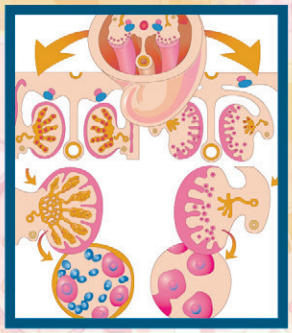

CHAPTER

1

Introduction to Human Development

Human development begins when an **oocyte** (ovum) from a female is fertilized by a **sperm** (spermatozoon) from a male. Development involves many changes that transform a single cell, the **zygote**, into a multicellular human being. The term *conceptus* refers to the entire products of conception, which includes the embryo from fertilization onward and its membranes (e.g., placenta). Embryology is concerned with the origin and development of a human being from a zygote to birth. The stages of development before birth are shown in Figures 1-1 and 7-3.

IMPORTANCE OF AND ADVANCES IN EMBRYOLOGY

The study of prenatal stages and the mechanisms of human development help us understand the normal relationships of adult body structures and the causes of congenital anomalies. Much of the modern practice of obstetrics involves applied or **clinical embryology**. Because some children have birth defects, such as spina bifida or congenital heart disease, the significance of embryology is readily apparent to pediatricians. Advances in surgery, especially in procedures involving the prenatal and pediatric age groups, have made knowledge of human development more clinically significant.

Rapid advances in molecular biology have led to the use of sophisticated techniques (e.g., **recombinant DNA technology, chimeric models, transgenics, and stem cell manipulation**) in research laboratories to explore such diverse issues as the genetic regulation of morphogenesis, the temporal and regional expression of specific genes, and the mechanisms by which cells are committed to form the various parts of the embryo. For the first time, researchers are beginning to understand how, when, and where selected genes are activated and expressed in the embryo during normal and abnormal development.

TIMETABLE OF HUMAN PRENATAL DEVELOPMENT
1 TO 6 WEEKS

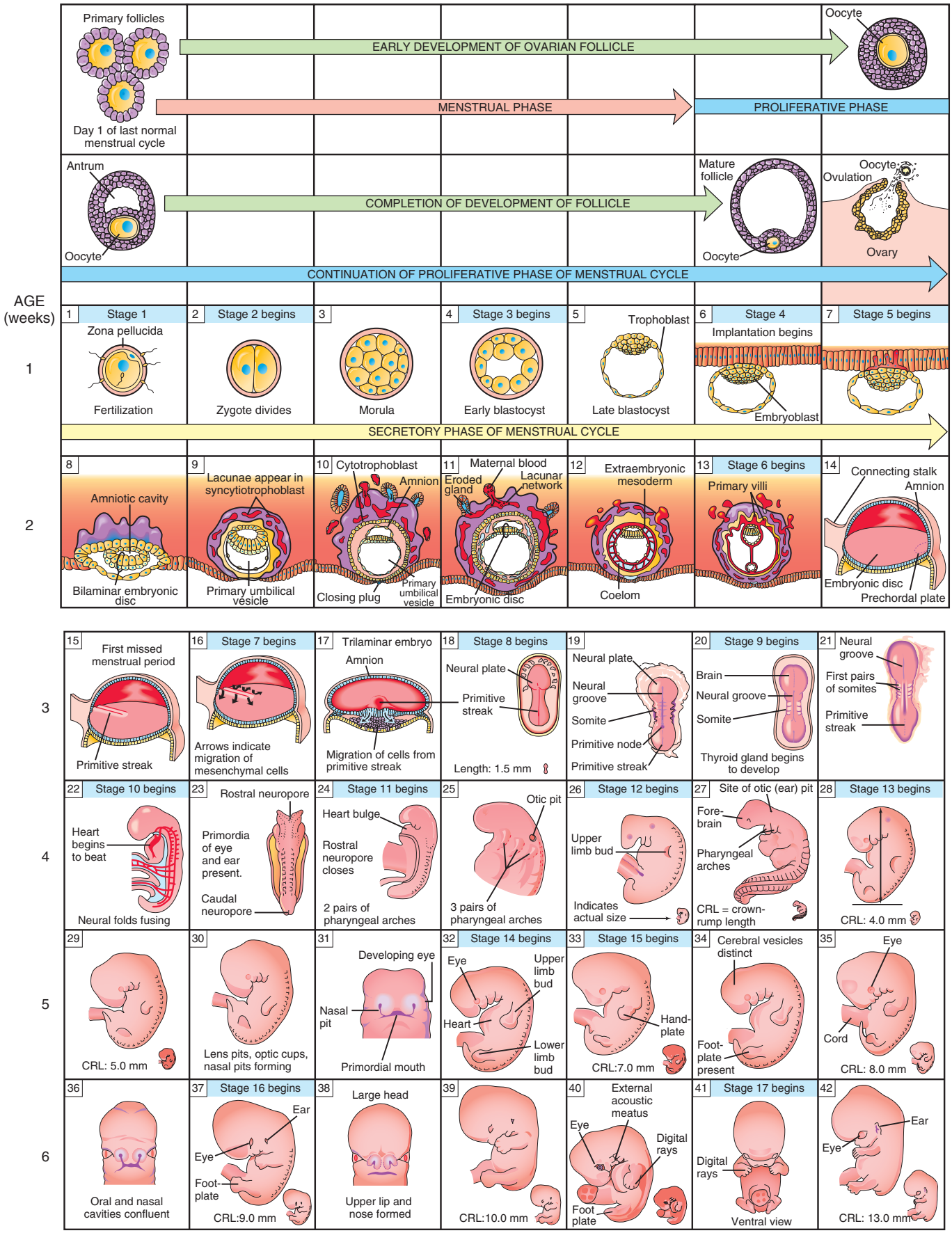

Figure 1–1 Early stages of human development. Development of an ovarian follicle containing an oocyte, ovulation, and the phases of the menstrual cycle are shown.

TIMETABLE OF HUMAN PRENATAL DEVELOPMENT

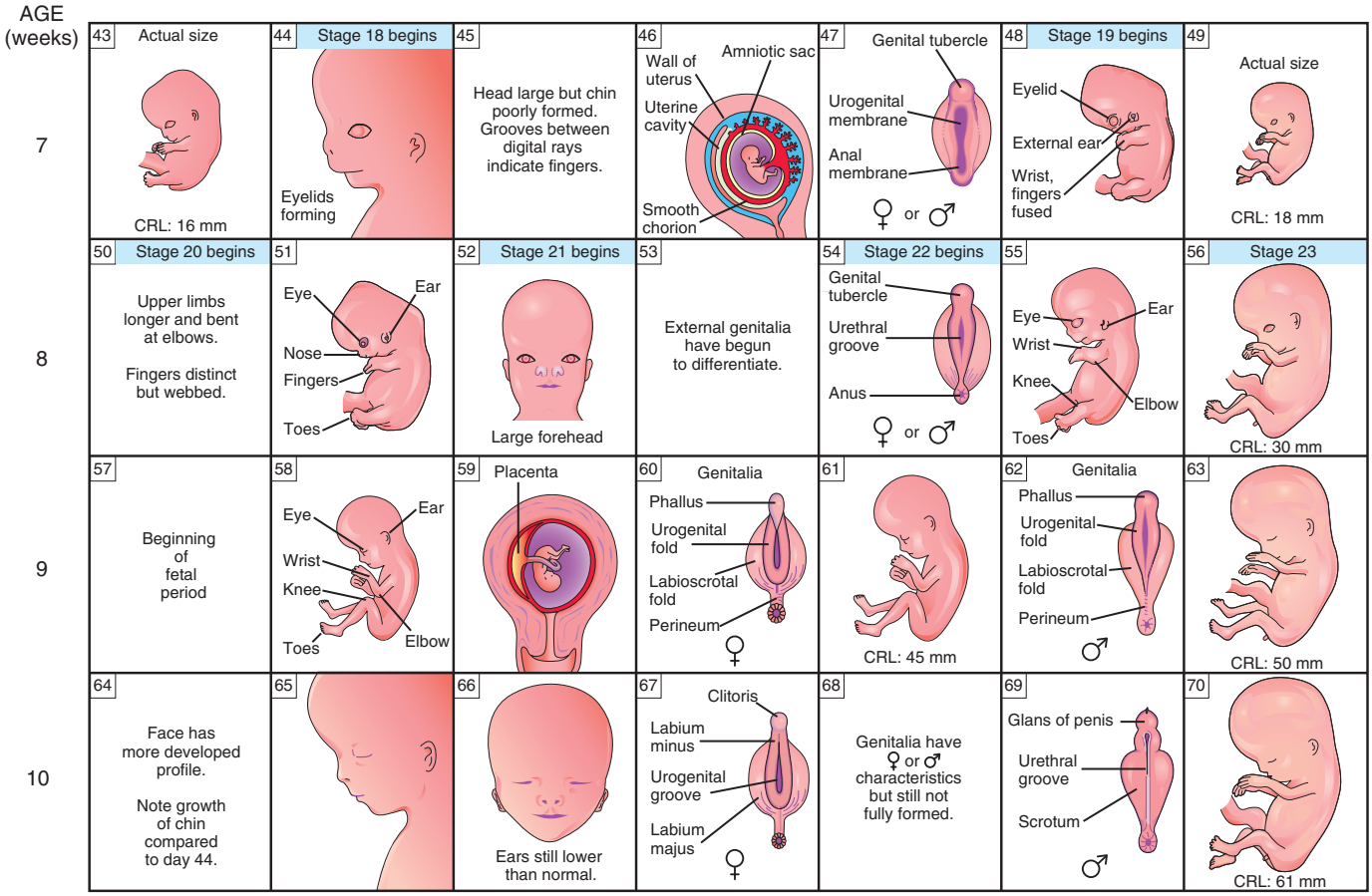

Figure 1–1, cont'd

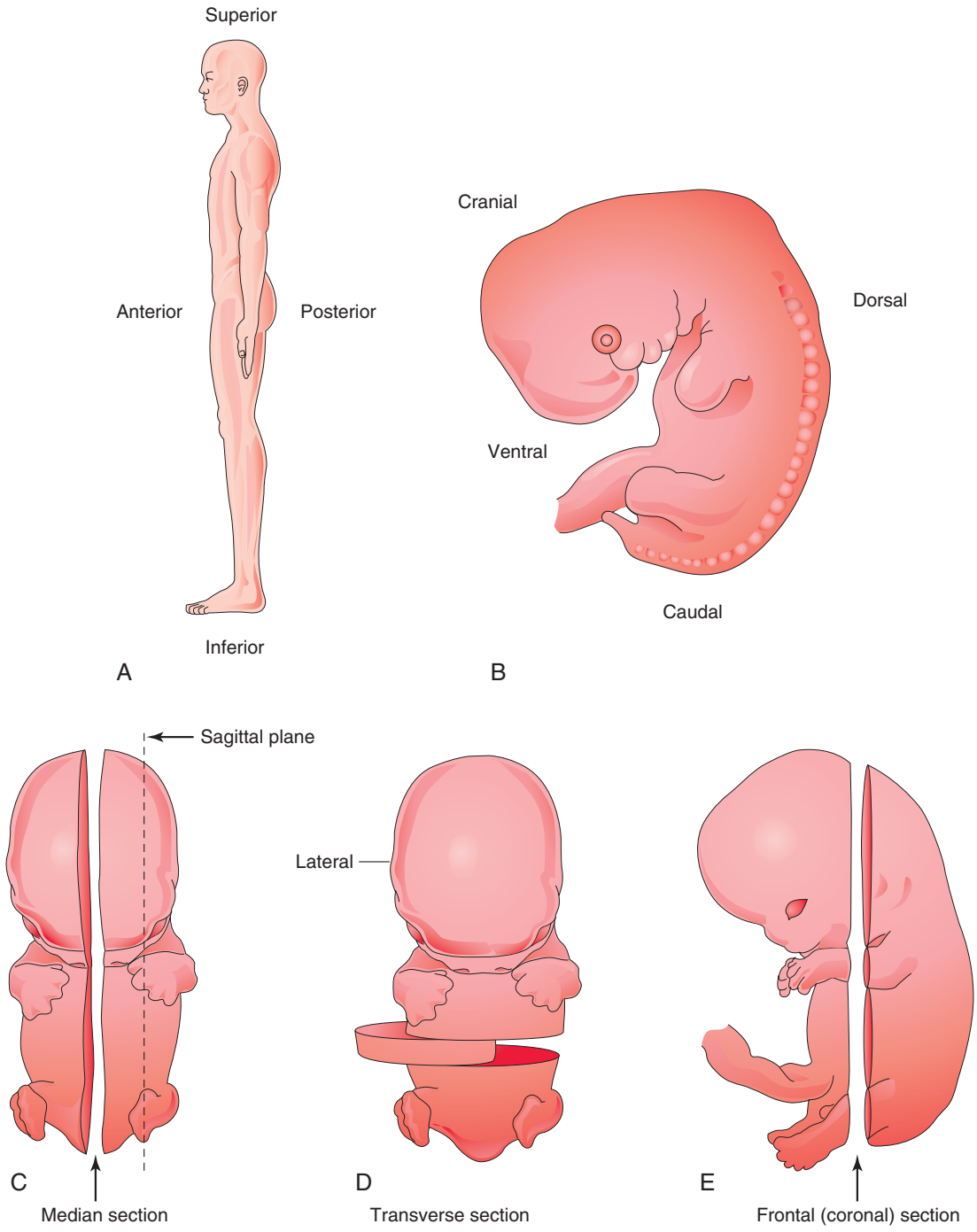

Figure 1–2 Illustrations of descriptive terms of position, direction, and planes of the body. **A,** Lateral view of an adult in the anatomical position. **B,** Lateral view of a 5-week embryo. **C** and **D,** Ventral views of a 6-week embryo. The median plane is an imaginary vertical plane of section that passes longitudinally through the body, dividing it into right and left halves. A sagittal plane refers to any plane parallel to the median plane. A transverse plane refers to any plane that is at right angles to both the median and the frontal planes. **E,** Lateral view of a 7-week embryo. A frontal (coronal) plane is any vertical plane that intersects the median plane at a right angle and divides the body into front (anterior, or ventral) and back (posterior, or dorsal) parts. In describing development, it is necessary to use words denoting the position of one part to another or to the body as a whole. For example, the vertebral column develops in the dorsal part of the embryo and the sternum in the ventral part of the embryo.

The critical role of genes, **signaling molecules**, receptors, and other molecular factors in regulating early embryonic development is rapidly being delineated. In 1995, Edward B. Lewis, Christiane Nüsslein-Volhard, and Eric F. Wieschaus were awarded the Nobel Prize in Physiology or Medicine for their discovery of genes that control embryonic development. Such discoveries are contributing to a better understanding of the causes of spontaneous abortion and congenital anomalies.

In 1997, Ian Wilmut and colleagues were the first to produce a mammal (a sheep dubbed **Dolly**) by cloning using the technique of somatic cell nuclear transfer. Since then, other animals have been cloned successfully from cultured differentiated adult cells. Interest in human cloning has generated considerable debate because of social, ethical, and legal implications. Moreover, there is concern that cloning may result in an increase in the number of infants born with birth defects and serious diseases.

Human embryonic stem cells are pluripotential and capable of developing into diverse cell types. The isolation and culture of human embryonic and other stem cells may hold great promise for the development of molecular therapies.

DESCRIPTIVE TERMS

In anatomy and embryology, special terms of position, direction, and various planes of the body are used. Descriptions of the adult are based on the *anatomical position*, the position in which the body is erect, the upper limbs are at the sides, and the palms are directed anteriorly (see Fig. 1-2*A*). The descriptive terms of position, direction, and planes used for embryos are shown in Figure 1-2*B* to *E*.

CLINICALLY ORIENTED QUESTIONS

1. What is the difference between the terms *conceptus* and *embryo*? What are the *products of conception?*
2. Why do we study human embryology? Does it have any practical value in medicine and other health sciences?
3. Physicians date a pregnancy from the first day of the last normal menstrual period, but the embryo does not start to develop until approximately 2 weeks later (see Fig. 1-1). Why do physicians use this terminology?

The answers to these questions are at the back of the book.

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