bility of arresting the growth of these tumours in some instances by appropriate medical treatment, as well as the greater probability of thus effectively checking hæmorrhage so occasioned, more especially by the free administration of ergot and iodide of potassium, to which I have elsewhere called attention, be entirely lost sight of. As to the former or surgical method, I may, however, venture to repeat that in the majority of cases of interstitial and subperitoneal uterine tumours no active treatment whatever appears to me essential, inasmuch as such growths seldom, if ever, destroy life, and in many cases become arrested in their development and quiescent in their symptoms at the menopause, or may even possibly disappear altogether in the course of time. The latter event is, however, too exceptional to have much influence in determining the expediency of surgical treatment, and more especially that by oöphorectomy, which is unquestionably called for in the case of fast-grown fibroids, giving rise to otherwise uncontrollable urgent hæmorrhagic or pressure troubles, particularly when occurring in young patients. With regard to hysterectomy, although exceptional cases may occur in which this procedure is necessitated, the average mortality that has followed its performance is such as to forbid its general employment, as an operation of election, in a disease the average mortality of which when left to nature is so comparatively insignificant. Whilst as to myotomy, in view of its too common results, I can only repeat that it would appear to me a method by which a patient may be effectually removed from a tumour, rather than as an operation by which a tumour can be safely removed from a patient.

Although I have so nearly exhausted the allotted limits of this address, I cannot omit a few words in reference to the latest and most promising of the methods available in the treatment of uterine fibromata—namely, that by electricity. Within the past year and a half I have had occasion to try this method, in some ten instances, in my hospital and private practice; and, so far as the arrest of hæmorrhage is concerned, the result was most satisfactory, the bleeding being thus arrested in six of these cases. But, with regard to the cure of the disease from this treatment, the possibility of which had been demonstrated in the experience of Dr. Apostoli and others, who had employed it on a much larger scale, I can only say that, whilst I have not as yet seen the complete subsidence of the tumour effected in any of the cases so treated by myself, in three of them its apparent bulk became distinctly diminished even after six weeks or two months' treatment of this kind. It should, perhaps, be added that in all these instances I used Dr. Apostoli's original abdominal electrode, the current used being of course monopolar, and acting directly on the growth by the intra-uterine pole, and was obtained from a powerful Leclanché battery of an estimated maximum current strength of 250 milliamperes. In the first of my cases I employed the electrolytic negative current, but after a little experience I abandoned this, and in the subsequent trials used only the positive current, which, although non-energetic as a galvano-caustic, is far less liable to give rise to trouble, and from its decided hæmostatic action is more suitable to these cases of large hæmorrhage-producing tumours, in which alone this or any other active treatment seemed to me generally necessary. If, however, the results obtained by Dr. Cutter, and, still more conspicuously, those recorded by Dr. Apostoli, from the employment of electricity—namely, permanent benefit in 95 per cent. of the cases of fibromata thus treated by him—should be confirmed, as I hope may possibly be the case, by the larger experience of those who are here about to discuss this disease, then we should have good reason to congratulate ourselves on having at last arrived within sight of the long-sought-for safe and effectual curative treatment of uterine tumours.

EDINBURGH VOLUNTEER MEDICAL STAFF CORPS.—

On the 10th inst. forty-two members of the Edinburgh Volunteer Medical Staff Corps, under the command of Dr. Cathcart, left the Waverley Station by the 10.20 London train *en route* for Aldershot, the headquarters of the corps, where they are to undergo ten days' training. Hitherto the corps has been represented at the Aldershot training by deputation merely; but on the present occasion the corps goes as a corps, Government paying the railway fares of the men, finding them in victuals during training, and allowing 10s. per man for expenses in addition.

WHAT IS THE CAUSE OF CANCEROUS INFECTIVITY?

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IN consequence of the editorial comments with which my previous paper, entitled "What is Cancer?" was favoured, I find myself very properly challenged to answer the important question which forms the title of the present communication. I do so with the full knowledge that failure in this implies the rejection of my theory as a working hypothesis. The subject, however, is one involving a more profound knowledge of what life is than we as yet possess, and still the answer depends upon this very point. On this account especially I ask the kind indulgence of the profession.

Before considering the question "What is the cause of cancerous infectivity," it is necessary for the reader to realise that vitality is comparative. We are apt to look upon a thing which is alive as simply alive, "and there is an end of it"; whereas one thing may be more alive than another. Life is simply one of the forces of nature. It is the only one which we cannot initiate or produce by conversion from another force, but we can convert it into other forces, as into mechanical force. Just as mechanical force, or light, or electricity may vary in amount, so may the vitality or intensity of life in one individual of a species be greater than that in another. In the same way the component cells of the tissues of his body may and do vary in their degree of life relatively to each other. For instance, the skin of the ankle is in a lower state of vitality than that of the thorax. The cells which are just being produced in the lowest layer of skin are in a state of active life; those which have been produced some days are less alive; and those which are just ready to be brushed off the surface are less alive still, if alive at all. Take a nail, and the same thing is seen more plainly. No one will admit that the morsel which he removes as superfluous is alive; yet, if not, at what distance from the root did its vitality cease—at three rows of cells from its root, or at four, or at what exact distance? There is no distinct boundary line between the living nail and the dead any more than there is under ordinary circumstances between life and death. Let this doctrine of comparative vitality be admitted, and we may then take a further step and admit as a question for consideration whether the vitality of certain cells of the body, such as epithelial cells, may be raised by an excessive amount of nourishment or by other peculiar circumstances in which they may be placed. The arguments in favour of the probability of this were given pretty fully in my previous paper, "What is cancer?" The hypothesis was brought forward that a malignant growth springing from epithelium may begin in several ways, but that penetration of the basement membrane and lodgment of cells beneath it, with subsequent non-encapsulation of the growth, are essential factors in all. In one set of cases the proliferation of cells upon a free surface is the first step, and the penetration is the effect of this proliferation; in the other the penetration is the first step, and the proliferation is the effect. In either case, however, the degree or intensity of life of the invading cells is increased. It is especially so when over-nourishment is the prime cause, whether from an excessive meat diet, or whether from non-use of even a proper amount of daily food, owing to an inactive life. When, however, from whatever cause, as a first step, epithelial cells become lodged in the softer tissues below the basement membrane, their supply of nourishment will be considerably increased. These cells, then, naturally hardy, somewhat incompressible, growing with great rapidity, and unable to die by abrasion, as is usual with epithelium cells, have their "tension" or intensity of life increased. It is now but a step to infection of the neighbouring lymphatic glands. The simple vection of the cells along the lymphatics I need not advance arguments in favour of: the possibility, probability, nay certainty, of this will be admitted. The question is, What happens when three or four of these cells arrive in a lymphatic gland? They then find themselves in a machine accustomed to deal

with effete and barely alive matter. Could we measure the degrees of life, we might imagine that of the gland cells to be 10 and that of the effete matter or lymph 2, but of the invading epithelial cells 15. Their vitality, therefore, overpowers that of the gland cells, and, as in the original locality where the parent growth took place, the invaders win. The success, therefore, of the invading epithelium cells is simply a question of comparative vitality. In a case of vection of cancer cells such as we are considering, the odds in favour of the invaders is still further increased by the tissues in general of the patient being in a lower state of vitality than in health. He probably is in a high state of chemical nutrition, but is probably in a low state as regards the quantity or the tension of his vital fluid, from anxiety and the wear and tear and the disappointments of life. We must remember that we do not yet understand life. It has not been studied, and it cannot be, as electricity has been. When electricity was first known, no person could have guessed or supposed that there would turn out to be such a quality as tension as opposed to quantity, or what we call positive and negative states. It may yet be discovered that there are qualities of life as well as quantities. It is evident that the life in the cancer cell is superior in some way, in quality, in quantity, in tension, in intensity, or in rapidity of formation, to the life in the cells of the gland to which it is carried; for it destroys them, grows faster, and crowds them out of their natural and proper place. I think, then, that a higher or more intense degree of life is the secret of what is called the infectivity of cancer cells—a comparative intensity, assisted by a lower tension or quantity of life in the part invaded. Experiments made upon this point should consist of transplantation of epithelium from a young and vigorous individual to the gland or tissues of an older and feebler individual of the same species. It is, I see, stated in the leading article of THE LANCET mentioned that the transplantation of living epithelium by embolism actually has been known to result in the production of a new growth capable of indefinite increase. The writer adds that he does not as yet admit this to be a settled and ascertained fact in the case of normal epithelium. We are, however, dealing with epithelium the nutrition of which has been stimulated, and which is not consequently in precisely a normal condition.

How accurately in nature is the food adapted to the wants of the tissues of the animal or plant consuming it. How is it that the spores of a mushroom must pass through the intestines of a horse, whilst those of a cow will not do? They both feed in the same field: how small must be the difference; yet it is one vital to the spores. Consider the effect of the peculiar food given by bees to a worker grub which they wish to develop into a queen. The food is the cause; the increased life is the effect. How is it that the tortoiseshell butterfly lays her eggs on a nettle, whilst she herself has drawn her food from flowers? How is it that it is necessary for the life of a hair-worm that its larva should have lodged in the bodies of two distinct individuals, a gnat and a fish? The least divergence from the proper nourishment is fatal. Actual changes in the texture of the flesh of several fishes (salmon, trout, &c.) are occasioned by change of food. If water cultures show the lowering effect of depriving seedlings of certain constituents of their normal food, why may not an increase of these constituents cause an increase of vitality and growth? I believe no bacterium will ever be discovered as the cause of cancer. Is not an epithelium cell, from its very peculiarities, to all intents and purposes a bacterium itself when out of its proper place and lodged amongst other tissues, and this especially when the first step of all has been over-nourishment by excessive and improper food? It does not happen to be long, or to be round, or to resemble in appearance in any way a bacterium or a coccus, but it is under these circumstances practically one.

About a year ago, having just removed a uterus entire, for cancer of its body, and looking into the abdominal cavity from the small space where the womb had been, I could see the peritoneum of a coil of bowel freckled with minute white spots from cancer cells, which had taken root, and were growing; yet the peritoneal basement membrane had not then been penetrated. I once added a few drops of nitric acid to the urine of an elderly woman suffering from merely a bad feverish cold, and was startled to see the deep blue of pure iodine appear. The urine held in solution a large amount of iodide of potassium. She had

repeatedly and for years taken this drug for rheumatism, but assured me she had had absolutely none for two years. This iodide must therefore have been held or stored by the cells of (probably) the liver. Why, then, had it thus suddenly been thrown off? Because the electric state of the blood and of the secretions made from it had become reversed by the febrile state. The blood and the secretions, the skin and the mucous membranes, are well known to be in opposite electric conditions. I think it not improbable that when an intensely vital cell comes into contact with one of lower vitality, as in the case of the cells in the peritoneum which we are considering, they will be in opposite electric states and adhere. This is, however, merely a surmise, and not essential to the explanation; because it is quite reasonable to suppose that, apart from any aid to anchorage like the electric one suggested, when a cell with its life in a high state of tension rests and remains for a time upon a spot in the peritoneum, it will adhere and draw nourishment. Proliferation, which is merely another word for intense life and rapid but ill-regulated multiplication, then takes place, and a colony is established. It has previously been shown how penetration of a basement membrane may take place by cells growing exuberantly upon a free surface. The same thing will occur when the proliferation has thus been established on the surface of the peritoneum.

If my view, therefore, is correct, the whole question of infectivity hinges upon the following points:—1. The certain fact of life being comparative in amount, a varying quantity in different tissues and cells of the same individual. 2. The probability that, just as decreased nourishment causes decreased vitality, so increased nourishment will cause increased vitality or life fluid in cells. 3. The probability that, as the cells of various tissues require different and varying forms of nourishment, so an increase in the food of one especial ingredient may cause an increase in the life fluid of one especial set of cells. 4. The probability that, when cells of different degrees of life compete for space, those of a higher grade will displace those of a lower grade, other circumstances being equal. 5. In the case of epithelium cells thus competing, their inherent peculiarities assist this competition in a remarkable degree. The truth or not of these propositions of course admits of argument and dispute, but they will, I think, be admitted by most men as reasonable and worthy of consideration. This question of cancer is the great question of the day in our profession; it is the dreaded disease, the very thought of which causes horror, and the actual existence of which is worse than death itself. To the elucidation of this question we are all called to devote our thoughts and energies.

Leeds.

THE USE OF LIVING BONE AS A BOND OF UNION AFTER EXCISION OF BONES AND JOINTS.

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THE various opinions which have from time to time been held in reference to the union and repair of bone have until recently undergone but little change in their essential elements. The ancients believed¹ that callus was formed by the extravasation of a gelatinous fluid, which gradually acquired consistence, and united the fragments in the same manner as a cabinet-maker would glue together two pieces of wood. Duhamel² regarded the periosteum as the "organ of ossification," and thought that after a fracture the periosteum of the two fragments first grew together and then swelled, forming a circular elevation around the line of fracture. This thickened membrane he thought was soon converted, first into a gelatinous and then into a cartilaginous substance, in which vessels developed and different points of ossification arose. Haller and Dethleef, after a long series of experiments, disputed this view, and concluded that

¹ Samuel D. Gross, M.D.: *Anatomy, Physiology, and Diseases of the Bones and Joints*. 1830.

² *Mémoires de l'Académie Royale des Sciences*. Paris, 1741.