cent.; small half-marble deposits in one or both lobes, 62 per cent. [6] All tuberculous bladders after the first year are slightly atonied, and contain a drachm or more of irritating puriform urine. [7] I may remind the reader that there are single ulcers of a non-tuberculous character that are benefited by washing or curettage, but these are only really diagnosable by the cystoscope. Author: BRITISH MEDICAL JOURNAL. The Clinical Significance of the Simple Solitary Ulcer, BRITISH MEDICAL JOURNAL, May 6th, 1896. [8] There is no urethra so hypersensitive or so intolerant of instrumentation as the tuberculous prostatic urethra. [9] The pain is fixed n the kidney in 80 per cent. of kidneys affected, and the pain is a true renal colic in 20 per cent. of kidneys affected by tubercle. The difference depends not so much on the thickening of the ureters as on the blockage of this narrowed channel by slough or mucus or phosphatic *débris*.

ON THE ETIOLOGY OF CANCER, WITH A NOTE OF SOME EXPERIMENTS.

By GEORGE THOMAS BEATSON, B.A.CANTAB., M.D.EDIN.
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IN May of 1896 I brought before the Medico-Chirurgical Society of Edinburgh some cases of inoperable carcinoma of the mamma, which, for reasons fully given at the time, I had treated by removal of the uterine appendages combined with the administration of thyroid extract. Those who saw the cases were satisfied that the progress of the carcinoma had been affected in a way that was contrary to the general experience of that disease. Since then the procedure I advocated has been put to the test by others, and their published cases go to confirm that the course of carcinoma in the mamma is materially affected by oöphorectomy and the administration of thyroid extract. Such a condition of matters is important from a therapeutic point of view, but it is equally clear that such cases have a special interest, as bearing on the etiology of carcinoma.

When I read my paper in May, 1896, the explanation that I ventured to put forward in reference to my cases was that in the process of development and specialisation of the ordinary cells of the body, these cells do not lose the reproductive or proliferating power which in the early days of embryonic life they undoubtedly possess, but that it is kept in check by the control of the healthy ovaries. Should this control be in any way interfered with by changes in the ovaries leading to altered secretion on their part, or possibly to the migration of ovarian cells, then any part of the body affected by the irritation of this pathological secretion or by the presence in it of a migrated ovarian cell, might resume that early reproductive power that was merely in abeyance, and thus come to display that proliferating power which is not only characteristic of germinal epithelium, but is also the distinguishing feature of carcinoma.

At first sight this might seem to be a return to the old theory of spermatic influence as explanatory of the origin of carcinoma; but it really is not so, and it is important that this should be clearly understood. The theory of spermatic influence as enunciated by the older writers assumed a conversion of the normal tissue of the part affected into tumour tissue; in other words, that there occurs what is known as metaplasia, or a transformation of the cells and intercellular substance of a tissue into cells of a different kind. This it is now generally admitted does not occur, and the only metaplasia of epithelial cells that we meet with is the occasional transformation of one form of epithelium into another, just as is seen in papilloma of the bladder, where the usual transitional epithelium of the mucous membrane is replaced by stratified columnar epithelium.

I do not think that in carcinoma we have any conversion of the cells of the part affected into cancer cells. My opinion is that the distinguishing cells of a cancer tumour are not the normal epithelial cells of the part converted into malignant ones. These latter differ so entirely from normal epithelium in their shape, size, mode of growth, and power not only of penetrating into neighbouring tissues but also of destroying them, that I cannot altogether bring myself to accept this explanation. Further, the transition stage of normal epithelial cells into cancer cells has never been clearly demonstrated. I can show sections where the cancer cells may be seen in active growth and the adjacent epithelium taking no active part in the process and even disappearing, a condition of things which would not present itself if normal epithelium became converted into cancer tissue.

This being so, what is the origin of the cancer cells? I am inclined to think that we must apply to our primary carcinoma what we see happen in the case of a secondary metastatic deposit. When this latter occurrence takes place, everyone admits that the resulting tumour is composed of cells which are the progeny of the original cells or cells which hived off from the primary growth and took up their abode elsewhere. There has been in this case no conversion of the surrounding cells into cancer cells. In the same way, I believe that primary cancer has its starting point in a special cell or cells of the part affected, and the cells that go to make up an epithelioma of the lip are not the normal epithelial cells of the part changed into malignant ones, but they are the offspring of one or more epithelial cells that have gone wrong, and have taken on the indefinite proliferating power that is the characteristic of carcinoma. That it is a cell of the part affected that begins the pathological process is rendered clear by the fact that in secondary tumours we have a repetition and imitation, often in minute detail, of the primary growth. This was very well exemplified in a case of carcinoma of the rectum that I had last year under my care. Previous to my seeing him, the lower portion of the rectum had been excised. After a time this was followed by a reappearance of the disease, and when I first saw the case there was protruding from the anal region to the extent of 2 or 3 inches a mass of what seemed merely granulation tissue. When a portion of this was examined microscopically, not only did it show cancer cells, but these were so arranged that they had taken on completely the structure of the part even to the extent of displaying the follicles of Lieberkühn in a modified form.

It may very reasonably be asked, Are there in different parts of the body and in the various organs any special cells that may be affected in the manner suggested? I am unaware that we have any positive proof of such, but Cohnheim's theory of embryonic remnants has undoubted support from the phenomena exhibited by some kinds of tumours; while Goodsir's nutritive centres with their special cells are possibly less problematical than we think. Then, if Ribbert's theory of growth liberation with its separated groups of cells, all ready to proliferate under certain conditions, be correct, we have another possible source of such cells.

Granting, however, that my surmise is a correct one, and that through any or even all of the above channels initial cells are available for the commencement of a carcinoma, what is the influence that first calls into activity the cell proliferation, so that these primary cells divide and subdivide, and eventually produce a countless host of descendants? The correct answer to this question would give the clue to the real etiology of carcinoma, and all we can do at present is to investigate every line of thought that offers a solution of the matter.

It may be that the theory of traumatic causation is the correct one, or that in the parasitic or infective theory we have the true exciting cause, but as yet certainly this has not been proved. No doubt trauma and long-continued irritation with its accompanying chronic inflammation are powerful factors, and even adjuvants, in this disease, but they do not seem to furnish the special fructifying influence that leads to the generation of true cancer cells. Working on the view that I have already enunciated in this paper, as suggested by what was seen in the behaviour of cancerous tissue under oöphorectomy, I thought it was possible we might have in the germinal epithelium of the body—that is, in the ovaries and testicles, healthy or diseased, the true exciting cause of carcinoma. Accordingly I performed some experiments in this direction, the results of which I wish briefly to record.

My first experiment consisted in placing in the subcutaneous tissue of the dorsal region of a rabbit a portion of the right testicle of the same animal. This was done on July 3rd of last year, and four months afterwards the animal was killed. Examined after death, only a faint induration could be felt at the site of the implanted tissue. The area was excised and sections cut. Microscopically it consisted mainly of fibrous tissue, cicatricial in character, with very few cell elements. At one part only there was a very limited area of small-celled infiltration, the cells being lymphoid in character. No actual remains of the implanted tissue could be found, and in other respects the animal was healthy.

The second experiment consisted in placing in the subcu-

taneous tissue of the back of a rabbit a portion of an ovary from a case of malignant disease of the uterus for which oöphorectomy had been performed. The experiment was carried out on July 12th, 1897, and on February 8th, seven months afterwards, the animal was killed, and the parts examined. There was no trace of the operation except a slight scar in the skin, which was freely movable, and no nodule could be discovered in the subcutaneous tissue. The portion of tissue inserted had entirely disappeared, and the animal was otherwise healthy.

In my third experiment a portion of a scirrhous tumour of the breast of a female patient was put into the left testicle of the rabbit on which I had done my first experiment of transplanting a portion of its right testicle into the subcutaneous tissue of its back. I was unfortunately compelled to use this rabbit, as we had had two deaths from the anæsthetic that morning and I had no other rabbit available. This second experiment was done on September 2nd, 1897. On October 5th the left testicle appeared if anything smaller than normal and of natural softness. On November 4th the rabbit was killed. Examination of the left testicle showed it to be atrophied. Under the microscope sections of it showed a few pigmented cells, often large, with one or more small, well-marked nuclei lying between bundles of fibrous tissue outside the body of the organ. The presence of these pigmented cells was the outstanding feature in the sections, for they were foreign to the structure of the testicle, and in appearance bore some resemblance to the large cells seen in mammary cysts.

On October 8th, 1897, the experiment was tried of placing a portion of a malignant epithelioma of the cervix uteri in the left testicle of a healthy rabbit. Four months afterwards (on February 8th, 1898) the rabbit was killed and examined. The testicle was found atrophied, and no trace of any new growth could be detected macroscopically or microscopically.

The next experiment consisted in placing a piece of carcinomatous tissue from the human cervix uteri into the left ovary of a rabbit. This was done on October 8th, 1897, and four months afterwards, on February 8th, 1898, the animal was killed. No growth was detected, and the ovary seemed as if had not been interfered with in any way.

The sixth and last experiment was a combination one. A portion of the left testicle of a rabbit was inserted into the left lumbar region of the animal on November 4th, 1897, and on December 7th, 1897, a portion of a recurrent carcinoma of the breast was introduced into the right testicle of the same animal. The rabbit was killed on February 8th, 1898, two months after the last inoculation, when examination of the right testicle showed no growth present, and microscopically nothing could be seen of the cancer cells.

Taken collectively, the result of these experiments is negative, and I find in them nothing to support my view as to the presence or influence of germinal epithelium being in any way the exciting cause of carcinoma. A weak point in my experiments is the fact that the cells of human carcinoma were employed for inoculation into rabbits, which may not be a suitable nidus for them. It may be possible in future experiments to obviate this source of fallacy.

SUMMARY OF THE EXPERIMENTS.

These were six in number, were performed on rabbits, and comprised the following procedures:

1. Inoculation of healthy testicular tissue into the subcutaneous tissue.
2. Inoculation of portion of human ovary from a cancerous patient into subcutaneous tissue.
3. Inoculation of a portion of cancerous human breast into the testicle.
4. Inoculation of a bit of epithelioma from human cervix uteri into testicle.
5. Inoculation of a bit of same tumour into ovary.
6. A combination experiment, consisting of first the transplantation of a bit of testicle into subcutaneous tissue, and then the inoculation of the testicle of the same rabbit with a bit of cancerous tumour from human breast.

THE annual report of the Regents of the University of New York show that there were 3,582 students in the medical colleges of that State in 1898.

TWO CASES OF COXA VARA, SHOWING THE RESULT OF DIVISION OF THE FEMUR BELOW THE TROCHANTERS.*

BY W. WATSON CHEYNE, M.B., F.R.S.

MY object in bringing these cases here to-night is to show the results which have followed division of the femur below the trochanters and correction of the eversion of the leg. My idea in adopting this measure was to bring the foot and leg into the proper position so as to enable the patient to walk—for my first patient was unable to walk—leaving the region of the hip-joint untouched. At the time that I performed the first operation I considered the possibility of correcting the deformity by removal of a wedge from the neck of the femur; but the child was very young—only 3 years old—and the parts so small that I did not think I should be likely to get the deformity properly corrected, while at the same time it seemed almost impossible to hope to maintain the correction in such a young child.

My first case came under my care at the end of 1892, and was operated on on January 23rd, 1893. It was shown at the Clinical Society on November 24th, 1893. Unfortunately the term "coxa vara" was not introduced till 1894, and I used the term "external rotation of the legs;" hence my case has not come under notice in the history of coxa vara, although, so far as I can find, it was one of the first in which any operation of this kind was performed. Apart from the restored usefulness of the limbs, the most remarkable, and to me most unexpected, result is that, as a consequence of dividing the femur below the trochanters, the progress of the deformity in the neck of the bone has been arrested, as will be immediately pointed out.

CASE I. *Operation Six Years Ago.*—Boy now aged 9, came under my care six years and a-half ago, with a deformity clearly referable to curvature of the neck of the femur, and chiefly characterised by marked eversion of both legs, and greatly diminished inversion; in fact, the feet could hardly be brought round sufficiently to look directly forwards. The trochanters were not above Nélaton's line, the essential deformity being curvature of the necks of the femora backwards.

On January 23rd 1893, the following operation was performed on the right leg (for photographs and a description of the case, see the Clinical Society's *Transactions*, vol. xxvii, p. 297): An incision was made on the outer side of the thigh at the upper part, and the femur, having been exposed and cleared, was divided transversely across by a saw a little below the trochanters. The foot and leg were then forcibly inverted till the normal degree of complete inversion was obtained, and being held in this position while the trochanters were pushed forward, a perforated oblong aluminium plate was placed over the femur opposite the line of division, and nailed on to the two fragments by means of tin tacks which had been nickelled. The object of this was to prevent rotation of the leg outwards during the union. The limb was put up in the inverted position, and the wound healed by first intention. The leg was afterwards put in a fixed apparatus for several weeks. Previously to the operation the boy could neither stand nor walk, but when shown at the Clinical Society in November of the same year he was able to walk quite well, and the left leg, which had not been operated on, was also very useful.

On January 7th, 1896, that is, about three years after the operation, the boy was admitted to Paddington Green Children's Hospital with an abscess at the seat of the former operation. On opening this I found the plate and tacks loose, and they were therefore removed, and the wound healed without any trouble. As his present condition resembles that of the second case, I shall narrate that first.

CASE II. *Operation Two Years Ago.*—Girl, aged 3 years at the time of operation. She had been previously in Paddington Green Children's Hospital for early rickets. At the time of her admission in January, 1897, there were all the signs of coxa vara in both legs. There was marked eversion of both legs, which could not be brought to look quite forwards, diminished abduction, and lordosis; the trochanters were at the level of Nélaton's line. There was anterior curvature of the femora and flat feet, The child walked with a waddling gait, and the knees tended to cross one another.

On January 26th, 1897, more than two years ago, a similar operation to that just described in Case I was performed on the left side. The wound healed by first intention and the plate is still *in situ*. The right leg was not touched.

The results are the same in both cases, and are as follows:

1. The object of the operation has in both instances been completely attained; the legs are in perfect position, inversion and eversion of the feet and legs are normal, and the legs are as useful as if there had never been anything the matter with them.

2. The left leg, for which nothing has been done, in each case has improved markedly in usefulness, and the eversion has somewhat diminished, though not to any great extent. In

* Read at the Clinical Meeting of the Medical Society of London on February 13th, 1899.