1. Explain the characteristics and periods of prenatal development.

Ans: Prenatal development refers to the process in which a baby develops from a single cell after conception into an embryo and later a fetus.

The average length of time for prenatal development to complete is 38 weeks from the date of conception. During this time, a single-celled zygote develops in a series of stages into a full-term baby. The three primary stages of prenatal development are the germinal stage, the embryonic stage, and the fetal stage.

Germinal stage

Conception occurs when the female egg (ovum) is fertilized by a the male sperm. Under normal circumstances, one egg is released approximately once a month from a woman's ovary during a process called ovulation. The egg makes its way into a fallopian tube, a structure that guides the egg away from the ovary toward the uterus. For fertilization to occur, sperm ejaculated during sexual intercourse (or introduced during artificial insemination) in a substance called semen must have made their way from the vagina into the uterus and subsequently into the fallopian tube where the ovum has been released. This process can take up to ten hours after ejaculation. For fertilization to occur, a sperm must penetrate the tough outer membrane of the egg called the zona pellucida. When one sperm successfully binds with the zona pellucida, a series of chemical reactions occurs to allow only that sperm to penetrate. Fertilization occurs when the sperm successfully enters the ovum's membrane. The genetic material of the sperm and egg then combine to form a single cell called a zygote and the germinal stage of prenatal development commences.

The zygote soon begins to divide rapidly in a process called cleavage, first into two identical cells called blastomeres, which further divide to four cells, then into eight, and so on. The group of diving cells begins to move along the fallopian tube toward the uterus. About sixty hours after fertilization, approximately sixteen cells have formed to what is called a morula, still enclosed by the zona pellucida; three days after fertilization, the morula enters the uterus. As cell division continues, a fluid-filled cavity called a blastocoele forms in the center of the group of cells, with the outer shell of cells called trophoblasts and an inner mass of cells called embryoblasts. The zona pellucida disappears and the morula becomes a blastocyst. At this stage the blastocyst consists of 200 to 300 cells and is ready for implantation.

Implantation, the process in which the blastocyst implants into the uterine wall, occurs approximately six days after conception. Hormones secreted from the mother's ovaries and a chemical secreted by the trophoblasts begin to prepare the uterine wall. The blastocyst first adheres to the wall then moves into the uterine tissue. Implantation marks the end of the germinal stage and the beginning of the embryonic stage.

Embryonic stage

The embryonic stage begins after implantation and lasts until eight weeks after conception. Soon after implantation, the cells continue to rapidly divide and clusters of cells begin to take on different functions (called differentiation). A process (gastrulation) leads to the formation of three distinct layers called germ layers: the ectoderm (outer layer), the mesoderm (middle layer), and the endoderm (inner layer). As the embryo develops, each germ layer differentiates into different tissues and structures. For example, the ectoderm eventually forms skin, nails, hair, brain, nervous tissue and cells; nose; sinuses, mouth, anus, tooth enamel, and other tissues. The mesoderm develops into muscles, bones, heart tissue, reproductive organs, lymphatic tissue, and other tissues. The endoderm forms the lining of lungs, bladder, digestive tract, tongue, tonsils, and other organs.

The process of differentiation takes place over a period of weeks with different structures forming simultaneously. Some of the major events that occur during the embryonic stage are as follows:

- **Week 3:** Beginning development of the brain, heart, blood cells, circulatory system, spinal cord, and digestive system.
- **Week 4:** Beginning development of bones, facial structures, and limbs (presence of arm and leg buds); continuing development of the heart (which begins to beat), brain, and nervous tissue.
- **Week 5:** Beginning development of eyes, nose, kidneys, lungs; continuing development of the heart (formation of valves), brain, nervous tissue, and digestive tract.
- **Week 6:** Beginning development of hands, feet, and digits; continuing development of brain, heart, and circulation system.
- **Week 7:** Beginning development of hair follicles, nipples, eyelids, and sex organs (testes or ovaries); first formation of urine in the kidneys and first evidence of brain waves.
- **Week 8:** Facial features more distinct, internal organs well developed, the brain can signal for muscles to move, heart development ends, external sex organs begin to form.

The major processes of the embryonic stage are as follows:

1. The process of differentiation takes place over a period of weeks with different structures forming simultaneously.
2. The major processes of the embryonic stage are as follows:
   - Week 3: Beginning development of the brain, heart, blood cells, circulatory system, spinal cord, and digestive system.
   - Week 4: Beginning development of bones, facial structures, and limbs (presence of arm and leg buds); continuing development of the heart (which begins to beat), brain, and nervous tissue.
   - Week 5: Beginning development of eyes, nose, kidneys, lungs; continuing development of the heart (formation of valves), brain, nervous tissue, and digestive tract.
   - Week 6: Beginning development of hands, feet, and digits; continuing development of brain, heart, and circulation system.
   - Week 7: Beginning development of hair follicles, nipples, eyelids, and sex organs (testes or ovaries); first formation of urine in the kidneys and first evidence of brain waves.
   - Week 8: Facial features more distinct, internal organs well developed, the brain can signal for muscles to move, heart development ends, external sex organs begin to form.