FEMALE REPRODUCTIVE SYSTEM

Plate 13.257 Vagina

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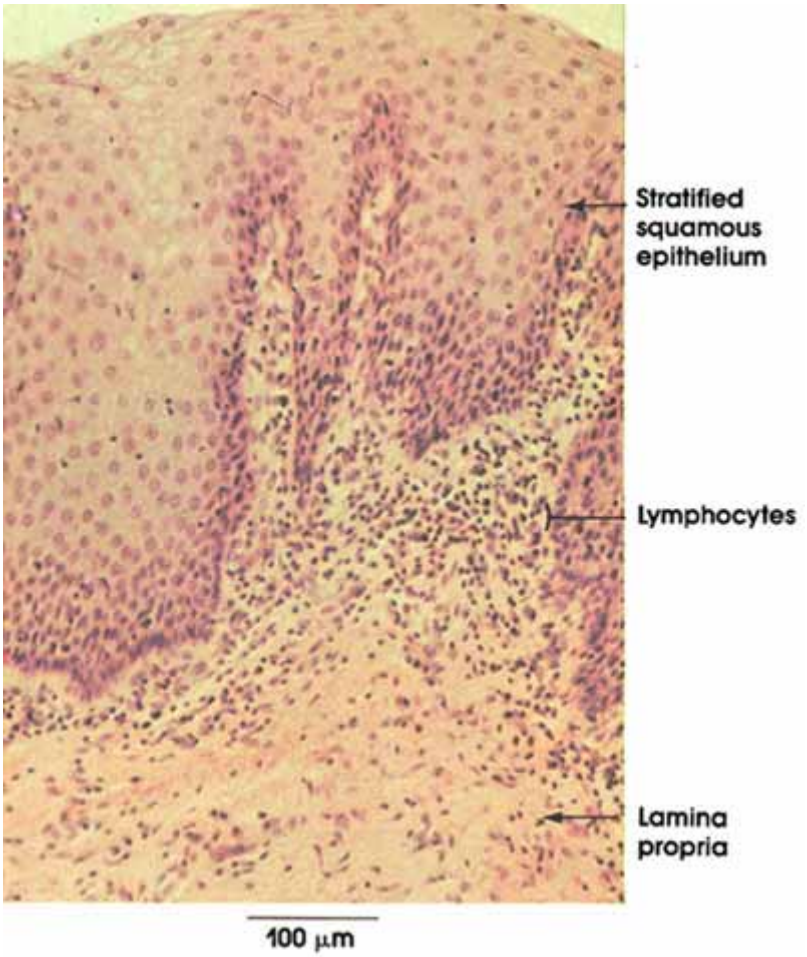
Peer Review Status: Externally Peer Reviewed

VAGINA



Human, 10% formalin, H. & E., 162 x.

This is a section of part of the wall of the vagina showing the mucosa. Note the stratified squamous non- keratinized epithelium. The lamina propria consists of loose connective tissue and is rich in lymphocytes. Occasional lymph nodules (not seen here) are found. The vaginal epithelium undergoes cyclic changes during the menstrual cycle.

Plate 13.261 Umbilical Cord

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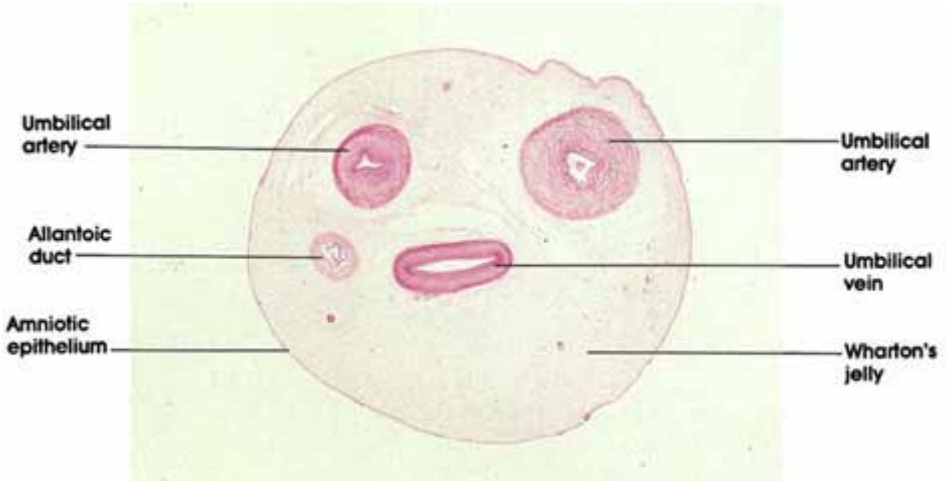
Peer Review Status: Externally Peer Reviewed

UMBILICAL CORD
Human



Human, 10% formalin, H. & E., 8.5 x.

The umbilical cord in transverse section reveals two umbilical arteries and a single umbilical vein embedded in mucous connective tissue (Wharton's* jelly). Also present is the endodermal remnant of the allantois, which extends the length of the cord in the human. The cord is covered by a simple epithelium of amniotic derivation, which becomes stratified in late gestation. The umbilical arteries are atypical of those of the remainder of the body in that they carry oxygen-poor blood, lack an internal elastic lamina, and have considerable metachromatic ground substance within their muscular tunic. They also lack an external elastic lamina, and the mucous connective tissue replaces the adventitia found in other arteries. Likewise, the umbilical vein exhibits an unusually thick muscularis, with intermingling circular, longitudinal, and obliquely disposed smooth muscle fibers. Furthermore, an internal elastic lamina is present, which serves to distinguish the vein from the accompanying arteries. Mucous connective tissue, a form of loose connective tissue, is characterized by its copious ground substance, rich in sulfated proteoglycan, which embeds a profusion of collagenous fibers. The cells of mucoid connective tissue are primitive fibroblasts, stellate in outline, which are not revealed with routine preparative techniques; their nuclei, however, are seen.

Plate 13.251 Ovary

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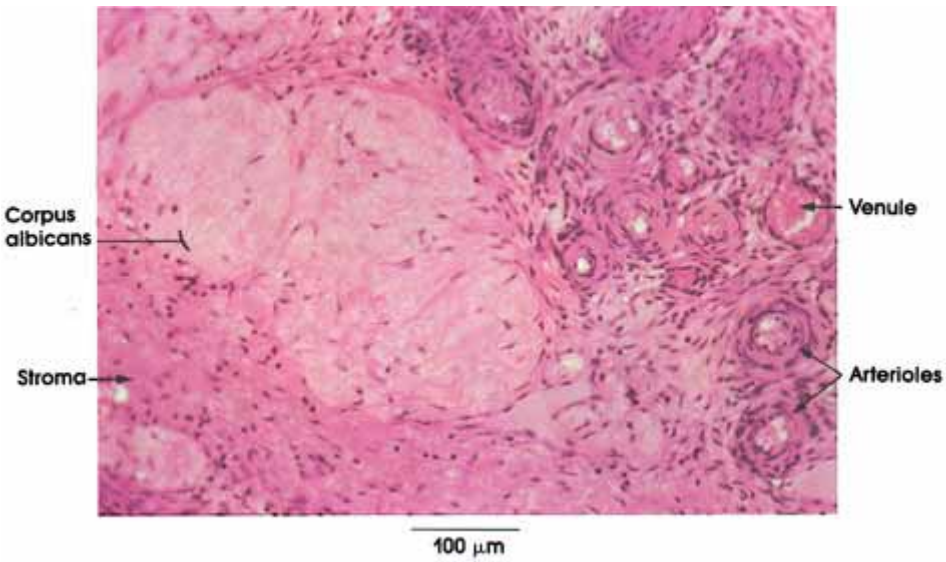
Peer Review Status: Externally Peer Reviewed

OVARY



Rabbit, 10% formalin, H. & E., 162 x.

Corpus albicans: A hyaline scar resulting from the degeneration of the corpus luteum.

Arterioles: Arteries enter the medulla of the ovary at the hilum and spiral their way through to the cortex.

Venules: Rich plexus of veins accompanies the arteries and leaves the ovary at the hilum.

Stroma: Compact connective tissue. Spindle-shaped cells with elongated nuclei and fine reticular connective tissue fibers.

Plate 13.246 Ovary

Ronald A. Bergman, Ph.D., Adel K. Afifi, M.D., Paul M. Heidger, Jr., Ph.D.
Peer Review Status: Externally Peer Reviewed

OVARY

Rabbit, 10% formalin, H. & E., 162 x.

Germinal epithelium: Forms the surface layer of the ovary and consists of a specialized peritoneal mesothelium. Misnomer, since there is no convincing evidence that it is the source of germ cells.

Stroma: Connective tissue stroma, richly cellular and compact. Stromal cells are spindle-shaped with elongated nuclei. The ovarian follicles are scattered within the stroma.

Primordial follicle: Consists of an immature ovum surrounded by a single layer of low cuboidal epithelium.

Growing follicle: At the initiation of follicular growth, the follicle cells assume a cuboidal shape, divide, and become multilayered.

Zona pellucida: Thick layer surrounds the growing ovum. Rich in polysaccharides.

Oocyte: Immature ovum containing the somatic number (diploid) of chromosomes. Will undergo meiosis to produce mature ovum.

Nucleus: The nucleus of an oocyte is large and contains a prominent nucleolus.

Plate 13.247 Ovary: Cortex

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Peer Review Status: Externally Peer Reviewed

OVARY
Cortex

Monkey, glutaraldehyde, plastic section, H. & E., 68 x.

An overview of the ovarian cortex is shown. Note that the surface of the ovary is epithelium-lined ("germinal epithelium," simple squamous, detail not discernible at this magnification). The underlying discrete layer of connective tissue represents the tunica albuginea, which is devoid of follicles. Immediately deep to the tunica albuginea, numerous primordial follicles are present, as is a follicle that has begun to grow (primary follicle). The eosinophilic zona pellucida (*arrow*) is a prominent feature of such follicles. Other follicles that have begun to grow and mature, but that have regressed at various stages of growth, are indicated by asterisks, and are termed atretic follicles.

Plate 13.248 Ovary: Cortical Region

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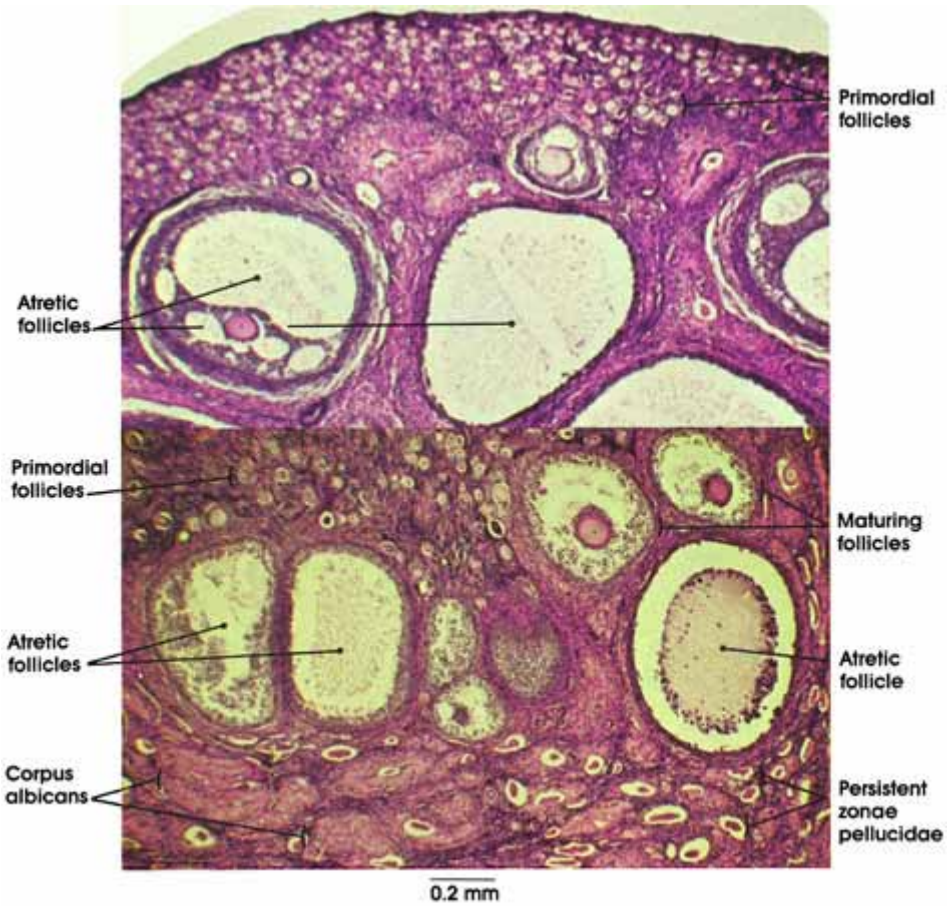
Peer Review Status: Externally Peer Reviewed

OVARY
Cortical region



Rhesus monkey, Helly's fluid, H. & E., 50 x.

Primordial follicles: Consist of an immature ovum surrounded by a single layer of low cuboidal or flattened epithelium (follicular or granulosa cells). Note the distribution in peripheral layers of the cortex.

Maturing follicle: Note the multilayered follicular cells, the increased size, the eccentric position of the developing ovum, and the prominent connective tissue capsule. Maturing follicles occupy deeper zones of the cortex. Note the vesicular nucleus and the deeply staining small nucleolus. The oocyte is pushed to the side of the follicle by the accumulation of follicular fluid.

Atretic follicle: Follicles that do not reach maturity degenerate and are called atretic follicles. The nucleus becomes pyknotic and later fragments. Follicular cells also degenerate. Atretic follicles are later resorbed and are replaced by a connective tissue stroma. The zona pellucida of an atretic follicle stains deeply and may persist by itself in the stroma.

Corpus albicans: A hyaline scar resulting from the degeneration of a corpus luteum of ovulation.

Plate 13.245 Ovary: Overview

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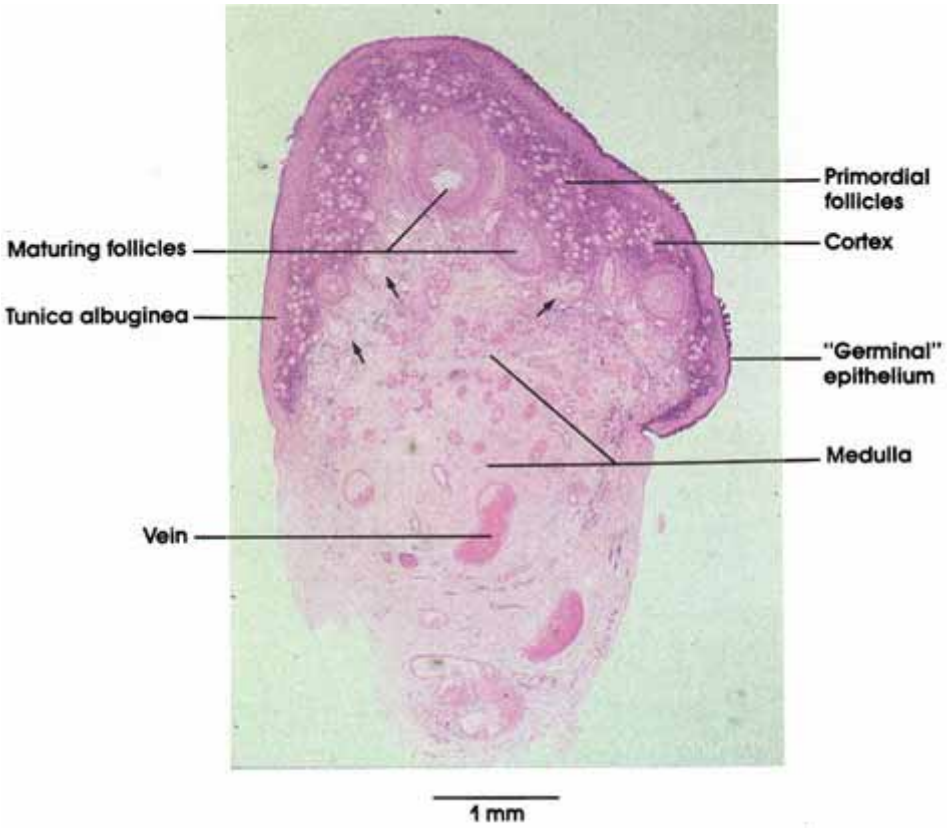
Peer Review Status: Externally Peer Reviewed

OVARY
Overview



Monkey, glutaraldehyde, 1.5 μm, plastic section, H. & E., 47.5 x.

In this low magnification micrograph of primate ovary, the differentiation of the organ into cortical and medullary regions is seen. The highly vascular medulla is overlaid by a cortex in which various stages of follicular maturation may be identified. For example, the primordial follicles are most numerous and lie peripheral to growing follicles. Mature follicles (not shown here), which eventually ovulate, will have overgrown the entire width of the cortex. Follicles that have initiated growth but that have regressed are indicated by arrows and are termed *atretic follicles*.

The outer connective tissue investment, the tunica albuginea, is covered with a thin epithelium of peritoneal origin, the so-called germinal epithelium, named for its earlier, erroneously conceived role of seeding the ovary with germ cells.

Plate 13.249 Ovary

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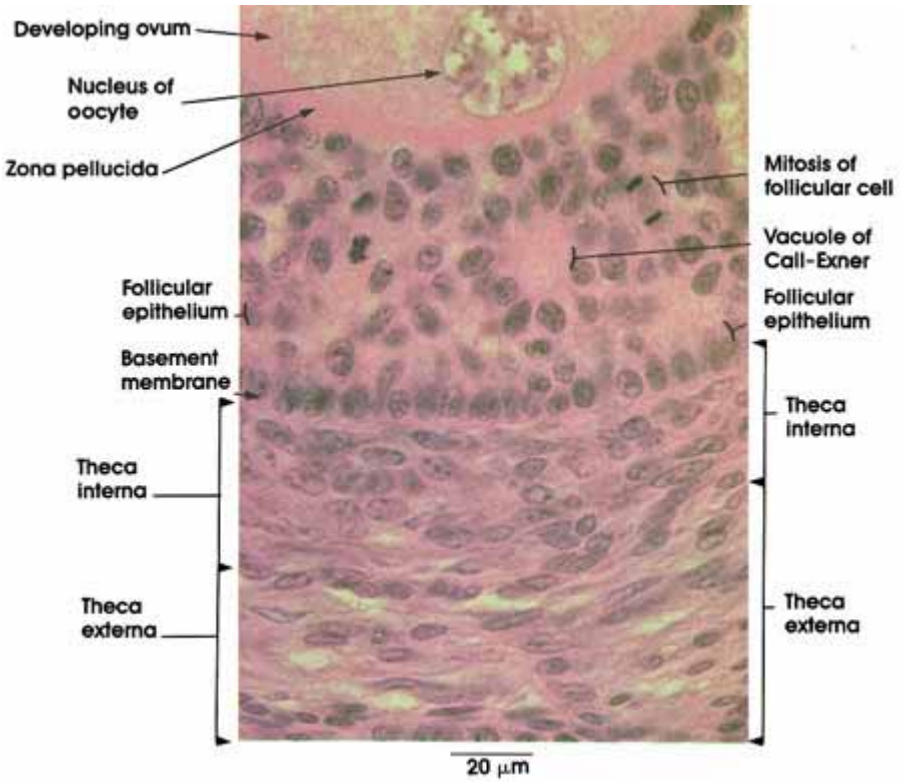
OVARY
Theca interna
growing follicle



Rabbit, 10% formalin, H. & E., 612 x.

This plate shows a rather advanced stage,in the maturation of a primary ovarian follicle. Note the increase in size of the oocyte and the follicular cells in comparison to that seen in early primary follicles (Plate 246). The nucleus of the oocyte is large and has a sparse reticulated chromatin network. The cytoplasm is granular. The zona pellucida separates the oocyte from the follicular cells. This prominent layer is rich in polysaccharides and is believed to be elaborated by both oocyte and follicular cells. It persists even after the degeneration of the oocyte during atresia of the follicle (Plate 248). The follicular cells have formed a stratified epithelial layer at this stage of growth. Mitotic figures are frequent, indicating continued active proliferation. Accumulations of densely staining material are seen among follicular cells. These are vacuoles of Call-Exner*. They are believed to represent droplets within the cytoplasm of follicular cells. They stain positively with PAS and may be the precursors of follicular fluid. The stroma around the follicular epithelium is composed of an inner theca interna and an outer theca externa. A basement membrane separates the follicular cells from the theca interna; no distinct boundary exists between the thecae interna and externa. The cells of the theca interna have epithelioid characteristics and are believed to

elaborate androstenedione. Note the ovoid or round nuclei of the theca interna. The theca externa is composed of spindle-shaped cells and is more fibrous. Both thecae are connective tissue derivatives.

Plate 13.252 Uterus

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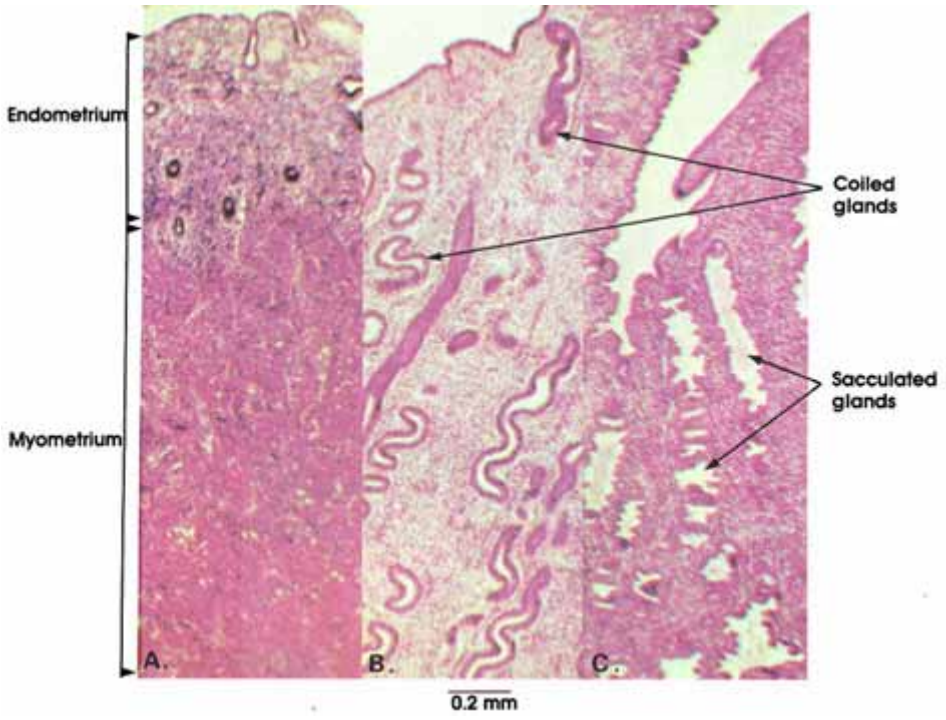
Peer Review Status: Externally Peer Reviewed

UTERUS
Endometrium
A. early postmenstrual, B. proliferative phase, C. secretory phase



Human, 10% formalin, H. & E., 50 x.

The uterine wall undergoes four phases during the menstrual cycle excluding menstruation. These are the (1) resurfacing, (2) proliferative, (3) secretory, and (4) ischemic phases.

The first three phases are shown in this plate. In A, the resurfacing phase, corresponding to days 5 and 6 of the cycle, is shown. During this stage, remnants of the glands in the basal zone of the mucosa proliferate and migrate to cover the raw surface of the endometrium denuded from its mucosa by menstrual flow. The thick myometrium is shown. This is a massive coat of smooth muscle fibers arranged in three concentric layers.

In B, the proliferative or follicular phase of the menstrual cycle, which lasts from day 7 to day 14 of the cycle, is shown. During this stage, the mucosal glands become longer and assume a curved or coiled configuration. The stroma between glands also increases by proliferation of connective tissue cells. The proliferative phase is induced by estrogen (see also Plate 249).

In C, the third or secretory phase, corresponding to days 15 to 27 of the menstrual cycle, is shown. This is also known as the progravid or luteal phase. During this stage, glands stop proliferating and begin to distend and secrete abundantly. in the middle region of the mucosa, saccular outpouchings of the glands are seen. The changes observed in this stage are induced by progesterone following estrogen priming.

Plate 13.260 Placenta

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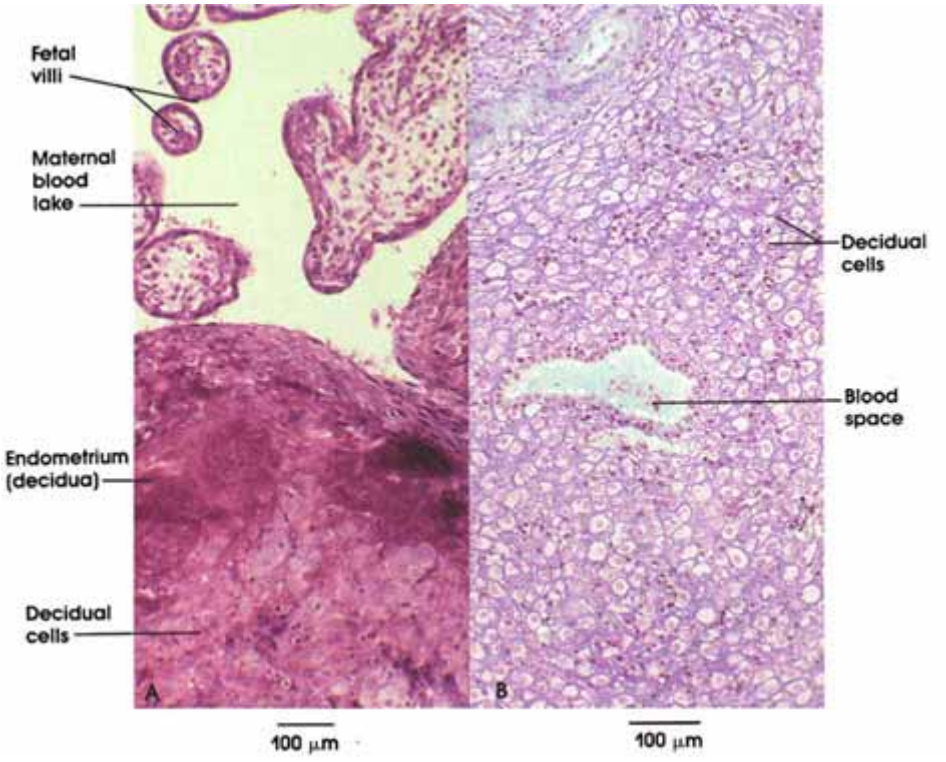
Peer Review Status: Externally Peer Reviewed

PLACENTA



A. Human, 10% formalin, H. & E., 89 x.
B. Human, Bouin's-Halmi's AFT, 107 x.

The maternal component of the placenta is shown in A; the endometrium of pregnancy is termed the *decidua*, and the stromal cells, which differentiate during pregnancy, are termed *decidual cells*. They are shown in profusion in B. Decidual cells are polygonal, possess a large, vesicular nucleus, and

demonstrate the electron- microscopic characteristics of secretory cells; they are imputed to be the source of placental prolactin. Note the finger-like incursion of the maternal blood space into the substance of the decidua. This space is lined with trophoblastic epithelium

Plate 13.259 Placenta

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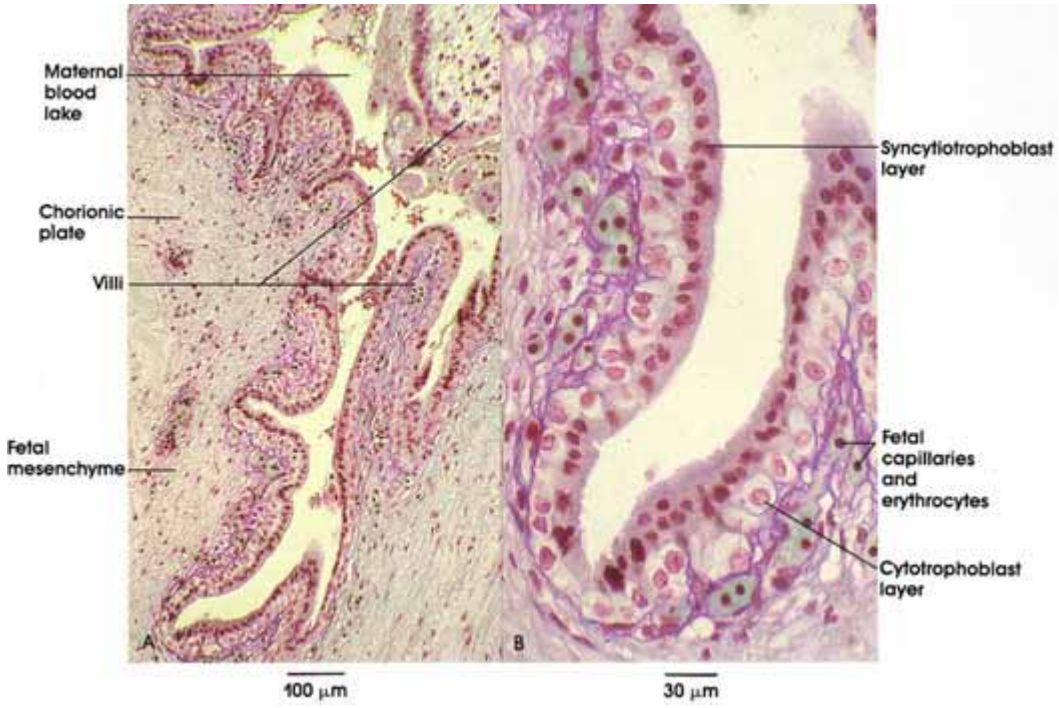
Peer Review Status: Externally Peer Reviewed

PLACENTA



Human, Bouin's-Halmi's AFT, A. 121 x; B. 357 x.

Fetal components of the placenta include the chorionic plate and the villi that originate from it (A); a high-magnification view of the epithelial lining of these structures is shown in B. In A, note that the epithelium-lined chorionic plate gives rise to villi, which project into the maternal blood space. Fetal mesenchyme constitutes the core of the villi; fetal blood vessels are present in the plate, and a rich capillary network is formed within the villi, analogous to the histophysiological arrangement of vessels within intestinal villi, which are also specialized to optimize absorptive capacity. Note that the capillaries in B contain fetal erythrocytes (stained green), which contain nuclei. The villi are lined by two layers of embryonic trophoblast. The inner cytotrophoblast consists of cells that give rise to the outer syncytial layer, the syncytiotroph o blast. Gradually, during the latter half of pregnancy, the cytotrophoblast is largely incorporated within the syncytial layer; therefore, specimens obtained at delivery will demonstrate only the syncytial layer. This histological feature

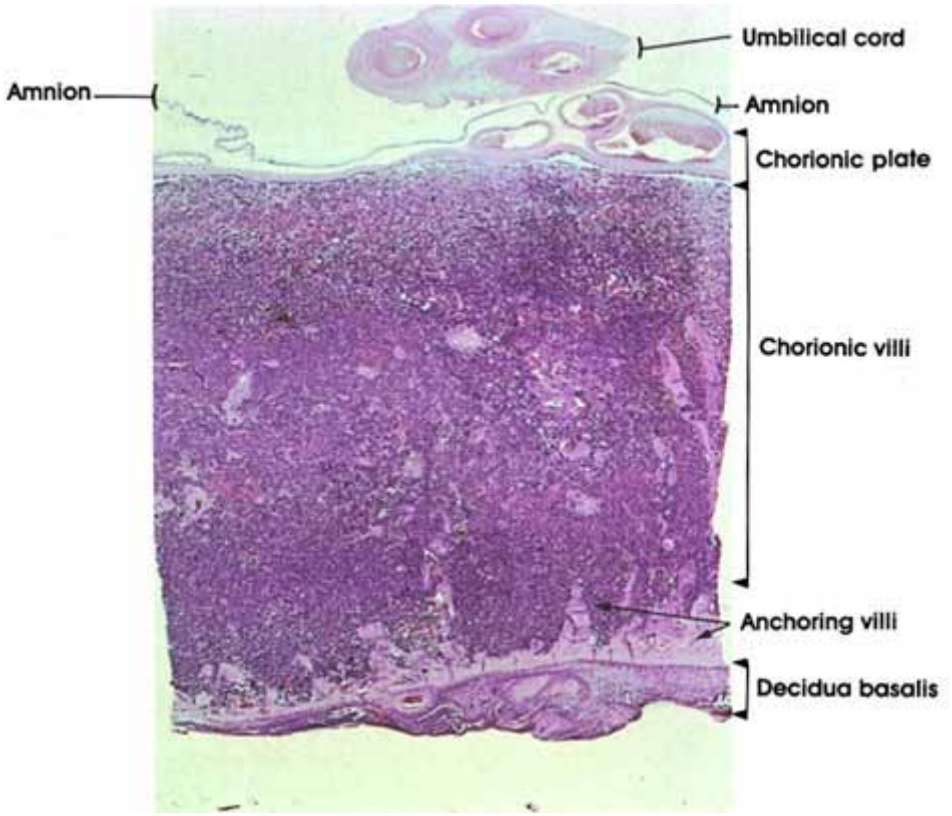
can assume importance to the forensic pathologist in medicolegal examination of placental specimens, as well as to inexperienced histologists seeking a layer that no longer exists in the most common source of placental tissues, the afterbirth.

Plate 13.258 Placenta

Ronald A. Bergman, Ph.D., Adel K. Afifi, M.D., Paul M. Heidger, Jr., Ph.D.

Peer Review Status: Externally Peer Reviewed

PLACENTA



Rhesus monkey, 10% formalin, H. & E., 3.5 x.

The components of the placenta are seen at low magnification in this plate. The maternal contribution is the decidua basalis. This is the part of the endometrial mucosa lying beneath the embryo between the embryo and the myometrium. The fetal contribution is the chorionic plate and its villi. The chorionic plate is a portion of the chorionic sac about the embryo. Chorionic villi arise from the chorionic plate and lie in the spaces through which maternal blood circulates. Many villi are floating; others attach to the decidua basalis as anchoring elements. Villi receive their blood from the umbilical arteries and drain into the umbilical vein. Outside the chorionic plate, note the amnion that lines the amniotic cavity containing the umbilical cord. The embryo is not seen.

Plate 13.250 Corpus Luteum

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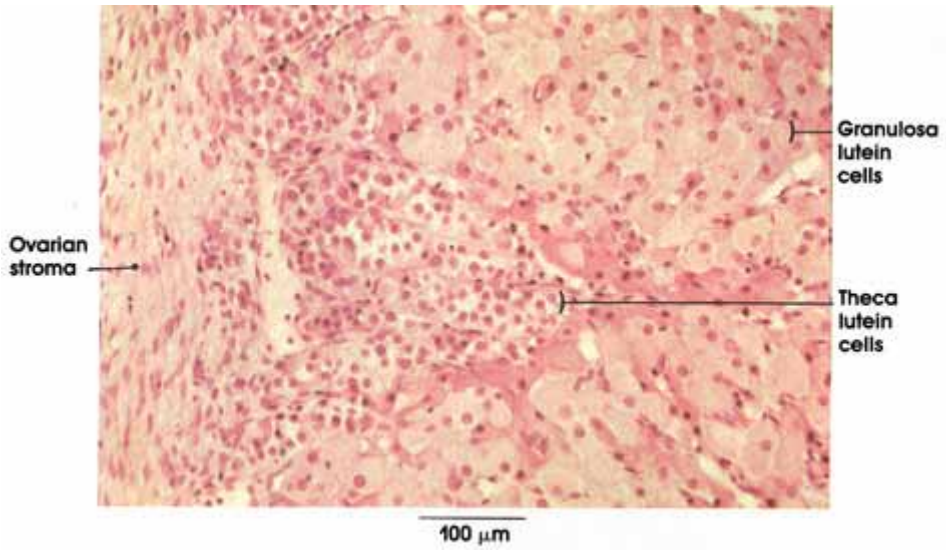
Peer Review Status: Externally Peer Reviewed

CORPUS LUTEUM



Human, 10% formalin, H. & E., 162 x.

The corpus luteum (yellow body) is a stage in the transformation of an ovarian follicle following ovulation.

Granulosa lutein cells: Larger in size, more centrally located; nuclei less densely stained and cytoplasm more abundant. They are transformed cells of the stratum granulosum of the ovarian follicle.

Theca lutein cells: Smaller, have less cytoplasm, are more peripherally located, and nuclei stain more densely. They are transformed cells of the theca interna of the ovarian follicle.

Both types of cells are epithelioid and produce steroids. The corpus luteum secretes both estrogens and progestins. Progesterone induces changes in the uterine endometrium (secretory phase), in preparation for the implantation of a fertilized ovum, and inhibits spontaneous contractions of the smooth muscle of the uterus so that gestation can be maintained. The vacuoles seen in some cells are due to the lipid droplets dissolved during processing of tissue.

Ovarian stroma: Connective tissue stroma, remnant of theca externa of the ovarian follicle. Sends fine septa into the parenchyma.

Plate 13.253 Mammary Gland

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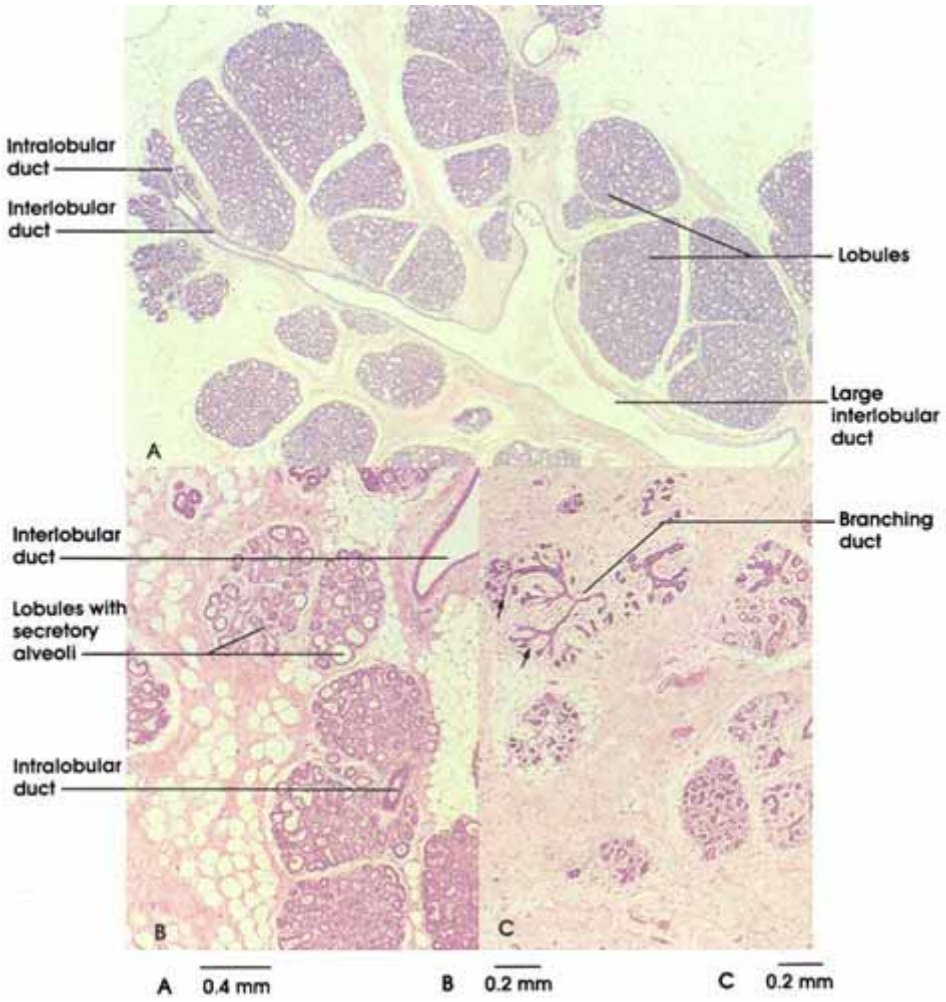
Peer Review Status: Externally Peer Reviewed

MAMMARY GLAND



A. Human, in pregnancy, 10% formalin, 22 x.
B. Monkey, late pregnancy, 10% formalin, 36 x.
C. Human, resting, 10% formalin, 36 x.

The mammary glands are compound tubuloalveolar glands derived from the integument; they are responsive to reproductive and other hormones, and therefore undergo marked developmental, aging, and physiological changes during the course of the reproductive life of the mammalian female. Of great clinical import is the sobering statistic that cancer of the breast (usually adenocarcinoma of the ductal lining) is the most common cancer in women.

This plate illustrates distinctive differences in the histomorphology, breast tissue exhibits, depending upon physiologic state. During the development of the gland at pregnancy (A), secretory units (alveoli) bud from the ducts, and

the glandular parenchyma enlarges in mass at the expense of the surrounding connective tissue. The duct system is best visualized in a gland that is "resting" (C), that is, one that is neither a gland of pregnancy nor of full lactation. Note in C how rudimentary secretory units, the alveoli (arrow), lie at the terminal arborizations of the alveolar duct system. The lobation of the gland is not well appreciated in histological section, a lobe being defined as that region of the breast drained by one lactiferous duct. The lobes are subdivided into lobules, the smallest order of which are seen here in each figure, separated by connective tissue partitions. Note the fortuitous section in A, revealing the continuity of the alveolar and higher-order system of ducts.

During pregnancy (A), the expanded alveolar component of the breast is evidenced by the highly basophilic cytoplasm of the alveolar cells, reflecting the initial synthesis of a product abundant in lactoprotein and low in lipid content (i.e., colostrum). The alveoli, however, do not reach their full degree of development until post-parturn and active lactation. Note that in the gland from late pregnancy (prelactating, B), the alveoli have expanded both in extent throughout the lobules and in size. Some alveoli are distended but exhibit regular walls and little secretory product. in contrast, the alveoli of the fully developed lactating gland typically are distended and saccular in appearance and contain a lightly eosinophilic secretory product (see Plate 254). Such alveoli are lined by a cuboidal or flattened epithelium. The alveoli and lobules are separated by sparse connective tissue, the mass of the entire gland being largely taken up with secretory alveoli and associated ducts. Like the sweat glands of the integument, the alveoli of the breast are enfolded by a network of stellate myoepithelial cells, which contract in response to oxytocin, thus facilitating the milk ejection mechanism.

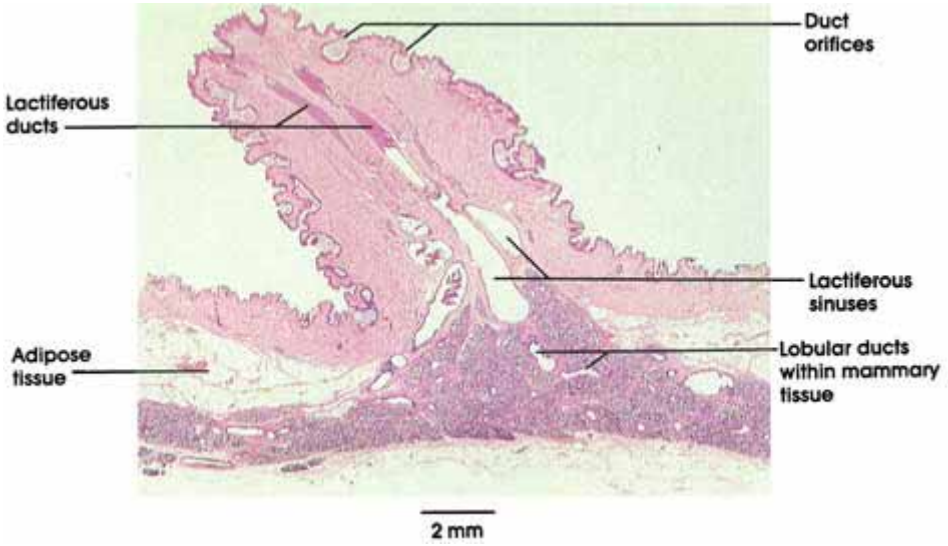
The student is cautioned that the mammary gland as a whole exhibits considerable normal variation in its histological development and, in addition, undergoes cyclic changes in synchrony with the menstrual cycle. Considerable latitude is encountered even within lobules with respect to activity and distention of alveoli (e.g., B). Therefore, variation from the "ideal" description is to be expected in your laboratory study.

Plate 13.256 Mammary Gland

Ronald A. Bergman, Ph.D., Adel K. Afifi, M.D., Paul M. Heidger, Jr., Ph.D.

Peer Review Status: Externally Peered Reviewed

MAMMARY GLAND



Monkey, 10% formalin, H. & E., 6.5 x.

The lactiferous ducts (galactophores) empty independently upon the surface of the nipple, imparting a serrated, pitted apprearance to the nipple surface. The openings of the ducts are lined with stratified squamous epithelium, keratinizing variety, which is continuous with that of the skin. The ductal orifices contain a keratinous cell debris. At the base of the nipple, the lactiferous ducts expand into large lactiferous sinuses; these, in turn, give rise to the lobular ductal system of the gland. This specimen is from the first trimester of pregnancy, and the mammary tissue is not well developed. During suckling, it is not uncommon for a lactiferous duct to become blocked and painfully engorged.

Plate 13.254 Mammary Gland: Lactating

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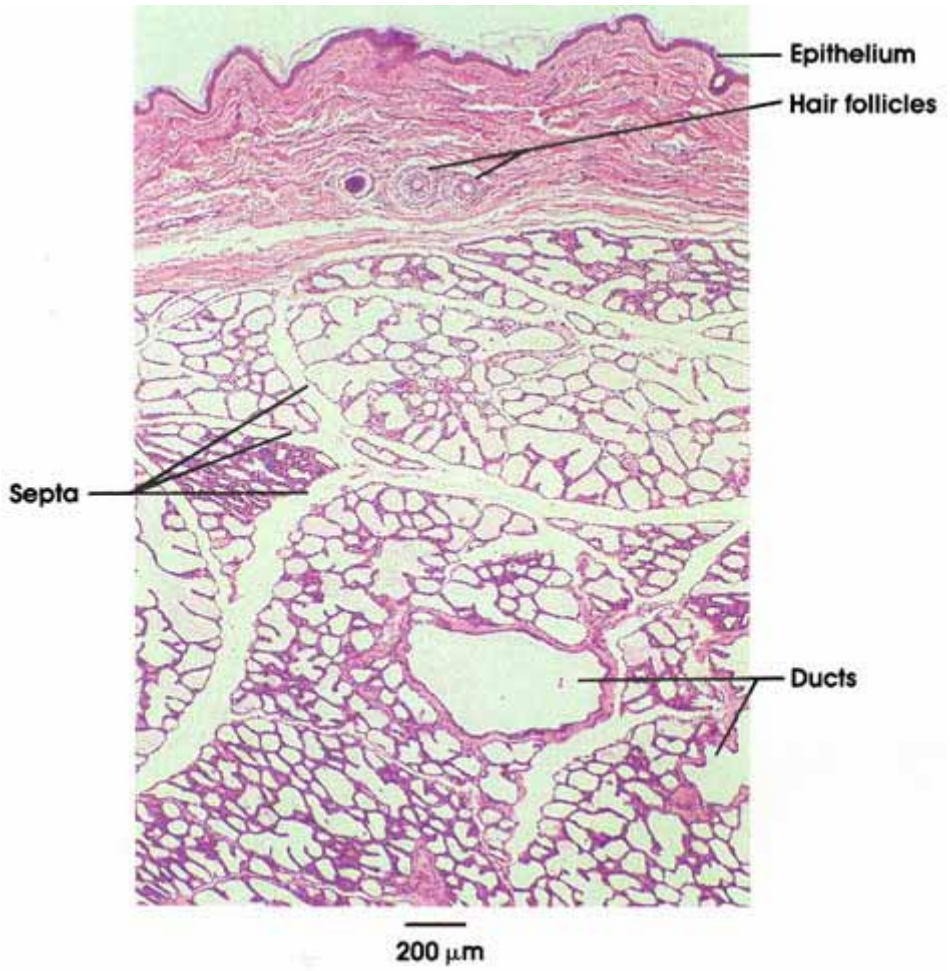
Peer Review Status: Externally Peer Reviewed

MAMMARY GLAND, LACTATING



Monkey, 10% formalin, H. & E., 36 x.

A low power view of a section of actively lactating breast post parturn. The surface of the mammary gland is covered by a thin epithelium. The underlying dermis contains the follicles of fine surface hairs; the areola (not shown) is devoid of hairs. Alveoli are dilated and sacculated and contain a light- staining secretion product. With the degree of dilation shown by the secretory units, the smaller ducts are not distinguishable from the secretory units. Profiles of higher-order ducts are seen in the lower portion of the field.