The success which attended the efforts to catheterize the ureter in the female bladder, and the information obtained in this way, naturally led to similar attempts in the male. To this end various modifications of the cys-

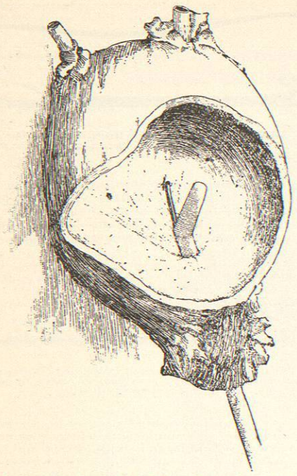

FIG. 1574.—Showing the position of a catheterizing cystoscope with window on convexity at the moment when a catheter is being introduced into the left ureter. (From F. Tilden Brown.)

toscope have been devised to enable the operator to introduce an ureteral catheter under the guidance of the eye.

The operation of cystoscopy is not difficult, but for its thorough performance some skill and patience are required. The interpretation of the conditions seen is by no means easy, and considerable experience is needed for the correct understanding of them.

The patient may be placed horizontally on his back, or in the lithotomy position, according to the individual preference of the operator. The bladder should be washed out, and the irrigation should be continued until the wash water returns clear.

If cocaine is to be used as the anæsthetic it should be introduced at this time, but the fact must be borne in mind that, while the mucous membrane of the bladder in health absorbs slowly and imperfectly, an ulcerated or diseased bladder may absorb with great rapidity. When ether or chloroform is used, the patient should be fully anæsthetized before the cystoscope is introduced.

The bladder should be distended with four or five ounces of a two-per-cent. solution of boric acid. In case of an over-distended and atonic bladder, even more than this amount of solution may be introduced. The instrument, lubricated with glycerin or other clear lubricant which will not cloud the window, is then passed in the same manner as a sound, care being taken not to start up bleeding. After the instrument has thoroughly entered the bladder, the light may be turned on, and at the same time the room should be darkened. By using the cystoscope that looks out posteriorly, the floor and fundus of the bladder, and also the sides for a considerable distance above the ureteric orifices, may be examined. Now by changing the instrument and taking the one which looks out anteriorly, the operator may inspect the front wall of the bladder and the parts above the urethral orifice. This examination should be systematic in order that no part of the bladder may be overlooked.

The limits of this article will not permit of any detailed description of the cystoscopic pictures, but will confine us to a brief consideration of the conditions in which cystoscopy may be of use.

Tumor of the Bladder.—The cystoscope affords often the most perfect opportunity for making an early and positive diagnosis of tumor. As the use of the instrument becomes more and more common it is to be expected that tumors will be detected early, before they have outgrown the possibility of thorough and radical removal. The pictures presented by tumors are often characteristic and easily understood. On the other hand, the examination is often very difficult, or indeed impossible, by reason of the hemorrhage which entirely prevents a clear picture.

It is well to remember that in a bladder not very fully distended the folds of mucous membrane may present misleading pictures closely simulating some forms of tumor. A mistake from this cause may usually be avoided by fully distending the bladder, and it is one which is but little likely to occur in the hands of an expert. With an irrigating cystoscope a jet of water may be thrown into the bladder during the examination, thus making a pedunculated tumor move in such a way that the operator may judge of the nature and extent of its attachment to the bladder wall.

Examination of an Hypertrophied Prostate.—The portions of the prostate which project back into the bladder

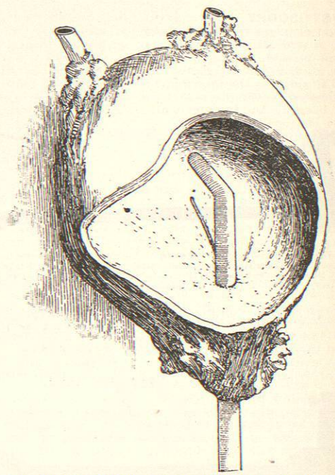

FIG. 1575.—Showing the process of catheterizing the left ureter through a cystoscope having window on the concavity. (From F. Tilden Brown.)

can be quite thoroughly and satisfactorily examined through the cystoscope. The knowledge thus obtained may be of decided value in determining the operative procedure appropriate to each case.

Sacculated Bladder.—There are certain cases of sacculated bladder in which the cystoscope is a great aid in

diagnosis. The pockets may contain stones or give rise to conditions resulting in the formation of stone, and in such cases an early and accurate diagnosis is difficult or impossible without the aid of the cystoscope. A more frequent use of this instrument might lead to a more intelligent treatment of the obscure conditions.

Ulceration of the Bladder Wall.—It is rare to see the bladder wall ulcerated except as the result of malignant disease or tuberculosis. It is usually possible to make the diagnosis of tuberculosis without the aid of the cystoscope; and this is fortunate, for the manipulations of a thorough cystoscopic examination often greatly aggravate the discomforts of a tuberculous patient and in some cases even seem to hasten the course of the disease. This is especially due to the danger of adding a mixed infection to the existent tuberculous process.

Examination of the Ureter.—Inspection of the ureteric orifice is possible through the cystoscope and may afford valuable information as to the condition of the kidneys. In hæmaturia or pyuria, for example, a cloudy jet of blood or pus from the ureter convicts the corresponding kidney of being the seat of the hemorrhage, or of some inflammatory process. The desire to extend the examination further and to get still more exact information as to the condition of each kidney has led to the use of ureteral catheters, through the cystoscope. Brenner, Caspar, Albarran, Otis, Brown, and others have devised a modification of the cystoscope which makes this procedure possible. For a more complete discussion of this subject the reader is referred to the article on *Catheterism*.

Detection of Foreign Bodies.—The cystoscope is occasionally useful in demonstrating the presence of foreign bodies in the bladder. In this way pins, silver-wire sutures, and silk sutures which were working their way into the bladder have been seen and removed.

Arthur T. Cabot.
Hugh Cabot.

CYSTS. (See also *Cystadenoma.*)—A cyst is a circumscribed cavity containing a more or less fluid substance, or in rare cases gas, shut off from the neighboring tissues by a more or less independent wall, and owing its origin to pathological processes. To this definition there are, however, a number of exceptions. Pericardial, pleural, and peritoneal effusions, tuberculous cavities, abscess caverns, sinuses, etc., as well as simple dilatations of the hollow organs of the body (stomach, colon, bladder, etc.), in which the normal wall as well as the form of the organ is preserved, are not as a rule designated as cysts. A distinction is also made by some writers between cysts possessing a well-defined wall and those whose wall consists only of the surrounding tissue, the latter being termed cystoid. On the other hand a distinction must be made between the true cysts and the cystic neoplasms. The latter are to be classed as cystomata or cystadenomata. It is very difficult, however, to fix the boundary line between the cyst and the cystoma. In the development of every cyst a certain degree of proliferation of its wall must take place to compensate for the increasing size of its cavity, else defects in its wall would result. This tendency of the cyst wall to proliferation is more marked in some cases of cyst formation than in others, consequently it sometimes becomes very difficult to fix the exact nature of the cyst. As a general point of differentiation it may be taken that all cystic growths which through the proliferation of the elements of their walls constantly form new cysts are to be classed with the cystomata. In connection with such growths there is usually a pathological formation of new gland tissue to which the cystic change is almost always secondary. The character of the growth is therefore more properly expressed by the term cystadenoma. In the true cyst the proliferation of the cyst wall is confined to that of the original cyst and there is no progressive formation of new glandular tissue. It must, however, be borne in mind that cystomata very frequently take their origin from simple cysts.

Cysts may vary in size from a pinhead to a man's head and occasionally much larger. They may consist of but one cavity (simple or unilocular cyst), or they may be many-chambered (compound or multilocular cysts). The chambers of a multilocular cyst are usually very irregular in size and shape, and may or may not communicate with each other. Communication between the cavities may occur primarily in cases in which an entire acinous gland becomes changed into a cyst, as may happen in the case of the salivary glands. Secondary communication may be established through rupture or atrophy of the partition walls. Complete destruction of these transforms a multilocular cyst into a unilocular. On the other hand, a cyst of a single cavity may through proliferation of its walls become changed to one of several or many chambers. Obliteration of a cyst cavity may result from organization or solidification of its contents, or rupture of the cyst may be followed by its collapse and subsequent union of its walls through fibroblastic adhesions. The inner wall of the cyst cavity may be smooth (simple cyst), or may be papillary (papilliferous or proliferous cyst). Cysts in their occurrence may be single or multiple. Multiple cyst formation in a number of adjacent cavities may assume the appearance of a multilocular cyst through the atrophy of the intervening tissues.

The essential elements of the cyst are the cyst wall and the cyst contents. The latter must be different in nature from the former, but both bear certain definite relations to each other. Either one or the other may be the primary agent in the formation of the cyst. In the case of the liquefaction of necrosed tissues or in the formation of a capsule around a parasite the wall is developed secondarily to the contents, while in other forms of cysts the contents are the result of secretion by the elements of the cyst wall. In these cases, however, the retention of secretions and the consequent stretching of the wall are the factors which excite further proliferation in the elements of the wall.

As a rule the cyst wall consists of a connective-tissue membrane of greater or less thickness separating the cyst contents from the neighboring tissues. It may be thick enough to be visible to the naked eye, or may be evident under the microscope as a very delicate fibrous layer, or only as a thickened layer of the surrounding tissues, while in other cases the cyst contents may lie in direct contact with these without any proper intervening membrane. Very frequently the cyst wall is so independently developed as to render it possible for the cyst to be easily shelled out from the surrounding tissues. In other cases the wall may become thickened through inflammatory processes and so intimately adherent to the neighboring structures that its separation from them becomes difficult or impossible. In a general way the thickness of the cyst wall will depend both upon the age of the cyst and upon the degree of pressure within it. In the early stages of formation the cyst may possess no definite wall, while later a thick fibrous capsule may gradually develop. On the other hand an originally thick capsule may be thinned from a great increase of pressure within the cyst. Deposits of fibrin, lime salts, etc., upon the inner surface of the wall may cause its apparent thickening. The connective-tissue capsule of the cyst may have either an epithelial or an endothelial lining, or the cyst contents may lie in direct contact with the connective tissue of the wall or with the surrounding tissue. This will depend chiefly upon the anatomical origin of the cyst, the character of the inner lining of the capsule being the same as that of the cavity from which the cyst arose. Epithelium will be found only in those cysts which arise from spaces originally lined with epithelium, and from the character of the epithelial cells lining the cyst it is possible within certain limits to tell its origin. Many changes, however, take place in the character of the lining cells: originally tall columnar cells may become cuboidal or flattened, ciliated cells may be changed to simple columnar or flattened, while a single-layered epithelium may become stratified through proliferation. Increase of pressure within the cyst is the chief factor in producing these changes. For this reason the true character of the lining

epithelium is best preserved in the cysts of smallest size. Under certain conditions these changed forms of epithelium revert to their original type. Cysts formed in connective tissue or from dilatation of blood or lymph spaces will be lined with endothelium. In the first case the endothelium arises from the proliferation of the endothelial cells lying in the connective-tissue spaces.

Retrograde changes are of very frequent occurrence in the cyst wall and the cells lining it. Mucous degeneration, as well as hydropic and fatty degeneration of the lining epithelium, is the most common. Desquamation and necrosis also occur, as well as pressure atrophy. Corpora amylacea and colloid-like substances are also found in cysts as the results of pathological secretion of the lining cells. In the connective-tissue capsule there may occur inflammatory processes of varied kinds, suppuration, hemorrhage, calcification, hyaline change, and even bone formation. Calcareous plates may be formed in the cyst wall or the entire wall may be completely calcified. Very rarely amyloid is found in cyst walls after inflammatory processes. As a result of changes in the capsule the lining of the cyst undergoes degeneration following the disturbance of its nutrition. Obliteration of the cyst may result from extensive changes in the wall.

The content of cysts varies greatly according to their origin. It may be serous with greater or less albumin content, or it may contain mucin, pseudo-mucin, albumose, etc., or it may be colloid-like, hemorrhagic, purulent, or contain fat, fatty-acid crystals, cholesterin, blood pigment, etc. To the naked eye its appearance may be thin and transparent, or thick, turbid, opaque, varying in color from red, brown, greenish, or gray, to yellow and white. The consistence may be stringy, gelatinous, waxy, slimy, pultaceous, greasy, etc. In rare cases the cyst may contain only air or gas. The epithelium lining cysts produces a secretion somewhat analogous to that of the gland from which it has its origin, but owing to the retrograde changes occurring in the epithelial cells the chemical nature of the secretion comes to differ greatly from that of the normal. According to the nature of these changes it may become serous, mucous, colloid, etc.; if exudates from the cyst wall are added to it the content may become fibrinous, purulent, albuminous, etc.; or in case of hemorrhage into the cyst it may contain the remains of red cells or blood-pigment granules. The reaction of cyst secretions is usually weakly alkaline, but it may be neutral or acid in rare cases of retention of an acid secretion. Cysts arising from the degeneration of tissues or tumors may contain portions of tissue showing sufficient structure to aid in the differential diagnosis. In cysts formed by parasites portions of the parasite may be present. In the case of cystic abdominal tumors the character of the cyst contents is of great importance in the differential diagnosis.

According to their origin cysts may be divided into:

1. Retention cysts.
2. Follicular cysts.
3. Proliferation cysts.
4. Degeneration cysts.
5. Endothelial cysts.
6. Congenital cysts.
7. Inclusion cysts.
8. Foreign-body cysts.
9. Parasite cysts.
10. Air or gas cysts.

Retention Cysts.—These arise through the dilatation of gland spaces or ducts caused by the retention of secretion due to some obstruction to the normal outflow. This is the most common form of cyst and may arise in any gland of the body possessing a duct or lumen, provided that an actively secreting parenchyma still remains behind the point of obstruction. Such cysts are therefore lined with epithelium resembling in character that of the gland in which they arise. Retention cysts lined with endothelium may arise from lymphatics, lymph spaces, synovial membranes, or tendon sheaths. The contents of retention cysts depend upon the nature of the tissue in which they are formed and upon the secondary retrograde changes present. The causes leading to the obstruction or closure of gland ducts are very varied in nature: inflammations in the gland or neighboring tissues, cicatricial contraction, thickening of secretions, calculi, new growths in or around the gland, etc. The gland duct may also be partially closed during a resting period, so that when the gland is suddenly called into activity the inadequacy of the outflow leads to a cystic dilatation. As the secretions collect behind the point of obstruction, the gland or duct becomes dilated and with the stretching of the wall there is usually a compensatory hyperplasia of the gland wall.

Retention cysts are most commonly found in the hair follicles and sebaceous glands of the skin, glands of Bartholin, mucous glands of the alimentary tracts, uterine glands, epididymis, kidney tubules, and mammary gland; less frequently in the sweat glands, biliary ducts, pancreas, salivary glands, etc. Cystic dilatation of the larger canals, ureters, vermiform appendix, Fallopian tubes, etc., may also be caused by obstruction and retention of pathological secretions and exudates.

Follicular Cysts.—Closed glandular cavities having no outlet, such as those of the thyroid, ovary, parovarium, etc., become cystic when an excessive amount of secretion is formed by their walls. Such cysts are extremely common in the ovary and parovarium, being found in practically every woman after the age of thirty. They are usually of small size but may become very large. They are lined usually with a single layer of columnar cells and contain a mucoid or colloid-like substance. This may present great alterations in character due to secondary pathological changes in the cyst wall.

Proliferation Cysts.—As the retention or follicular cyst enlarges there must take place also a compensatory increase of the tissue elements of its wall, or else rupture from excessive thinning would eventually take place. Cyst formation is therefore not entirely of the nature of a retrograde change, but involves a certain degree of proliferation. It is consequently difficult to draw a definite line between simple proliferating cysts on the one hand and cystic neoplasms on the other. As true tumors of the latter class (cystomata or cystadenomata) may be classed all cystic growths which through the proliferation of their walls constantly form new cysts. Preceding this new cyst formation there is usually a pathological formation of new gland tissues to which the cystic change is secondary. As mentioned above such growths are therefore more properly classed as cystadenomata. Cystic tumors may also arise from newly formed lymph and blood vessels, but these are to be classed with the angiomata. As true proliferation cysts are to be regarded those unilocular cysts which become multilocular through the proliferation of their walls, at the same time increasing greatly in size; or those cysts whose walls proliferate into the lumen of the cyst, forming papillary excrescences on the inner surface of the cyst wall. Proliferation cysts occur chiefly in the ovary, parovarium, kidneys, and cervix uteri. Between them and the true cystoma there is a gradual transition.

Degeneration Cysts.—Cystic spaces are very frequently formed by the liquefaction of necrosed portions of tissues or organs. They may possess no definite wall, or the space may be surrounded by a connective-tissue capsule which in some cases is lined with endothelium derived from the endothelial cells of the connective-tissue spaces. The cyst may contain portions of necrosing tissue-elements whose structure is sufficiently preserved to admit of identification. Degeneration cysts may arise as sequelæ to anæmic infarctions, especially those of the brain. In the ovary they occur within certain limits as a physiological degeneration of the corpus luteum and also of the Graafian follicle after the menopause. Large extravasations of blood in the tissues, chronic abscesses, old tubercles, gummata, etc., may also become liquefied and form cysts. Degeneration cysts occur also in the bone marrow of old age, and in the thyroid, pancreas, kidneys, etc. They are also very commonly present in quickly growing malignant tumors following simple necrosis, fatty or mucous degeneration. In these cases the content of the

cyst is usually cloudy or turbid, containing blood pigment and remains of tumor elements. Such degeneration cysts are especially common in myxomata and sarcomata, sometimes occurring to such a degree as to warrant the employment of such terms as cystomyxoma, cystosarcoma.

Endothelial Cysts.—Degeneration cysts lined with endothelium may be formed by the proliferation of the endothelial cells of the connective-tissue spaces. Retention cysts with endothelial lining may arise from blood-vessels, lymphatic vessels and spaces, tendon sheaths and synovial membranes. The so-called ganglion, hygroma, etc., may be placed in this category. In these cases the cyst is usually formed by the shutting off of some portion of a cavity by inflammatory adhesions or constrictions, and the dilatation of the sac so formed through the accumulations of inflammatory exudates. In the case of the ganglion the cyst is formed by a myxomatous degeneration of the connective tissue in the neighborhood of the joints, and derives its endothelium from that of the lymph spaces. It is partly a new formation and partly a degeneration. The cystic hæmangiomata and lymphangiomata belong to the neoplasms and are not to be placed in this category.

Congenital Cysts.—Remains of fœtal clefts, canals, and fissures in normal locations or misplaced fœtal inclusions may become cystic as a result of proliferation of their walls excited by trauma, inflammation, etc., or from excessive formation of secretion. Such cysts occur in the branchial clefts, urachus, parovarium, remains of the Wolffian body, Müller's ducts, etc. The dermoid cysts and cystic teratomata are usually classed with neoplasms. Analogous to the cysts arising from fœtal inclusions are those arising from the implantation of epithelium occurring rarely as the result of trauma, inflammation, or operation (inclusion cysts.)

Inclusion Cysts.—Through traumatic or surgical displacement of portions of epithelium into mesoblastic tissues cysts may be formed from the resulting proliferation of the included epithelium. Kaufmann's experiments in enkatarrhophy are well known. He found that the inclusion of portions of a cock's comb was followed by the formation of cysts lined throughout with epithelium and containing material resembling that found in atheromatous cysts. The growth of these cysts continued until a certain limit was reached when they remained stationary. Similar cysts have been observed in the human body arising from implantations of portions of epithelium after trauma to the skin and scalp. They are found more frequently in the scars of burns than after wounds. The writer has observed a case of multiple cyst formation after the removal of a portion of the jaw in a case of giant-cell sarcoma. The cysts, the largest of which was of the size of a hen's egg, were lined with stratified squamous epithelium most probably derived from the mucous membrane of the mouth. Such dislocated portions of epithelium do not possess the intrinsic capacity for unlimited growth as seen in the cell nests of epiblastic tumors. Traumatic epithelial cysts must be thoroughly removed, otherwise they may recur.

Foreign-Body Cysts.—Around foreign bodies embedded in the tissues a capsule of connective tissue may be formed. This may undergo proliferation while degenerative changes may occur within the cyst contents. In this manner cysts may arise that partake of the nature of both degeneration and proliferation cysts. Such cysts contain in addition to the primary cause, necrosed tissue and pathological exudates from the wall.

Parasite Cysts.—Aside from the capsule which may be formed around a parasite, certain organisms such as the cysticercus and echinococcus may be found in the human body in the cystic stage of their development. Around the cyst formed by the parasite itself there is usually developed a connective-tissue capsule. Only rarely are the parasite cysts found free in the tissues or in the body cavities, the cysticercus being occasionally found in the meninges and ventricles of the brain. Parasite cysts may contain characteristic portions of the parasite or may be sterile.

Air and Gas Cysts.—Cyst-like cavities filled with air may arise from the shutting-off of portions of emphysematous lungs. Air-containing diverticula are found rarely in the pockets of Morgagni, and the mucous glands of the trachea and larynx may undergo cystic dilatation from air forced into them under high pressure. Cysts containing gas are occasionally found in the mucous membrane of the vagina. According to Zweifel the content of these cysts consists of trimethylamine. Eppinger and others hold that the condition is only an emphysema of the vaginal wall. According to Chiari's investigations the cysts are dilated lymph spaces lined with endothelium which not infrequently produces giant cells. The origin and nature of the gas filling the cyst are unknown. Similar gas cysts have also been observed in the wall of the intestines and in peritoneal adhesions. Cystoid spaces containing gas are also found throughout the body in cases of infection with the Bacillus aërogenes capsulatus. The gas found in gas cysts is sometimes inflammable.

Occurrence.—The occurrence of cysts in the human body is very widespread. They may be found in practically every organ and tissue. The most important distribution is as follows:

Fœtus.—Small cysts in the amnion are occasionally found. They are the result of a myxomatous hyperplasia of the mesenchyma. They are small and without clinical significance. Small cysts of this membrane lined with epithelial-like cells have also been described and called dermoids, but their exact nature is unknown. Cystic change of the chorionic villi due to a myxomatous degeneration of the villous stroma is relatively common. It may affect the chorion as a whole or be limited to single villi (bladder mole, grape mole, etc.). Larger cysts of the chorion have been observed in a few cases. These may have their origin in the liquefaction of placental infarcts, or they may arise from disturbances in the development of the chorion and amnion. Retention and degeneration cysts may be formed in the internal organs of the fœtus, especially in the liver and kidneys. Their etiology is obscure; they are in part explained by errors of development and in part by inflammatory processes occurring in intra-uterine life.

Bones.—The cysts most commonly found in bones are of the nature of degeneration cysts. They occur chiefly in osteomalacia and in the osteoporosis of old age, arising from the liquefaction of the marrow, and may reach such a large size that only the outer shell of the bone is preserved. The cyst contents may be clear, cloudy, or hemorrhagic, frequently containing much liquid fat. As a rule they possess a connective-tissue capsule, and from this capsule there occurs sometimes in osteomalacia a reparative proliferation of connective tissue. Degeneration cysts are also of very frequent occurrence in tumors arising either from the periosteum or from the medulla but more often in those from the latter. They occur most frequently in the myxoma and sarcoma of bones, but also in synchondromata and fibromata as well as in metastatic carcinoma of bone. A cystoid cavity, often multilocular, usually results from the degeneration of these tumors, the wall of the cavity consisting of tumor tissue or bone. Not infrequently there is a new formation of bone in the wall of the cyst. Cystic dilatation of the antrum of Highmore occurs rarely. Proliferating cysts are seen rarely in the jaws; they arise from the tooth sacs (alveolar cysts). Echinococcus cysts may occur, usually in the long bones, pelvis, skull, vertebræ, and phalanges. They may occur as exogenous cysts beneath the periosteum, and a few cases have been reported in which the surface of the femur and tibia was completely covered with such cysts. Through pressure the bone atrophies and disappears, or necrosis takes place, thus often leading to spontaneous fracture. When originating in the medulla echinococcus cysts resemble myelogenous tumors for which they are usually mistaken. The cysticercus is only very rarely found in bone.

Muscle.—Degeneration cysts occur in old extravasations and in myxomata and sarcomata arising from the inter-