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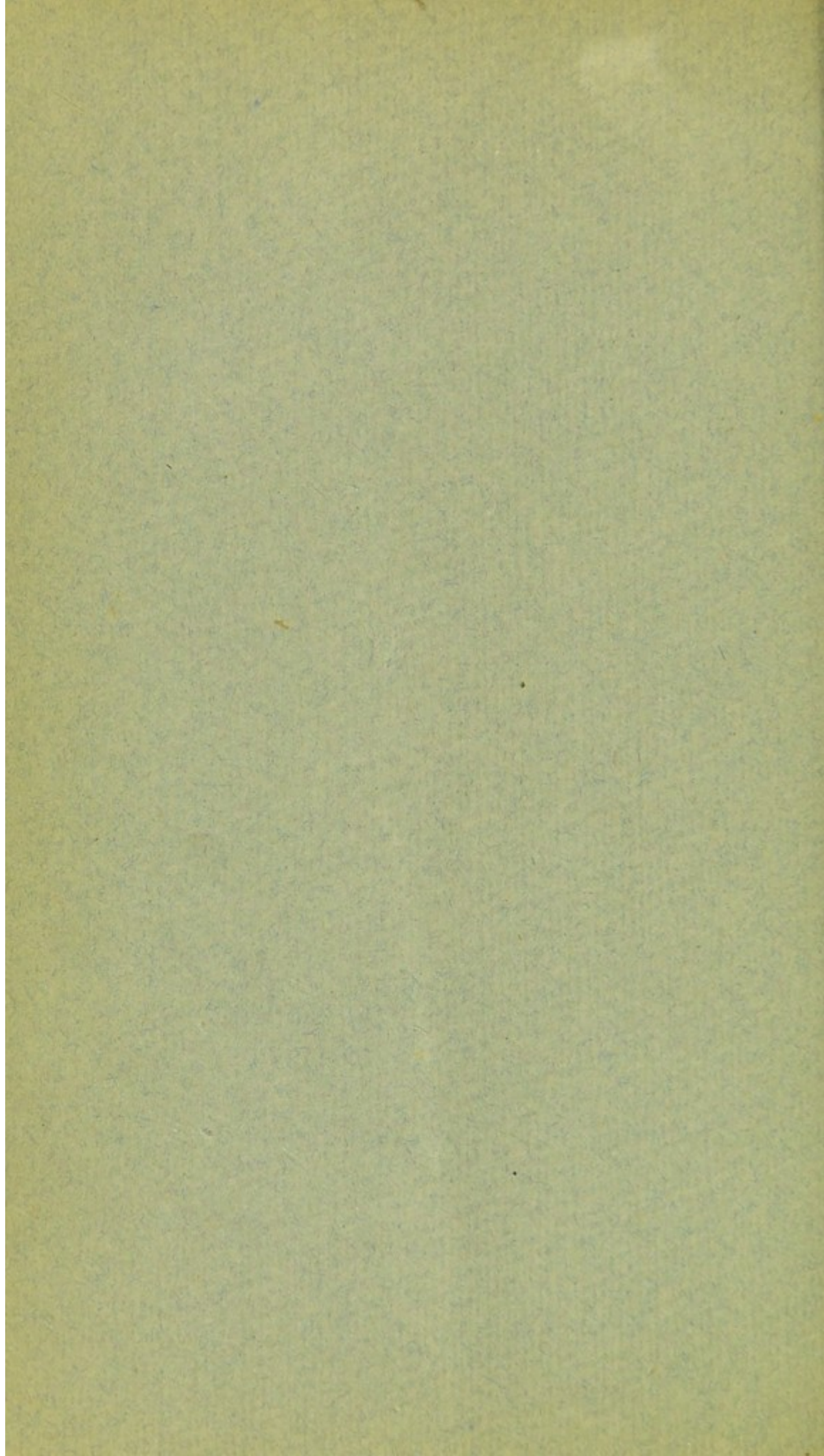
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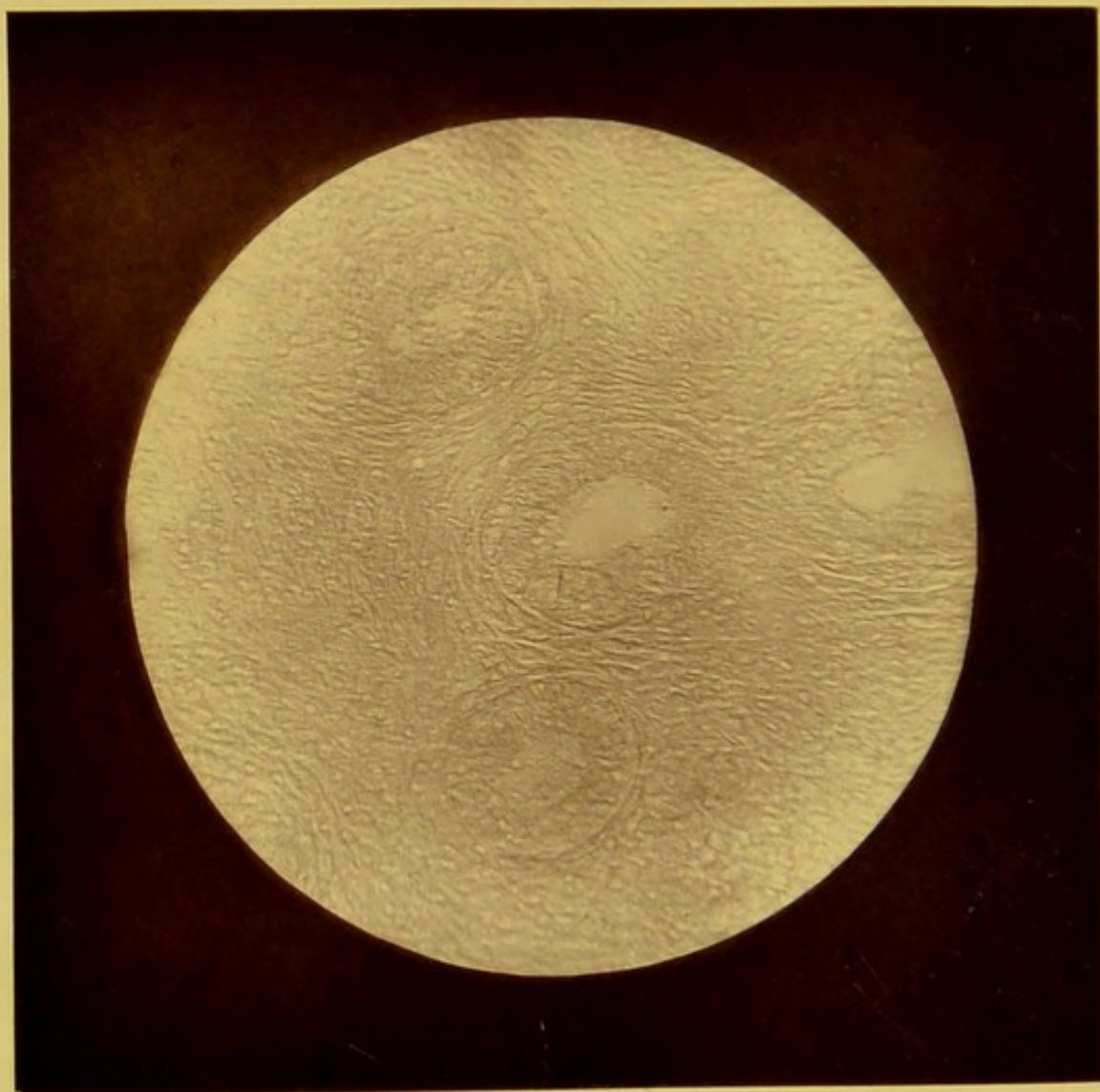




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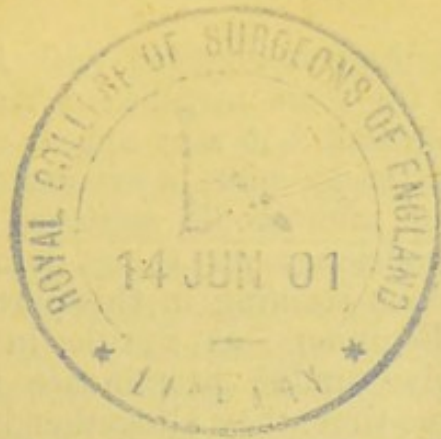
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ADENO. SARCOMA OF MAMMA AMPUTATED BY DR. WHITSON.

PHOTO-MICROGRAPH OF SECTION.

Printed by the Woodburytype Company, from a negative taken by MR. ADOLF SCHULZE, with Carl Zeiss' D.D., or $\frac{1}{8}$ -inch focus objective.



THE PHOTOGRAPHY OF MICROSCOPIC SECTIONS.

By JAMES WHITSON, M.D., F.F.P. AND S.G.,

Surgeon to the Dispensary of Anderson's College ; Late Extra Dispensary
Surgeon, Glasgow Royal Infirmary.

(With a Microphotograph.)

FOR some time past photography has been made use of as an aid to surgery, not only with the view of furnishing an important accessory in teaching, but as a potent auxiliary towards the more perfect exposition of operative principles, and recently, though only in a very small degree, as a means for the clearer elucidation of histological research; and in many instances the assistance thus afforded has been of the greatest value. Accurate representations of rare and interesting cases can in this way be obtained for permanent record, where the original is invariably so faithfully maintained, that dispute on the point is rendered superfluous. A drawing may, and often has only too good reason to be challenged as to the veracity of its details, but a photograph never can belie itself, or be called in question thereon.

During the month of October, 1882, while taking charge of the Wards of my friend Dr. William Macewen, in the Royal Infirmary, a most unusual case of adeno-sarcoma of the mamma came under my care, and was successfully removed, the report of which I had the honour of reading before the Medico-Chirurgical Society of Glasgow, on 12th January, 1883, and which will shortly appear in the columns of the *Lancet*. Excellent sections of the tumour were prepared for me by Dr. Newman, pathologist to the Infirmary, and I was extremely anxious to obtain a good sketch of one or more of these; but unfortunately no one capable of undertaking the task could be found. The only man likely to

accomplish it satisfactorily was engaged with Dr. Coats, and would not be at liberty for some months. I may here state, that though to the uninitiated it may appear very simple, it is in reality no easy matter to make a creditable representation with the pencil of microscopic sections, and any one wishing to acquire proficiency in their delineation must undergo no little previous training in this particular department of histology. Beginners, as a rule, in their earlier attempts, frequently give undue prominence to the minor details, while, at the same time, they altogether ignore, or glide hastily over the salient and typical points of the specimens, which for the time being happen to be placed before them. Under these circumstances, I bethought myself that photography might, if sufficient care were bestowed on the process be conducted to a successful issue, and make as effective a contributor for the demonstration of microscopy as it has proved advantageous to the interests of surgery; and in conjunction with my friend, Mr. Schulze, set to work at once in order to see for ourselves what could be done in this matter. After a good many attempts we succeeded in obtaining some very fair negatives, transparencies of which were executed for me by Mr. Thomas Swan, of Messrs. George Mason & Company, 180 Sauchiehall Street, and shown by means of lime light as lantern slides at the meeting of the Medico-Chirurgical Society recently alluded to.* Soon afterwards I gave two similar exhibitions for the benefit of my many student friends in the Royal Infirmary and Andersonian Medical Societies. When well put on the screen the value of these transparencies as a teaching medium is self-evident, from the fact that the lecturer is able to place at once before his whole class, in a brilliant and attractive form, a capital exemplification of his subject, written, so to speak, in the largest and most legible of types. The great drawback to the use of lime-light is its expense, while the fitting up of the apparatus, which is necessarily rather bulky, takes some time, and demands a good deal of care in its subsequent management.

Mr. Swan also prepared some excellent silver prints of the tumour sections, which were shown by me in Dr. Macewen's Systematic Class, he being then engaged in the consideration of the sarcomata. It was, however, altogether out of the question to get ready a sufficient number of these for the

* My best thanks are due to Mr. Swan for the extreme care which he bestowed on the arrangement and subsequent manipulation of the lime light, as well as for the many invaluable services which he rendered in connection with the production of the lantern slides.

present paper, and I therefore employed the Woodburytype Company, whose resources in this way are practically unlimited, to get ready several hundred copies, specimens of which will be found to accompany each number of the *Journal* for the present month.

The following account of the microscopical characters of the tumour has been kindly supplied me by Dr. Newman, Pathologist to the Infirmary:—Microscopic examination of sections taken from periphery of tumour show it to be composed of spindle-shaped cells imbedded in a homogeneous matrix, in addition to a large number of dilated acini and excretory ducts, the number of which varies, however, in different parts of the growth. The acini and excretory ducts are lined by a single layer of cylindrical epithelium, and in none of the sections examined is there any tendency shown to proliferation of the epithelial elements beyond their normal limits. Immediately surrounding the acini, but distinctly separated from them, there is a layer of large closely packed spindle-shaped cells, almost all of which contain well marked nuclei. These spindle cells are so large, that at first sight they appear like, and might easily be mistaken for, epithelial cells. Where the acini are close together, the intervening tissue is composed entirely of these large cells, arranged concentrically around them; but where the interacinous tissue is large in quantity, it is made up, unless close to the acini, where the cells are always large in size, of small round cells imbedded in a tolerably abundant homogeneous intercellular substance. Sections from parts of the tumour other than the periphery, reveal no difference in its microscopic characters.

The following is a description of the method (read before the Medico-Chirurgical Society of Glasgow, 12th January, 1883), which was adopted in the taking of these photo-micrographs, and I must here acknowledge my deep sense of obligation to Mr. Schulze, not only for the use of his valuable instruments, but for his indefatigable labours to secure a good result:—

The photographs were taken by means of a large microscope stand, made by Ross & Company, and arranged as now described. The axis was disposed horizontally, and the binocular body was replaced by a short wide monocular one, the end of which farthest removed from the objective carried a biconcave amplifying lens of one inch diameter. To the short body was attached a pyramidally-shaped mahogany photographic camera, carrying at the large end the focussing screen of ground glass. The object glass employed was one of Zeiss' D D, equivalent

to one-sixth English focus, and giving a magnification of sixty diameters at ten inches, or of three hundred diameters at ten inches' distance when combined with the usual lowest, so called A ocular, of English opticians. The D D of Zeiss is a remarkably fine lens, having an air angle of 105° , or a numerical aperture of 0.79.

The object was illuminated by a powerful paraffin lamp, having a flat wick, one and a half inches broad, and a bull's eye lens of three inches diameter, which carried on its flat side a disc of dark blue glass, for the purpose of obtaining monochromatic blue light, as with the use of it the visual and actinic foci of the objective practically coincide. The lamp is the one designed by the Rev. W. H. Dallinger, F.R.S. It has beautiful vertical and horizontal motions for both lamp and bull's eye lens, so that the illumination can be adjusted to the greatest nicety. With the D D, and the previously mentioned amplifying lens the object on the negative is magnified one hundred and forty diameters, or about twenty thousand times superficially.

Some negatives were taken with Zeiss' C C, or one quarter of an inch objective, the object on the negative being magnified seventy diameters, or four thousand nine hundred times superficially.

The light having passed through the bull's eye lens, with its convex side turned towards the edge of the flame, was received by one of Ross's Kelner C oculars, which has a large field lens, and which ocular, placed in the sub-stage of the microscope, served as an achromatic condenser. The stand having been arranged as described, a characteristic portion of the object was selected, and carefully focussed. Particular attention was paid to an uniform and correct illumination of the field of view, by no means an easy matter when sunlight is not available. The shutter of the camera having been closed, the focussing screen was withdrawn, and replaced by a dark slide containing one of Wratten & Wainwright's instantaneous plates (4×4), and after the room had been darkened, leaving only the aforesaid paraffin lamp burning, a time was selected when all tremor had ceased, to expose the sensitised plates for ninety seconds, this having been found the correct time of exposure for the plates, apparatus, and object used.

The negatives were developed by Mr. Thomas Swan, who, as before stated, also produced the positive transparencies.

It is, of course, not to be expected that a photograph on the screen should be, by any means, so sharp and well defined as the image of the object in the microscope. For we have to

consider that, supposing the lantern photograph to be three inches in diameter, and the picture on the screen eight feet in diameter, that the former is further amplified thirty-two times diametrically, or one thousand and twenty-four times superficially. In point of fact, we would then have before us the image of the object magnified four thousand four hundred and eighty diameters, or twenty million times superficially. The sensitive film of both negative and positive being a coarse one, microscopically speaking, causes also the loss of some of the finest details. Besides, a photo-micrograph never can possess the same depth of focus as the image projected on the retina, because the eye involuntarily adapts itself to the different foci while viewing an image, the result being increased penetration; but nevertheless I feel sanguine when this method comes to be better understood than it is now, that it will be universally used by histologists for producing permanent as well as faithful records of microscopical structures.

In conclusion, I may say that Mr. Schulze and I are still pursuing this subject, and we have every prospect before long of being able to exhibit much better specimens of photo-micrography than the one now placed before the numerous readers of the *Glasgow Medical Journal*.

