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GYNECOLOGIC and OBSTETRIC UROLOGY

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PREFACE

In preparing the second edition of *Gynecologic and Obstetric Urology*, we have expanded the text from 28 to 38 chapters. The reader will find new chapters reflecting technologic advances, including urodynamics and ultrasonography, and extended descriptions of surgical procedures such as endoscopically controlled urethropexy for the relief of stress incontinence and transvesical repair of vesicovaginal fistulas. A new three-section chapter addresses the age-specific and sometimes unique urinary problems of the child, the adolescent, and the postmenopausal woman. Another new chapter deals with office cystourethroscopy utilizing carbon dioxide, a technique finding increased popularity with gynecologists.

It is not our intent to take sides on issues of territoriality, such as the current controversies over endoscopy in the female patient or the entire subject of female urology. Rather, we wish to present to the interested reader all techniques currently available for diagnosis and treatment in the female patient. We have again tried to avoid overlap and duplication, but have not hesitated to present divergent surgical solutions to gynecologic and obstetric problems, as presented by authors from the disciplines of gynecology and urology.

We wish to express our thanks for the continued effort and devotion of our editorial assistants, Bette Jo Garrett (San Diego) and Joyce Perry (Dallas), as well as for the support of Carroll Cann, Medical Editor at W. B. Saunders Company.

Lastly, it is with deep regret that we acknowledge the death of two contributors, Drs. William C. Keettel and Thomas H. Green, Jr.

HERBERT J. BUCHSBAUM
JOSEPH D. SCHMIDT

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ANATOMY, PHYSIOLOGY AND EXAMINATION

1

DEVELOPMENTAL ANATOMY

MARGARET B. AYDELOTTE, Ph.D.

During embryonic development there is a close association between the urinary and genital systems, especially in the early stages. Both systems develop largely from the urogenital ridges, bilateral thickenings of intermediate mesoderm with overlying coelomic epithelium, which lie along the dorsal wall of the abdominal cavity. In the male the close connection between the two systems is retained in the adult, but in the female this early association is lost with the development of separate müllerian (paramesonephric) ducts, which give rise to the uterus, fallopian tubes, and part of the vagina. Although the urinary and genital systems are closely linked in development, it is easier to describe their formation separately, after first reviewing some aspects of early embryology.

EARLY DEVELOPMENT

Two weeks after fertilization, the implanted human embryo consists of a flat disc with two layers of cells, a columnar ectoderm forming the floor of the amniotic cavity, and a layer of flattened endodermal cells constituting the roof of the yolk sac (Figure 1–1). Both layers of the embryonic disc are continuous at their edges with tissue that will form the extraembryonic membranes.

The third germ layer, the mesoderm, from which the urogenital system largely develops, begins to segregate during the early part of the third week of development (Figure 1–2). Cells of the primitive streak (i.e., in the midline at the future caudal end of the embryo) leave the upper ectodermal layer, sink below the surface, and migrate laterally, spreading out between the ectoderm and endoderm to form the embryonic mesoderm, the middle layer of the trilaminar embryonic disc. At two sites in the midline of the embryo, this mesoderm fails to separate the ectoderm from the adhering, underlying endoderm. One of these two remaining bilaminar regions is found cranial to the developing notochord, and is destined to become the oropharyngeal (or buccopharyngeal) membrane; the other region lacking mesoderm lies caudal to the primitive streak, and will form the cloacal membrane (Figure 1–2). Mesodermal cells continue to migrate around the edges of both of these membranes to meet in the midline. That mesoderm which comes to lie lateral to the cloacal membrane contributes to the external genitalia, and that which migrates to the midline, initially caudal to the cloacal membrane, helps to form the phallus and the infraumbilical part of the body wall (Patten and Barry, 1952).

The intraembryonic mesoderm differentiates as shown in Figure 1–3. On each side of the developing notochord and neural tube the paraxial mesoderm forms segmentally arranged blocks of tissue, the somites. The columns of intermediate mesoderm adjacent to the somites show segmentation only at the cranial end of the embryo. Lateral to the intermediate mesoderm, the coelomic cavity forms as the lateral plate mesoderm splits into the outer somatic and inner splanchnic layers. Both the inter-

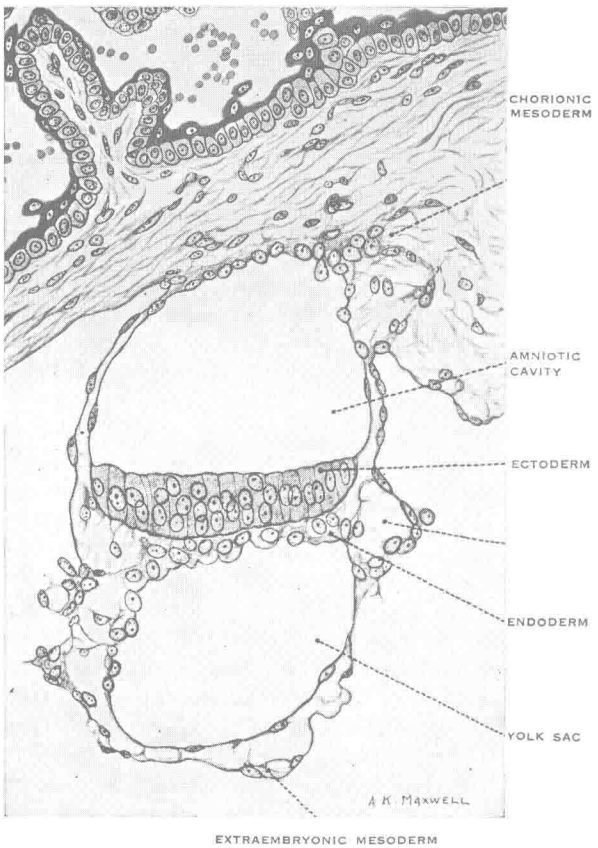

Figure 1–1. Transverse section through the anterior part of the bilaminar embryonic disc and chorionic vesicle of a 15-day-old human embryo. (From Hamilton, W. J., and Mossman, H. W.: Human Embryology. 4th Ed. © 1972 The Williams & Wilkins Co., Baltimore.)

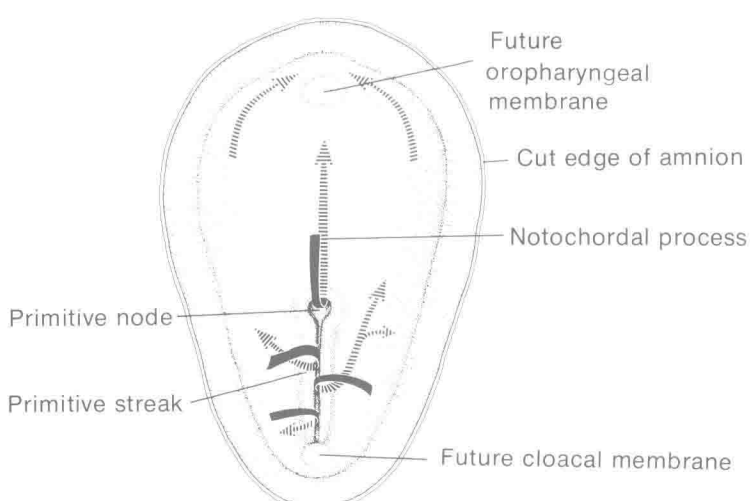

Figure 1–2. Dorsal side of the embryonic disc during the third week, indicating movement of superficial cells (solid black lines) towards the primitive streak and node, and subsequent migration of mesodermal cells (broken lines) away from the primitive streak between the ectodermal and endodermal germ layers. (From Langman, J.: Medical Embryology. 4th Ed., © 1981 The Williams & Wilkins Co., Baltimore.)

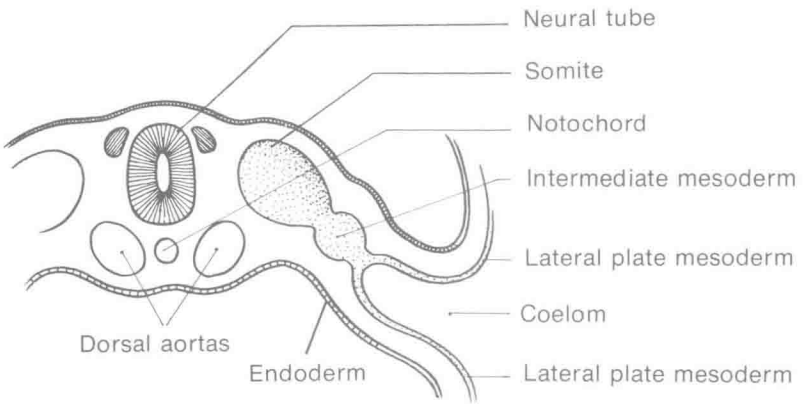

Figure 1–3. Diagrammatic cross-section of a 3-week embryo, showing development of the mesoderm. (From Tuchmann-Duplessis, H., David, G., and Haegel, P.: Illustrated Human Embryology. Vol. 1, 1972. Courtesy Springer-Verlag, New York, and Masson, Editeurs, Paris.)

mediate mesoderm and a portion of the coelomic lining, the superficial layer of lateral plate mesoderm, contribute to the urogenital system.

DEVELOPMENT OF THE URINARY SYSTEM

The Kidney and Ureter

Below the mesothelium along the dorsal wall of the coelomic cavity, the intermediate mesoderm on each side of the embryo forms a longitudinal ridge, the nephrogenic cord. Each nephrogenic cord shows a craniocaudal sequence in its development. The most cranial portion differentiates before the more caudal regions, and according to the classic view, the ridge gives rise successively to three kidneys: the pronephros, the mesonephros, and the metanephros, or definitive kidney (Figure 1–4). The first two are not completely distinct in the human being, the caudal end of the pronephros merging with the cranial end of the mesonephros. There is probably little reason to regard them as separate entities, but for convenience their names are retained (Potter, 1972).

Pronephros

The pronephros is a transitory, nonfunctional structure in the human being. It consists of a few nephrotomes, small clumps of cells or vesicles which begin to form late in the third week of development from the cervical segmented intermediate mesoderm. These vesicles or tubules have no glomeruli, do not connect with the pronephric duct, and regress by the end of the fourth week. The pronephric duct is independent in origin from the pronephric vesicles (Torrey, 1954), and first appears as a solid cord of cells in the dorsal part of the nephrogenic cord. The duct acquires a lumen progressively from its cranial end, and gradually grows in a caudal and then a ventral direction. It opens into the dorsolateral part of the cloaca early in the fifth week of development (Figure 1–4).

Mesonephros

As the pronephros regresses, the nephrogenic cord in the thoracic and lumbar regions gives rise to tubules of the mesonephros. These tubules become S-shaped and open laterally into the adjacent portion of the pronephric duct, called at this point in development the mesonephric (or wolffian) duct. The medial end of each mesonephric tubule enlarges and invaginates to form a Bowman's capsule in association with a developing knot of capillaries, the glomerulus (Figure 1–5*A*). The S-shaped mesonephric tubule lengthens rapidly and becomes highly coiled, but no loop of Henle develops. Since the most cranial