University of Mentouri Brothers - Constantine 1
Institute of Veterinary Sciences El Khroub (ISVK)
Dr. Abdeltif Besma
Academic Year: 2025-2026

Introduction to Embryology

1. Ontogenesis

Ontogenesis (ontos = living being; genesis = formation) is the study of the development of the egg from fertilization to the adult form. The early stages of ontogenesis constitute embryonic development or embryogenesis.

2. Embryology

Embryology (embryon = embryo; logos = science, study) is the science that studies the development of animals from the fertilized egg to birth.

Embryology refers to the prenatal development of embryos and fetuses. Development does not stop at birth; significant changes, in addition to growth, occur after birth (postnatal changes), such as the development of teeth and mammary glands.

3. Development Periods

✓ Prenatal Development

This includes the major developmental changes occurring before birth, divided into two periods: the embryonic period, which lasts from fertilization to the 8th week. During the following period, called the fetal period, which lasts from the end of the 8th week to birth, differentiation and maturation of tissues and organs continue, along with the growth of the fetus in size and weight.

✓ Postnatal Development

This includes changes occurring after birth, such as the development of teeth and mammary glands.

4. Major Events of the Embryonic Period

Embryonic development includes a sequence of four main phenomena:

- ✓ **Fertilization**: The union of a female gamete (ovum) and a male gamete (spermatozoon). The result of this union is a zygote or fertilized egg.
- ✓ **Segmentation**: A series of mitotic divisions of the fertilized egg cell that allows for the transition from a unicellular state (zygote) to a multicellular state (embryo).
- ✓ **Gastrulation**: A set of cellular movements that occur to establish the three primary embryonic layers: an outer layer (ectoderm), an inner layer (endoderm), and a middle layer (mesoderm). These layers are the origin of all the tissues that make up the body.

✓ **Organogenesis**

After gastrulation, the morphogenetic movements that follow establish, according to the organizational plan of the species, the rudiments of organs that will differentiate.

5. Critical Periods of Development

The most critical period of development is the embryonic period. During this stage, the embryo is sensitive to external agents such as medications and viruses, which can lead to congenital anomalies. The development of the embryo is most easily disrupted when tissues and organs are forming during the embryonic period.

6. Terminology

- ✓ **Oocyte** (female gamete = secondary oocyte arrested in metaphase II): This is a cell with a single set of chromosomes (haploid cell).
- ✓ **Spermatozoon**: The male sex cell responsible for fertilization, which, like the oocyte, has a single set of each chromosome.
- ✓ **Zygote**: The fertilized egg or diploid cell resulting from the fusion of a male gamete and a female gamete. The term "egg" also refers to the entire zygote and its coverings: albumen, shell membranes, and shells in birds.
- ✓ **Germ**: Corresponds to the early stages of development as long as the external form is more or less spherical. The germ has no orientation (it is impossible to distinguish the ventral region from the dorsal region and the cephalic region from the caudal region).
- ✓ **Embryo**: An organism in development from the first division of the fertilized egg (zygote) until the stage where the main organs are rudimentarily formed.
- ✓ **Fetus**: A term used in mammals after the 8th week until the end of gestation. It corresponds to the stage at which the embryo begins to resemble the adult.

7. Localization Terms

Anatomical localization terms are essential for understanding and using embryological anatomy. They help avoid any ambiguity that may arise when describing the location of structures. We will describe the most commonly used anatomical localization terms in embryological anatomy.

✓ **Cranial-Caudal**

Anatomically, cranial or anterior can be used interchangeably with caudal or posterior. Cranial clearly refers to the head end of the embryo, and caudal (from the Latin word "cauda," meaning "tail") refers to the tail end. The term "rostral" can also be used in place of cranial. Rostral is derived from the Latin word "rostrum," meaning "beak."

✓ **Dorsal–ventral**

The dorsal surface of the embryo and the adult corresponds to the **back**. The ventral surface of the embryo is the **front or anterior part** of the embryo, opposite to the dorsal surface.

✓ **Medial–lateral**

As in adult anatomy, structures that are **closer to the median sagittal plane** are described as **medial**, while structures **farther from the midline** are described as **lateral**.
This also helps describe the **left–right axis of the embryo**.

✓ **Proximal–distal**

The terms **proximal** and **distal** are slightly different from medial and lateral, but they similarly describe structures **close to the center of the body (proximal)** and **farther from the center (distal)**.

8. Section planes

Often, to show the parts of the embryo being described, illustrations represent a **section of the embryo or of a structure**. These sections may be **transverse, median, coronal, or oblique**. These section planes can be seen in the illustrations in the figure below.

✓ **Frontal section**
Passes through the head and divides the body into **dorsal and ventral regions** (not symmetrical).
✓ **Transverse section**
Perpendicular to the **bilateral plane of symmetry**; it is **dorso-ventral**.
✓ **Longitudinal section**

- **Sagittal section:** passes through the **plane of bilateral symmetry**.
- **Para-sagittal section:** parallel to the sagittal plane and close to it.
- **Lateral para-sagittal section:** also parallel to the median plane but **farther away from it**.