whisper 1 ft.

Operation.—A radical mastoid operation was decided upon and was performed on June 21st. There was nothing unusual about the early stages of the operation, but on commencing to remove the bone the sinus was almost immediately exposed, lying only a little over ½ in. behind the posterior wall of the meatus. The sinus wall was apparently uninjured. The antrum and attic cavity were then freely exposed; the bone was everywhere found to be extremely sclerosed; patches of carious bone were found in the outer wall of the antrum and in the overhanging edge of the outer wall of the attic; the contents of the antrum were very offensive. All diseased tissue was carefully removed, and after arresting haemorrhage and treating the cartilaginous meatus according to the Panse method, the cavity was packed and the superficial wound sutured.

For the first week the progress of the patient was uneventful. The packing was removed through the meatus three days after the operation, and after syringing the cavity with boric lotion it was gently repacked. This was repeated daily. On the morning of the seventh day (June 28th), immediately after the dressing, the temperature suddenly rose to 103.2°. The packing was at once removed, as was also one of the sutures which appeared rather tense. At 6 p.m. the temperature was normal, but on the following day there was a similar rise about the same hour. All the stitches were removed, and warm boric fomentations were applied. The temperature again subsided as rapidly as on the previous day, but next morning (June 30th) there was a slight rigor, and the temperature rose rapidly to 104.8°.

Second Operation.—I then decided to open up the wound and ascertain whether a septic thrombus had formed in the lateral sinus. Before this could be done there was a sharp haemorrhage from the ear. The original incision was opened up and the cavity found full of clot. On carefully removing this there was a sudden gush of blood. The haemorrhage, which was very severe but easily checked by pressure, was evidently coming from the spot where the lateral sinus was exposed during the first operation. This opening was now enlarged in a backward direction, with the intention of occluding the sinus by placing a plug between its outer wall and the bone. The haemorrhage could not, however, be sufficiently controlled to allow this to be done, so the aperture in the sinus was plugged with iodoform gauze. A drainage tube was passed through the meatus into the deeper part of the antro-tympanic cavity. The rest of the cavity was gently packed with gauze through the wound behind the ear, which was left open.

After-History.—For two days the patient was comfortable, and the temperature remained normal. The packing was then removed (July 2nd). As soon as the plug in the sinus was withdrawn, there was severe haemorrhage. Fresh packing was immediately reinserted and the wound dressed as before.

The temperature, which had been slightly elevated (100° F.) before the dressing, continued to rise; six hours later, therefore, 10 c.cm. antistreptococcus serum was injected; the