vellous changes we find produced in the epithelial linings of its cysts. Much more requires to be done in the study of this most interesting question, and doubtless, when the method of its progress is made clear, we may find some indications for a more sure prevention of it. One thing I am certain it clearly establishes, and that is the absolute propriety of removing ovarian tumors at a very much earlier stage of their existence than has been, till recently, the accepted rule in practice. If these epithelial changes are progressive—as doubtless they are, and if they are malignant—as I certainly believe them generally to be, then, acting upon the principles which guide us in the treatment of all tumors, we ought to remove an ovarian cystoma early in its history, before these changes have been effected, and certainly before there is any risk of cyst-rupture. Finally, we ought to regard the operation of tapping as one which ought to be discarded, save under very exceptional circumstances, because not only is it fraught with considerable immediate danger, but it seems to possess a still more important secondary risk, which has until lately been almost overlooked. I may say that in my own practice it is an operation never performed, unless I am certain the tumors cannot be removed.

There is one fact which may be quoted in support of the views advanced by De Sinéty and Melassez, to which they have not drawn attention, but the significance of which becomes apparent; that is, that while, in the cysts of the tumors which I shall afterward describe as possessing ova, the contents are always limpid, whereas in the cysts where the changes have occurred the contents are mucous, viscous, highly albuminous, and often bloody; in fact, they present all the characteristics which the contents of mucous cysts would possess. It might not be inappropriate also to point out here that the arguments I have given above also point in the direction of establishing for cancer a local origin. We have, then, ovarian tumors with well-pronounced and distinctive characters, possessing the power of infecting the system generally with cancer, as they most undoubtedly do when their removal is too long delayed, or when they have ruptured or been frequently tapped; and, on the other hand, we have tumors with the same characters, but which have never been tapped and have not ruptured, but have been removed early in their history. By the early removal of these latter tumors we remove the source of the systemic infection, and prove, it seems to me, a local origin for cancer—as far as the ovary is concerned, at least.

There comes then the question—if we should see any of these altered and sprouting cells in fluid removed from a cyst or from

a serous cavity—Should we set the case down as being hopelessly malignant, and, in the case of an ovarian cyst, refuse on that account to operate? I certainly could not answer these questions in the affirmative. I believe that such appearances indicate the high road to cancer, but it is possible that the goal may never be reached. I think it perfectly certain that removal of the tumor may arrest the progress of the change before a general infection is reached. Dr. Mathews Duncan very well points out that the ovary is in every way the most isolated organ in the body. Removal of a cystoma in which such changes are being effected, at an early stage, may avert a systemic affection; and, as a matter of fact, I have observed all these changes in tumors which I removed many years ago, and the patients from whom they were cut out are alive and well at this date. In one case the period which has elapsed is eleven years.

Upon the question of the origin and diagnosis of this condition a good deal has been written, especially by Dr. Foulis, of Edinburgh, and Mr. Thornton, of London. They both claim the credit of having discovered masses of sprouting epithelium, both in the cystic fluid and in that of the peritoneum, which will enable us to diagnose cases of cancer. After a very large experience, both of microscopic manipulation and of cases of this character, I must absolutely dissent from the views they express. Dr. Foulis goes so far as to say that the absence of these sprouting masses from ascitic fluid is an almost certain sign of the absence of malignant peritonitis and malignant ovarian tumor. But I have had, in at least two cases, reason to suspect malignant tumors, when I found none of these cells in the fluid, and yet I found abundant reason afterward to know that my suspicions were correct. In fact, I place no reliance on the presence or absence of these cells in fluid removed by tapping, and as I never tap removable tumors at all now, I never have any occasion to look for them, or any opportunity. The changes to which their presence is due certainly lead to a malignant condition in their later stages, but their presence is no guide for a prediction that the patient will die of cancer, and it is the best of all arguments for the speedy removal of the tumor.

It is also quite certain that this form of papillary cancer frequently arises long after the removal of an ovarian tumor under circumstances which make it extremely unlikely that the tumor should be regarded as its cause. They are both probably the result of the same condition, whatever that may be. Thus, in the *Lancet* of October 25, 1875, I published a brief note of a case of ovariotomy in a young girl, in which the operation was made to cure a complete protrusion of the uterus. The operation was

performed on August 18, 1875, and after her recovery from it, until about May, 1877, she remained in perfect health. She came to me then with indications of a general failure in her health, obscure pelvic pains, a slight amount of ascites, and a small fixed mass behind the uterus. For a month she took chalybeates, and returned to me much improved in her general health, but with more ascites and with the retro-uterine mass increased. In the beginning of July the increase of the ascitic effusion was so marked that it became evident something must be done. The age of the patient (nineteen) made me hesitate to pronounce it a case of cancer of the peritoneum, to which view I strongly inclined. The only alternative which seemed to me reasonable was that the other ovary had become cystic, was fastened in the pelvis, and was producing the ascites by pressure on veins. I deemed it therefore right to make an exploratory incision, and this I did on July 15th. In the operation the only noteworthy point was the absolute perfection with which union had taken place between the tendinous structures divided in the previous operation—a result which is not always obtained after abdominal section.

When the peritoneum was opened and the fluid evacuated, the lesion was found to be the papillary form of cancer of the peritoneum. Small papillary nodules were scattered over the whole surface of the parietal peritoneum within reach, and on the surface of the small intestines. The pelvis was occupied by several masses, the largest of which, about the size of an orange, seemed to embrace the rectum, and this it was which had been previously felt from the vagina. At the posterior surface of the uterus several nodules were felt, but the remaining ovary (the left one) was perfectly healthy. The right cornu of the uterus was tied up to the lower angle of the wound by a firm band about a third of an inch in diameter, representing the pedicle of the tumor removed nearly two years before. She recovered from this operation, went home, and died after great suffering, on the 27th of August. I have again examined the tumor removed from her with great care, and can discover no appearance of papillary growths about it, and, as she remained in perfect health for at least eighteen months after the operation, I can only regard the access of the papillary growth as an independent event.

There is another condition associated with malignancy in ovarian tumors—hemorrhage into their cavity. I have seen one case where this occurred, yet where the tumor was not cancerous; yet, as a rule, its occurrence must always be regarded as suspicious.

The following is a typical example of a case of cystic tumor of the ovary which has undergone malignant degeneration—one

in which the mistakes I fell into have been of immense service to me since.

On March 2, 1876, I was summoned to the neighborhood of Llangollen to see a patient under the care of Dr. Price Jones, from whom I received the following history: She had been confined of her first child on February 21st. The labor was natural, the child still-born, the placenta somewhat friable, but expelled without difficulty. She did not, however, diminish in size as much as usual after labor, and in a day or two symptoms of peritonitis appeared. On February 28th her pulse and temperature fell to 100 and 99° respectively, and the only matter of note was that the abdomen was greatly distended by fluid. At 2 A.M., on March 2d, I found the abdomen so distended as to have quite a drum-like tightness, the temperature quite normal, but the pulse about 180 and the respirations 50 in the minute. These symptoms were regarded as due solely to the mechanical interference with breathing. The uterus was fixed high up in a solid, doughy mass, which could only be blod-clot. No intestinal resonance could anywhere be discovered. Generally over the abdominal surface a wave of fluctuation could be felt, but here and there it was less distinct. Palpation gave no assistance on account of the tenseness of the integument. The conclusion I came to was that it must be a case of intraperitoneal hæmatocele followed by some serous effusion; for I regarded it as impossible that it could be all blood. I tapped the abdomen, and removed about three quarts of fluid, which seemed like pure venous blood. This gave immediate relief; and when I left her, at 7 A.M. on March 3d, the pulse had fallen to 120 and the respirations to 32 in the minute. The relief of the tension also enabled me to discover floating doughy masses, which I regarded as blood-clot. She improved considerably after this, and was brought to Birmingham on March 30th. The journey was delayed as long as possible; but she became so urgent for something more to be done that it was impossible to appease her any longer. The exertion of removal was, however, evidently too much for her, as on the following day a passive œdema of the left thigh occurred, and this was followed by an increase in the size of the abdomen. This latter condition became so serious on April 2d that it was necessary to tap her again, and eight pints and a half of a fluid which seemed like equal parts of blood and water were removed. The breathing was greatly relieved by this for a few hours; but on the afternoon of the next day it became again very bad, and, as it then seemed to come from the chest, Dr. Heslop was called to see her in my absence. It was then discovered that the left pleura was full of fluid, and three pints and a half were immediately re-

moved from it by aspiration. This quite relieved her breathing. As the fluid was distinctly tinged with blood, Dr. Heslop suggested that there might be some malignant disease in the chest; but, on careful discussion of the whole aspects of the case, there was no sufficient data to arrive decisively at such an unfavorable conclusion, as it was thought possible that the pleural effusion might have been the result of mechanical pressure from the abdomen. On April 4th, 5th, and 6th she was very comfortable; and, after careful discussion, it was determined to open the abdomen to determine if anything could be done to arrest the hemorrhage. In cutting open the abdomen, a line of abnormal tissue was cut through which looked like malignant growth, and then a cavity was opened which contained a quantity of bloody fluid and thick layers of laminated fibrin. As no point of hemorrhage could be detected, and as it was felt that any disturbance of the structure might lead to hemorrhage which might not be controllable, the cavity was washed out with thymol solution, a drainage-tube inserted, and the wound closed. The nature of the case was not made absolutely clear by the section, as no accurate idea could be formed as to the nature of the posterior wall of the hæmatocele cavity. She died on the afternoon of April 9th. The post-mortem examination was made by Dr. Saundby, who found that the left pleural cavity contained about two quarts of blood-stained serum, the lung being quite collapsed, but healthy. There was a fungating ulcerated growth about the size of a walnut, covered with blood-clot, on the pleural surface of the diaphragm. The right pleural cavity contained about a pint and a half of similar fluid, with a similar growth on the diaphragm. Some of the mediastinal glands were as large as hens' eggs from cancerous infiltration. The abdomen was occupied by a large tumor matted down to the uterus, broad ligaments, and section, and only after careful dissection could it be made out that this mass was a cancerous tumor of the left ovary, that into its cavity the hemorrhage had occurred and the incision had been made. It was adherent over the whole of its anterior aspect to the abdominal wall. The microscopical appearances were those of encephaloid cancer.

Looking back on this case, I of course regret that I performed abdominal section; indeed, I did so against my own convictions and entirely at the patient's most urgent request. I had the advantage of the help of Dr. Marion Sims in the case, and therefore had as good security for avoidance of error as could be—yet we were all mistaken.

The term *colloid*, as applied to tumors of the ovary, must be held to refer only to the consistency of the fluid contained in them,

and in no way as a point for classification. I have never met with a description which has persuaded me that the so-called *colloid cancer*, as seen in the breast, intestines, and peritoneum, has ever been met with in the ovary. What we see of it is the myxoma already described, and which is always quite localized in the tumor, a mere incident, as it were, never forming the mass of the growth. In other organs it is practically a malignant disease, but whether it is so in the ovary I do not know. It is, as I have said, the reversion of the stroma of the ovary to its young form, and may therefore be suspected. The first time I saw it was in a tumor sent to me for examination by Mr. Spencer Wells, who asked the question, "Do you think this cancer?" In my reply I said I feared it was; the stroma was so young and immature as to resemble perfectly a myxomatous growth, or the canalicular structure of the umbilical cord. Indeed, if I had placed sections from these three structures under adjoining microscopes, I do not think that I have yet met with the histologist who could distinguish between them.

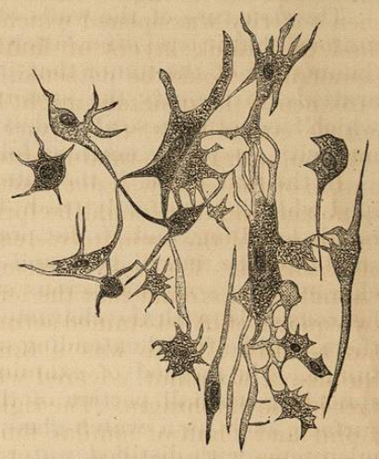

FIG. 27.—Myxomatous Growth of Ovary.

An example of this disease was exhibited before the Obstetrical Society of London, in June, 1878, and as it illustrates not only this disease, but the fact that diseased ovaries lead to intractable menorrhagia which kills the patient, I shall quote the report in full. If instead of using a sponge tent, which merely had the effect of killing the enfeebled patient by septic peritonitis, the surgeons had removed the patient's ovaries, they would have removed the cause of the hemorrhage, and probably have saved and cured their patient. The victim, a woman aged twenty-one, had suffered from almost constant hemorrhage since her marriage three years previously; and when admitted into Guy's Hospital she was so exhausted that transfusion was thought of. The hemorrhage, however, was checked by the use of a sponge tent and the subsequent injection of warm water, but the woman died ten days later of suppurative peritonitis. Both ovaries were found enlarged, but retaining their normal shape; and it was at first thought that the enlargement was due to acute inflammation.

Microscopical examination, however, showed that the histological characters of the growth were those of myxoma, though the harder portions exhibited the characters of sarcoma. The spleen was leukæmic. The uterine mucous membrane was disintegrated on its surface (as shown in one of the microscopical sections) and altered in structure, its round cells appearing separated, as if by fluid effused between them, and being surrounded by a fibrillar growth, reminding one of the state of things found in the ovaries. He would leave it, the reporter said, to the pathologists to decide whether there was any connection between the leukæmia, from which the patient suffered, and the myxomatous enlargement of the ovaries.

The structure of the walls of ovarian cystomata is tolerably uniform, but it is so often altered by protracted growth and inflammation of the tumor that it may be difficult, in many preparations, to identify the structures. If a tumor be examined which has not been so altered, it will be found that the structures met with are pretty much as follows:

In the first place, if the outer surface of the tumor be examined while it is perfectly fresh, before it has been damaged by rough handling, and if the preparation be made in the way I shall describe, it will be found that this membrane has all the characters of a normal serous surface. A mosaic of flat, polyhedrous cells, with the characteristic cement substance between them, will be found extending uniformly over the surface of the tumor. The method of examination which I pursue is that of spreading a small portion of the tumor over a slightly convex surface, such as a watch-glass, and placing it in my freezing microtome with distilled water only. I then screw it carefully up to the level of the cutting-slab, and take a thin slice off the outside surface of the tumor. This is immersed in a solution of .5 per cent. of lactate of silver, and is then mounted in glycerine jelly. This treatment brings out all the structures I have described in similar situations, and we see the stigmata and stomata, with the characteristic endothelium of the latter, just as we find them in all other serous pavement surfaces. From the endothelium of the stomata I have an absolute assurance that the malignant growths of which I have spoken, and of which I shall have to speak again, are derived. They constitute a variety of epithelioma, and are, in my estimation, analogous to the nesting of the epithelial cells which we see in skin cancer. These cells are produced by a rapid and immature proliferation of the endothelium of the stomata. In a favorable section they may be seen to be crowding out of a stoma, tearing asunder the relations of the epithelium to its subjacent structure; and thus it is

that they possess to the naked eye and to the touch the peculiar characteristics which have obtained for this disease its special names of papilloma and miliary cancer. It will be seen, therefore, from this description, that it differs in no way from any other form of epithelioma, and it is to be seen on the surface of an ovarian tumor as often as it is to be seen either on its inside or upon the peritoneum without the presence of an ovarian tumor at all.

The descriptions given by De Sinéty and Melassez of the external surface of an ovarian cystoma differ very materially in some points from my own, but I have only to point to their methods of examination as affording a complete solution of the discrepancy. I have already said—in a paper read before the Royal Society upon the "Anatomy of the Umbilical Cord"—that no correct descriptions can be given of any tissue from a microscopical examination made upon anything but perfectly fresh tissue, and this is most peculiarly true of an epithelial surface. To employ any hardening reagent, and then describe what is seen, is, therefore, not describing what may be seen in fresh tissue. When the French authorities say: "That by employing these two processes we have assured ourselves that the exterior investment of the walls in no way resembles the endothelium investment of the peritoneum," the difference between their description and mine is further to be explained by the different use of the term *endothelium*. They seem to employ it to mean a subepithelial layer of cells, while I use it, on the authority of Dr. Klein, exclusively to mean the cells within the stomata; and while there can be no doubt that the subepithelial arrangements are altogether different in the ovarian cystoma from those of the peritoneum, because the structures are in themselves altogether different, the subepithelial arrangements of an ovarian tumor are precisely those of the ovary.

Underneath the epithelial layer which I have just described there is a layer of fibrous stroma of varying thickness, and having a variety of structures in it. The stroma is stated by different authors to be capable of subdivision into a varying number of layers—from two to six—the only point of agreement between them being that the divisions are most marked at the point of implantation of the tumor. Thus, De Sinéty and Melassez say:

"In the neighborhood of the point of implantation may thus be obtained three principal layers: one external, in connection with the peritoneal cavity; one internal, in connection with the cystic cavity; and one medium, interposed to the two preceding. The external and internal layers have the aspect of fibrous membranes, while the medium layer has rather the aspect of loose

cellular tissue. It is in this latter layer that the large vessels of the pedicle spread themselves out. Departing from the base of the tumor, the medium layer becomes thinner, is no longer isolable, and the cystic wall then appears to be formed only of two fibrous layers. Still farther toward the summit of the tumor the cystic walls are thinner, and can no longer be dissociated into several layers, except by the aid of a most artificial dissection. They are no longer anything but a fibrous membrane, homogeneous in its whole thickness. These transformations are easily explained. They are due to the medium layer of loose cellular tissue becoming thinner and thinner, and finally disappearing, and to the internal and external fibrous layers adhering together and becoming intimately blended."

Concerning these various statements I would only say that a skilful dissector could manage still further to subdivide them, and the results obtained in this dissection would, of course, be very materially influenced by the number of diseased follicles in the neighborhood where he was working.

The microscopic structure of this middle layer varies very much with the age of the tumor. In an old example with thickened and hardened walls, more particularly if it has been frequently tapped, the elements are almost entirely fibrous, with here and there a few indications of nuclear arrangements of the proper ovarian stroma, the almond-shaped nuclei being often so altered and elongated that they are taken for the rod-shaped nuclei of unstriped muscular fibre. I have, however, never been able to satisfy myself in a single instance of the presence of muscular fibres in the walls of an ovarian cystoma; while, on the other hand, in the parovarian cyst it is an almost uniform experience to find muscular fibre largely entering into its constitution. Dr. Grailey Hewit has described an ovarian tumor with muscular envelope, but on reading the account I had no doubt whatever that what he found was a parovarian and not an ovarian cystoma. I have myself seen a mass of muscular fibre in an example of the former almost half an inch thick.

De Sinéty and Melassez, however, speak of having found a great abundance of unstriped muscular fibre in the walls of an ovarian cystoma, an observation the results of which are open to various explanations. They speak as a conclusion to be drawn from their researches, that the employment of ergot of rye may have the result of arresting the growth of ovarian cystoma by reason of its power over involuntary muscular fibre, and they actually quote a case in which hypodermic injections of ergotin are supposed to have cured one. I cannot, however, assent to anything which would involve the application of therapeutic re-

sults for the establishment of microscopical or pathological investigations. In the words of Dr. Mathews Duncan I may say that "we know of not one single case of cure of an ovarian cystoma by any other proceeding than that of the operation of Ephraim McDowell."

In the wall of a cyst of recent growth we constantly find the remains of normal Graafian follicle, to which there had not extended the mysterious influence which directs cystic development; but in an old tumor these are not readily found, for they have either already developed into cysts, or the advancing sclerosis has altogether destroyed their characters. At its base an ovarian tumor may easily be separated from its peritoneal capsule, just as a normal ovary may be, and upon this fact is based the ingenious treatment of sessile tumors by enucleation, originally suggested by Dr. Miner.

Among the conclusions made by De Sinéty and Melassez is one to the effect that a large number of ovarian cystomata have their origin in the tubes of Pflüger. Now, these tubules have been the cause of a great deal of discussion, and I, for one, am perfectly satisfied that they have received an amount of attention, and have been elevated into an importance they do not deserve. In Figures 7 and 9 very fair representations of these tubes are given, after Balfour. They are confined entirely to the hilum of the organ, being, as I have said, survivals of the Malpighian tubes, and therefore no part of the true structure of the ovary. I have never yet seen them lined with epithelium, and therefore I do not believe they are capable of undergoing cystic development, for without epithelium I do not think any such process could occur. In all probability they have some kind of epithelium in the early stages of their existence, but if they ever had any at all they lose it in more mature growth. It is possible that in occasional instances they may retain it, and then be developed, just as the tubules of the parovarium; but I have never seen any case in which I had reason to believe these tubes were the origin of the cysts. If they should give rise to a cystic tumor, one would suspect it ought to be of a unilocular character, and that its walls would not possess the features which are always characteristic of an adenoid cystoma.

In the *Archives für Gynekologie*, 1870, Waldeyer confirms this view in a remarkable sentence: "My researches have demonstrated to me that the opinion of Foster and Rindfleisch, to the effect that cystomata originate from the connective elements of ovarian stroma, is not admissible;" and with this opinion I entirely agree. It will be seen, therefore, that, with the exception of the possible occurrence of an occasional unilocular cyst

arising from the tubules of Pflüger, my belief is that all ovarian cystomata have their origin in follicular dropsy.

I have failed to find any description of a cartilaginous growth of the ovary apart from cystic alteration, but I have twice found plates of cartilage in the walls of ovarian cysts, and in neither of these tumors were there any other structures which might place them in the category of dermoid cysts. The cartilage was composed of large cells with very little fibrous matrix; in fact, it was hyaline cartilage, identical with what I have seen repeatedly in the testicle. There is, of course, no good reason why enchondromatous tumors should not be met with in the ovary, just as they are in the testicle; but in the latter organ they occur independently of cystic degeneration, while I am not aware that they ever have done so in the ovary.

Fibromatous tumors of the ovary must be very rare, for I have only met with three cases, and one which was clearly malignant. Growth of the fibrous stroma of the ovary, so as to form a large abdominal tumor requiring removal, has not yet been described, so far as I have been able to discover; and under any circumstances the condition is a rare one, for Peaslee has collected only seven cases, including two which he had seen himself, and Atlee describes another which probably was of this nature, though unfortunately no microscopic examination of it has been recorded. I think that if I had a similar opportunity now of examining such a preparation, I should be able to give a much better account of it, for I suspect that the reason of its malignancy would be capable of explanation by reversion to an immature form of growth of the cells of the ovarian stroma, analogous to that of the cystic epithelium.

The patient in whom occurred the first of the tumors I am about to describe was forty-four years of age, was very stout, had borne six children, and had been failing in health, owing to the increasing size of her abdomen, for about two years. She was sent to me by Dr. Vinrace in July, 1873, when I found the abdomen occupied by a large quantity of ascitic fluid, in which floated a large and perfectly solid tumor. The abdominal walls were also very œdematous. I tapped the abdomen and punctured the skin repeatedly with a lancet to get quit of the anasarca. This was repeated several times, until it was evident that only the removal of the tumor, which I had diagnosed to be solid ovarian, would permanently benefit the patient. When the abdomen was opened, it was found necessary to extend the incision eight centimetres above the umbilicus, in all nearly twenty-five centimetres, before the tumor could be removed. It had an adhesion to a coil of intestine, and a very extensive adhesion to the great omentum, and it occupied exactly the relations of the left ovary, the other being perfectly healthy. Its pedicle was clamped, and the wound closed in the usual way. The patient died on the fifth day, as was usual when the clamp was employed. The tumor was round, smooth, and of a creamy white color, and it weighed almost nine pounds. When cut into, it had a glistening, white, and trabeculated structure; and it was perfectly solid throughout, there being no indication anywhere of cystic formation. A number of very thin sections were made, and these were treated by various processes, their uniform result being to show that the tumor really was the ovary, and that its overgrowth was limited to the fibrous stroma. The fibres were ranged in bands which crossed in all directions, and treatment by acetic acid showed that a few of these bands, or perhaps I should say a very few, were composed of muscular fibres, an observation which substantiates that of Sangali, quoted by Virchow, made in a similar but much smaller tumor. Looking at my sections of this tumor, made nearly ten years ago by the rough processes in use before I had introduced the method of cutting sections of fresh frozen tissue, I cannot make out very much more now, but I feel nearly satisfied that these fibres are but the result of immature fibre-cell growth running to riot. Throughout the tumor, but chiefly toward its surface, a number of minute cavities were observed, lined by epithelium, and having in one or two instances a large cell with a nucleus, presenting all the appearances of an ovum. The number of these cavities in a less pronounced condition was very large, and I have no doubt they were immature Graafian follicles. I have, within the last few days, removed an exactly similar tumor of smaller size. The pedicle was ligatured, and the patient recovered as usual without any difficulty.

A Microscopical Committee of the Philadelphia County Medical Society reported as follows on a tumor of a similar kind, submitted to them by Dr. Washington L. Atlee, and which he had successfully removed in 1876:

"Thin sections from both the fresh tumors and from hardened preparations exhibited a dense, fibrous-looking stroma, in which the spindle-cells apparently constituted but a small portion, the large majority having, it seemed, been developed into the fully formed fibrous tissue which gave its firm, dense character to the growth. The application of diluted acetic acid brought into view small oval nuclei, arranged with considerable regularity in the section, and which, even under a high power (1,250 diameters), displayed none of the double, triple, and multiple character commonly met with in neoplasmata of the more malignant type.

"Your committee, therefore, conclude that these two ovarian