

# 39-3 The Reproductive System



## Sexual Development

In humans, the reproductive system produces, stores, and releases specialized sex cells known as gametes.

These cells are released to create the fusion of sperm and egg to form a zygote, the single cell from which all cells of the human body develop.

# The Male Reproductive System

Release of Follicle Stimulating Hormone (FSH) and (Lutenizing Hormone) LH stimulates cells in the testes to produce testosterone.

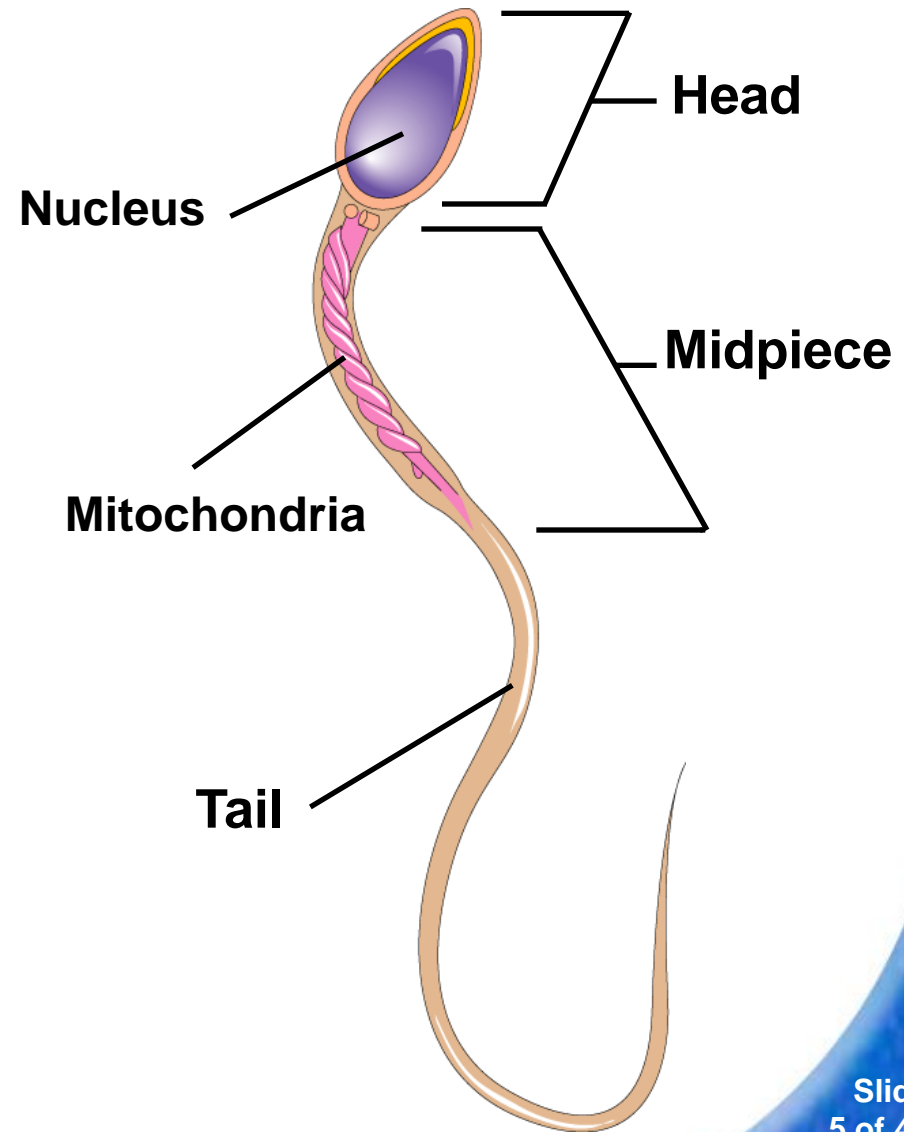
FSH and testosterone stimulate the development of sperm.



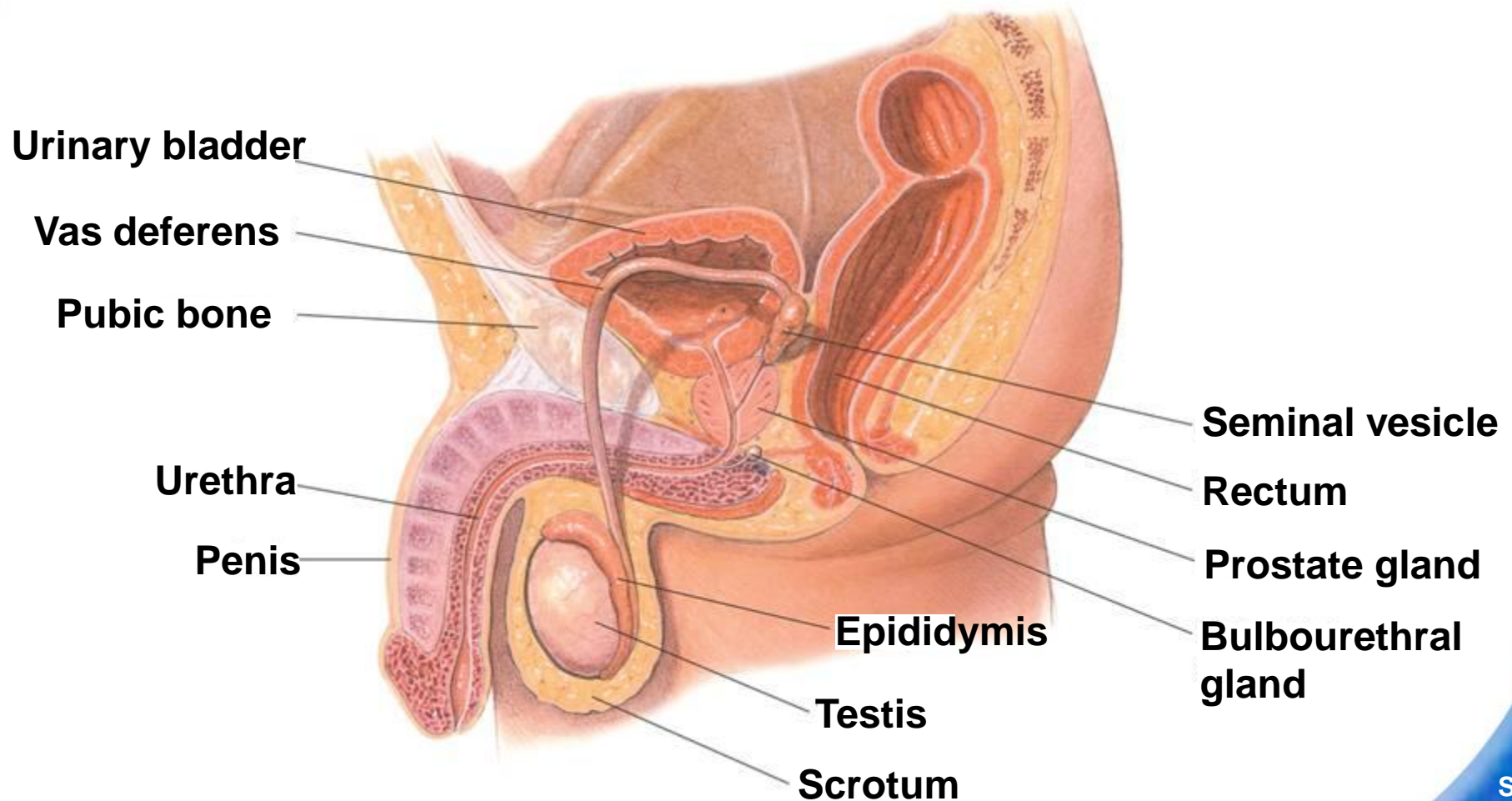
**The main function of the male reproductive system is to produce and deliver sperm.**

A sperm cell consists of:

- a head, which contains the nucleus
- a midpiece, which contains energy-releasing mitochondria
- a tail, which propels the cell forward



# Male Reproductive System



# **The Female Reproductive System**

The primary reproductive organs in the female are the ovaries.

The ovaries are located in the abdominal cavity.



**The main function of the female reproductive system is to produce eggs. In addition, the female reproductive system prepares the female's body to nourish a developing embryo.**

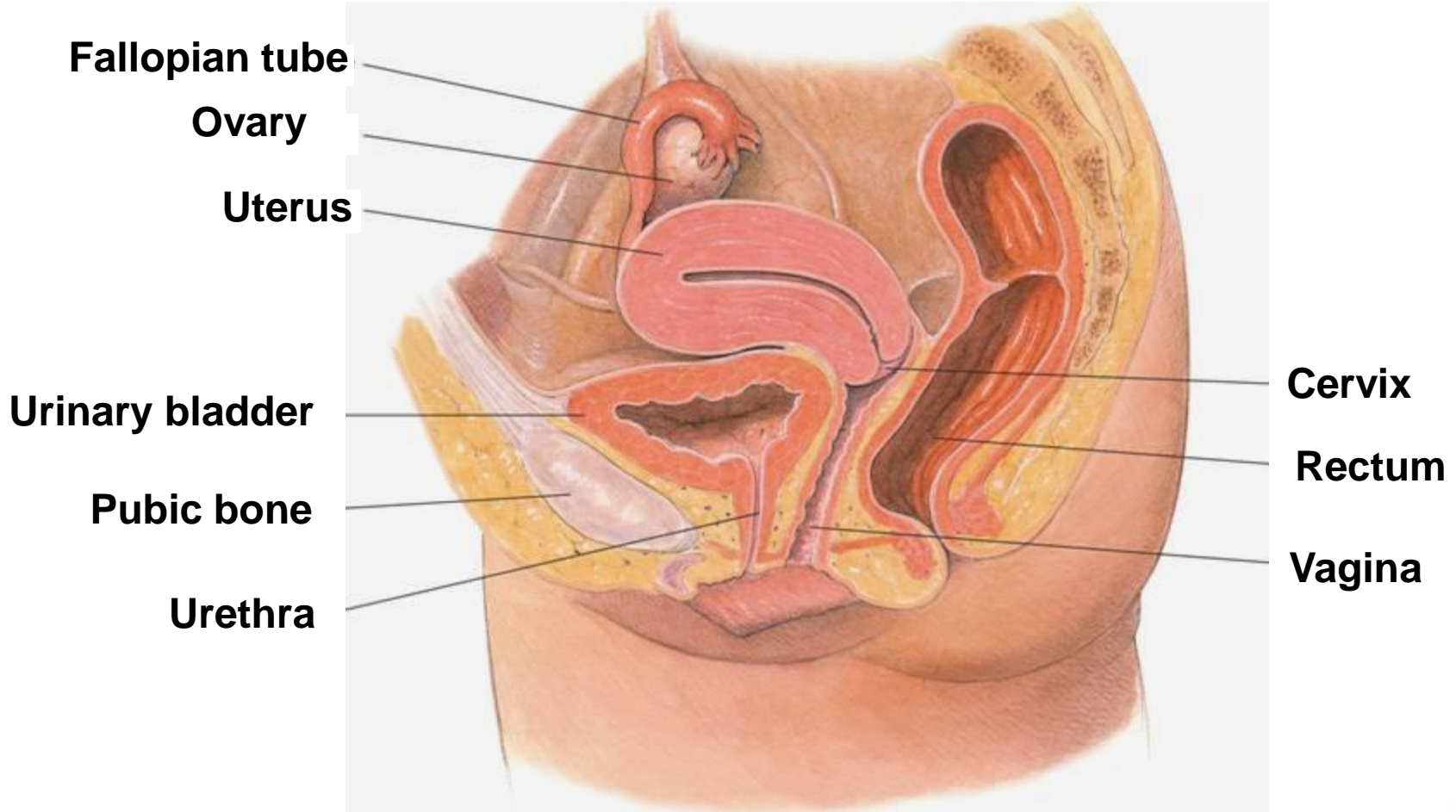


## 39-3 The Reproductive System → The Female Reproductive System

Puberty in females starts when the hypothalamus signals the pituitary gland to release FSH and LH.

FSH stimulates cells within the ovaries to produce estrogen.

# Female Reproductive System



# The Menstrual Cycle

The menstrual cycle is controlled by internal feedback mechanisms between the reproductive system and the endocrine system.

The cycle takes an average of 28 days.

During the **menstrual cycle**, an egg develops and is released from an ovary.

The uterus is prepared to receive a fertilized egg.

If the egg is fertilized, it is implanted in the uterus and embryonic development begins.

If the egg is not fertilized, it is discharged.



**What are the four phases of the menstrual cycle?**



**The menstrual cycle has four phases:**

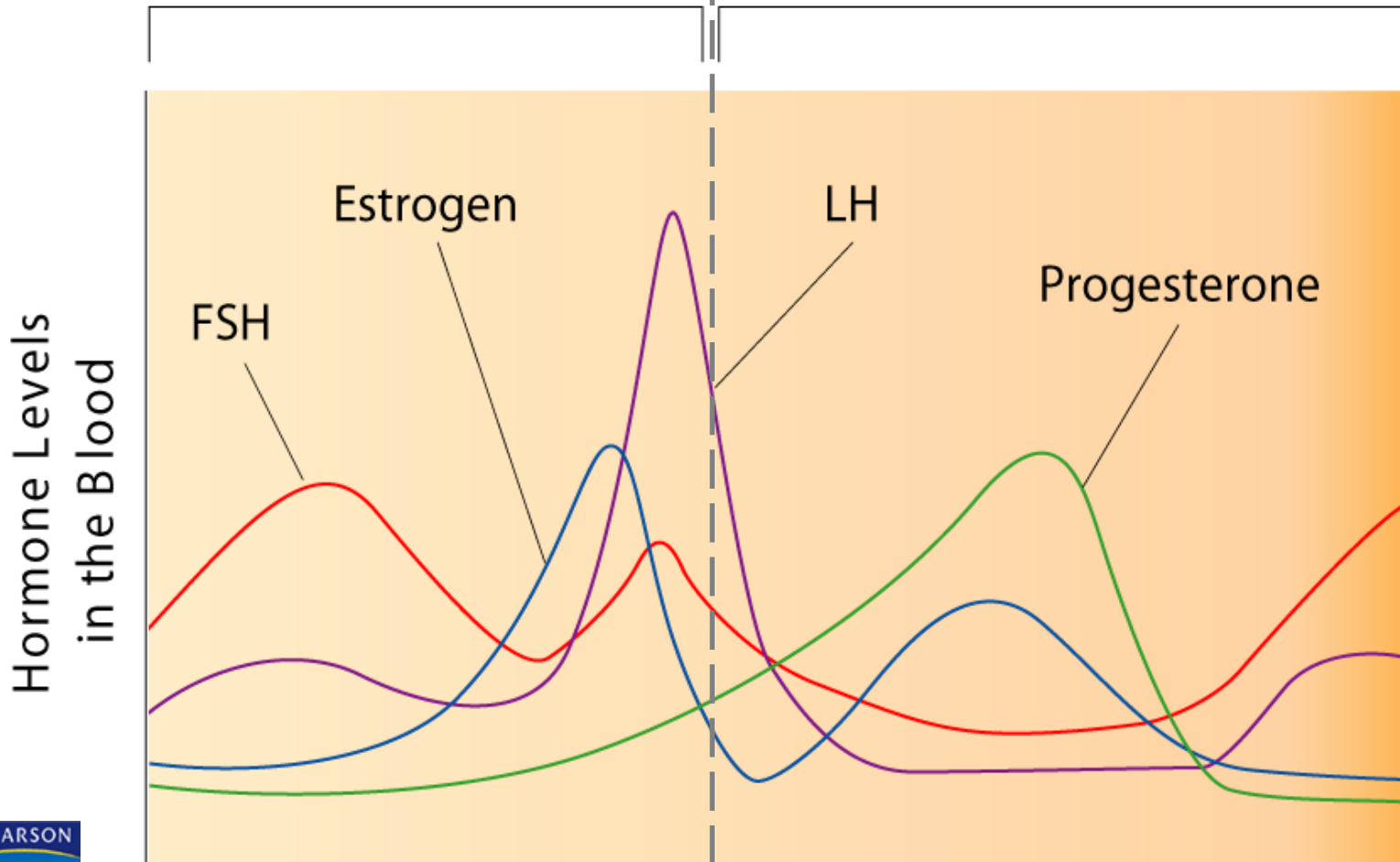
- **follicular phase**
- **ovulation**
- **luteal phase**
- **menstruation**

# Menstrual Cycle

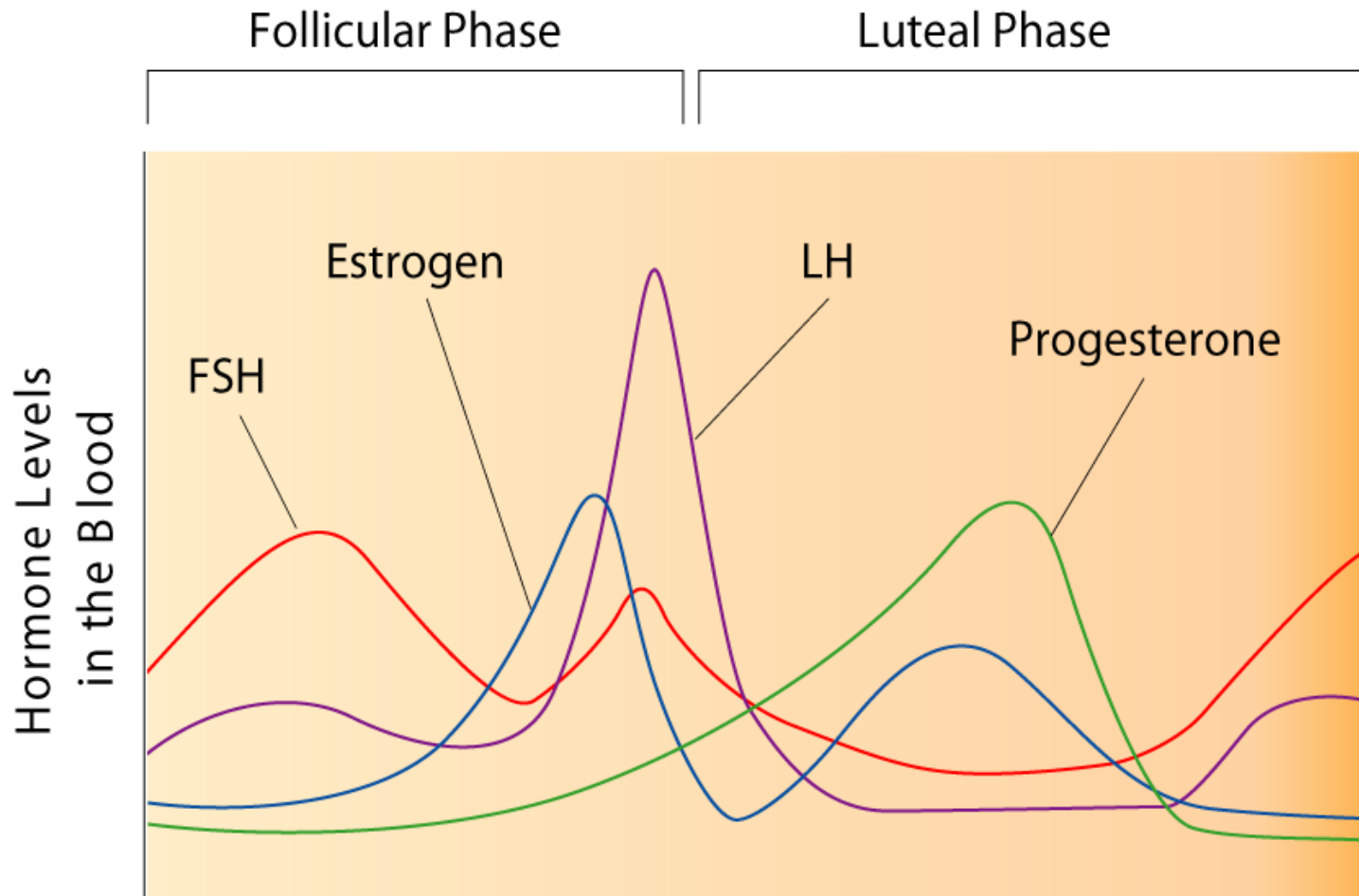
Ovulation

Follicular Phase

Luteal Phase



The follicular phase begins when estrogen levels in the blood are low.





The anterior pituitary secretes FSH and LH, which cause a follicle to develop to maturity.

As the follicle develops, cells surrounding the egg enlarge and produce more estrogen.

Estrogen causes the lining of the uterus to thicken.

## Ovulation

This phase occurs midway through the cycle and lasts 3–4 days.

The pituitary gland produces more FSH and LH.

The release of these hormones causes the follicle to rupture, and a mature egg is released into one of the Fallopian tubes.

## Luteal Phase

The luteal phase begins after the egg is released.

As the egg moves in the Fallopian tube, the follicle turns yellow and is called the **corpus luteum**.

The corpus luteum continues to release estrogen but also begins to release progesterone.

Progesterone stimulates growth and development of the blood supply and surrounding tissue.

Within a few days of implantation, the uterus and the growing embryo will release hormones that keep the corpus luteum functioning for several weeks.

This allows the lining of the uterus to nourish and protect the developing embryo.

## Menstruation

If fertilization does not occur, the corpus luteum will begin to disintegrate.

The follicle breaks down and releases less hormones, which makes the uterine lining detach.

This tissue, blood, and the unfertilized egg are discharged through the vagina.

This phase is **menstruation**, and it lasts 3–7 days.

# Sexually Transmitted Diseases

Diseases that spread from one person to another during sexual contact are called **sexually transmitted diseases** (STDs).

STDs are a serious problem in the U.S., infecting millions of people each year and accounting for thousands of deaths.

STDs caused by bacteria include chlamydia, syphilis, and gonorrhea.

STDs caused by viruses include hepatitis B, genital herpes, genital warts, and HIV/AIDS.

## 39-3 Section QUIZ

Continue to:

**Section QUIZ**

- or -

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## 39-3 Section QUIZ

1

Human male and female embryos are identical until they begin to differentiate at about

a. 7 hours of development.

b. 7 days of development.

A

c. 7 weeks of development.

d. 7 months of development.

## 39-3 Section QUIZ

**2** The process in which a mature egg is released from the follicle of an ovary is known as

a. fertilization.

**A** b. ovulation.

c. menstruation.

d. meiosis.

## 39-3 Section QUIZ

**3** An egg passes from a Fallopian tube into the cavity of the

a. ovary.

b. vagina.

**A** c. uterus.

d. cervix.

**4** Which statement best describes male sperm cells?

a. They are motile, produced in small numbers, and larger than most body cells.

**A** b. They are motile, produced in large numbers, and smaller than most body cells.

c. They are nonmotile, produced in small numbers, and larger than most body cells.

d. They are nonmotile, produced in large numbers, and smaller than most body cells.

- 5** The menstrual cycle is regulated by hormones that are controlled by
- a. positive feedback mechanisms.
  - b. ovulation.
  - A** c. negative feedback mechanisms.
  - d. fertilization.

# 39–4 Fertilization and Development



## 39–4 Fertilization Development

When an egg is fertilized, human development begins.

In this process, a single cell undergoes a series of cell divisions that results in the formation of a new human being.

## 39–4 Fertilization and Development

The egg is surrounded by a protective layer that contains binding sites to which sperm can attach.

When a sperm attaches to a binding site, its head releases enzymes that break down the protective layer of the egg.

The sperm nucleus enters the egg, and chromosomes from the sperm and egg are brought together.



## 39–4 Fertilization and Development



**The process of a sperm joining an egg is called fertilization.**

## 39–4 Fertilization and Development

After the two haploid (N) nuclei fuse, a single diploid (2N) nucleus is formed.

A diploid cell has a set of chromosomes from each parent cell.

The fertilized egg is called a **zygote**.

## Early Development

While still in the Fallopian tube, the zygote begins to undergo mitosis.

Four days after fertilization, the embryo is a solid ball of about 64 cells called a morula.

# 39–4 Fertilization and Early Development



**The stages of early development include implantation, gastrulation, and neurulation.**

## Implantation

As the morula grows, it becomes a hollow structure with an inner cavity called a blastocyst.

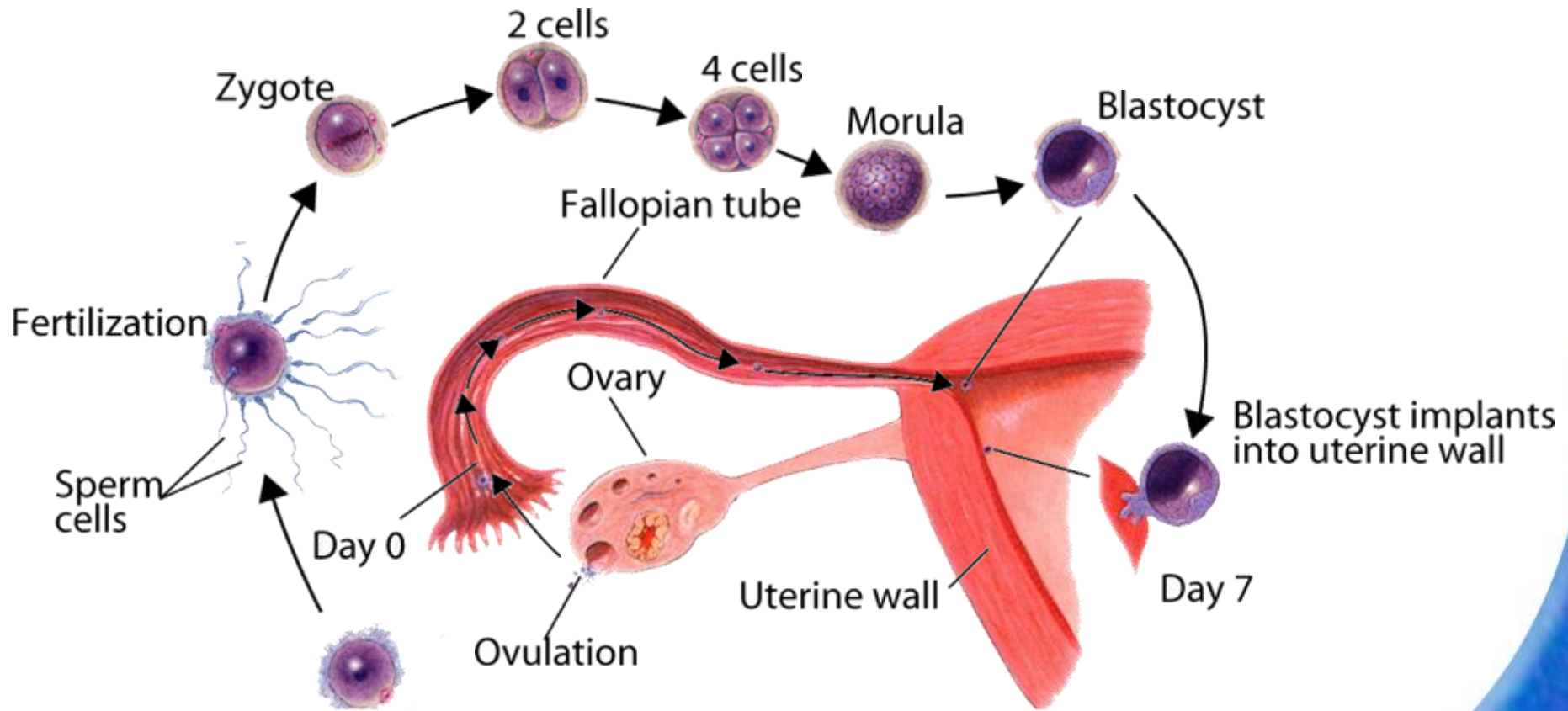
6–7 days after fertilization, the blastocyst attaches to the uterine wall.

The embryo secretes enzymes that digest a path into it.

This process is known as **implantation**.

# 39-4 Fertilization and Development

## Fertilization and Implantation



## 39–4 Fertilization and Early Development

Blastocyst cells specialize due to the activation of genes.

This process, called **differentiation**, is responsible for the development of the various types of tissue in the body.

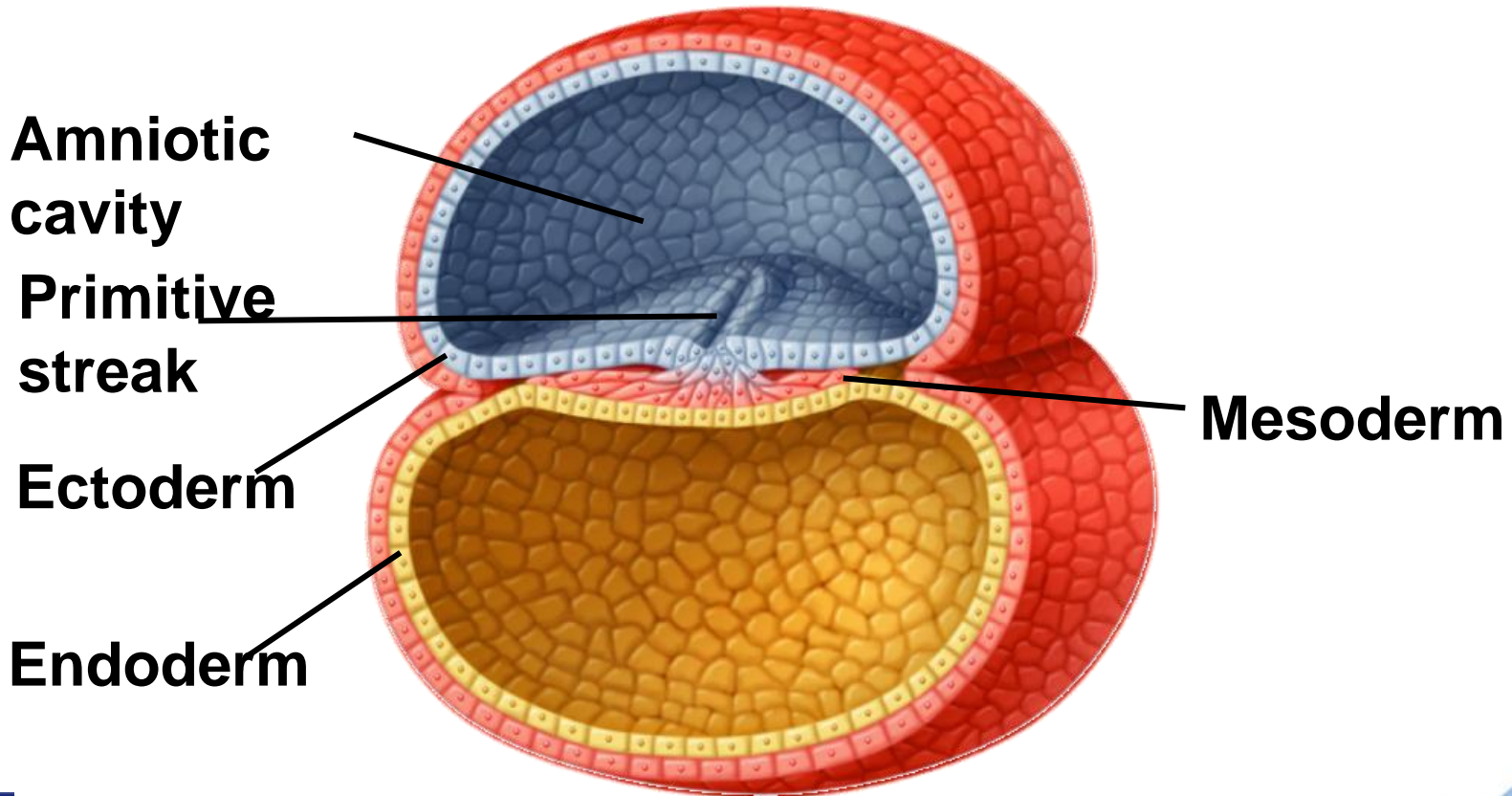
## Gastrulation

The inner cell mass of the blastocyst gradually sorts itself into two layers, which then give rise to a third layer.



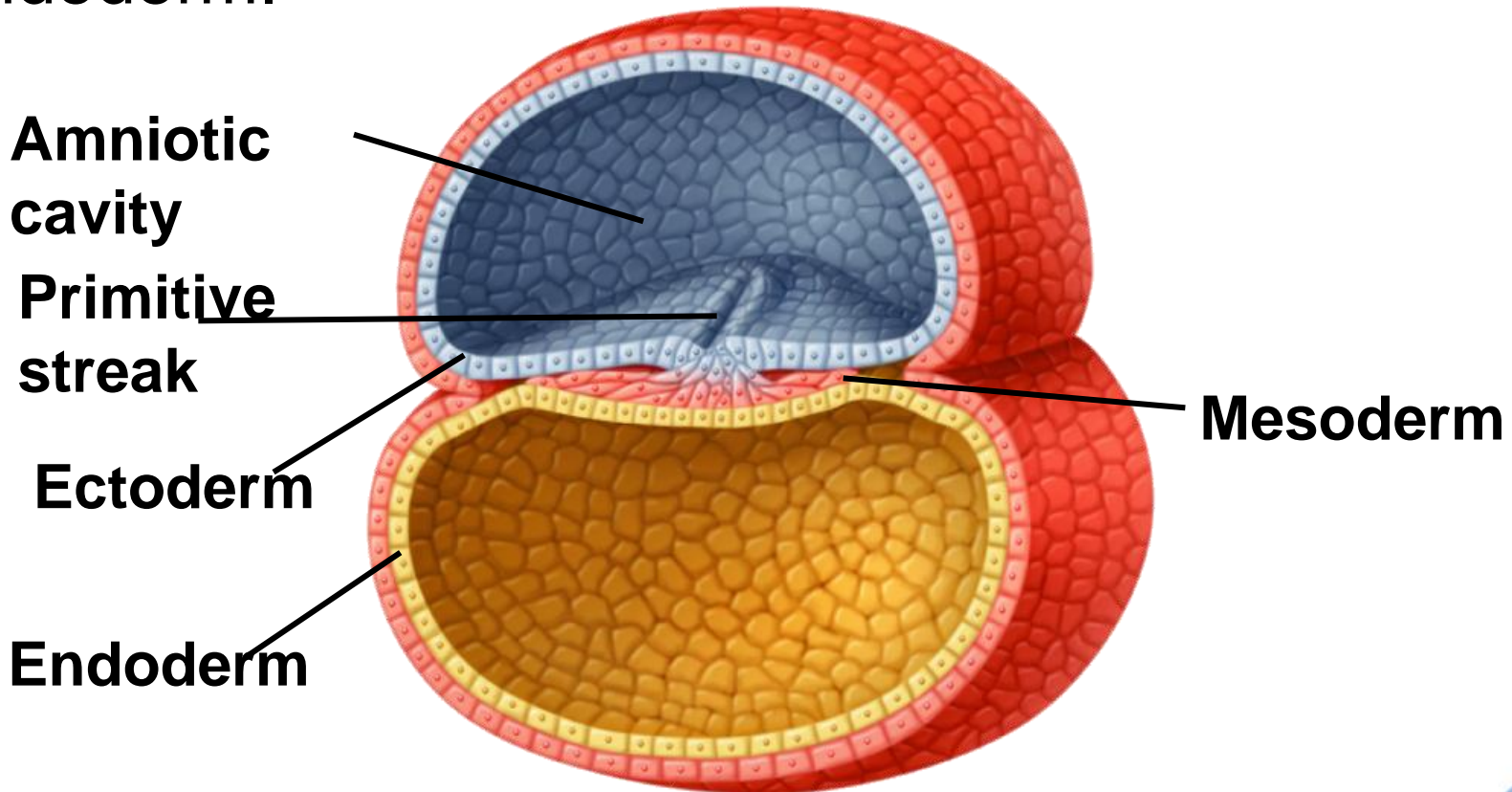
# 39-4 Fertilization and Early Development

The third layer is produced by a process of cell migration known as gastrulation.



# 39-4 Fertilization and Early Development

The result of gastrulation is the formation of three cell layers—the ectoderm, the mesoderm, and the endoderm.



## 39–4 Fertilization and Early Development

The ectoderm develops into the skin and nervous system.

The endoderm forms the digestive lining and organs.

Mesoderm cells differentiate into internal tissues and organs.

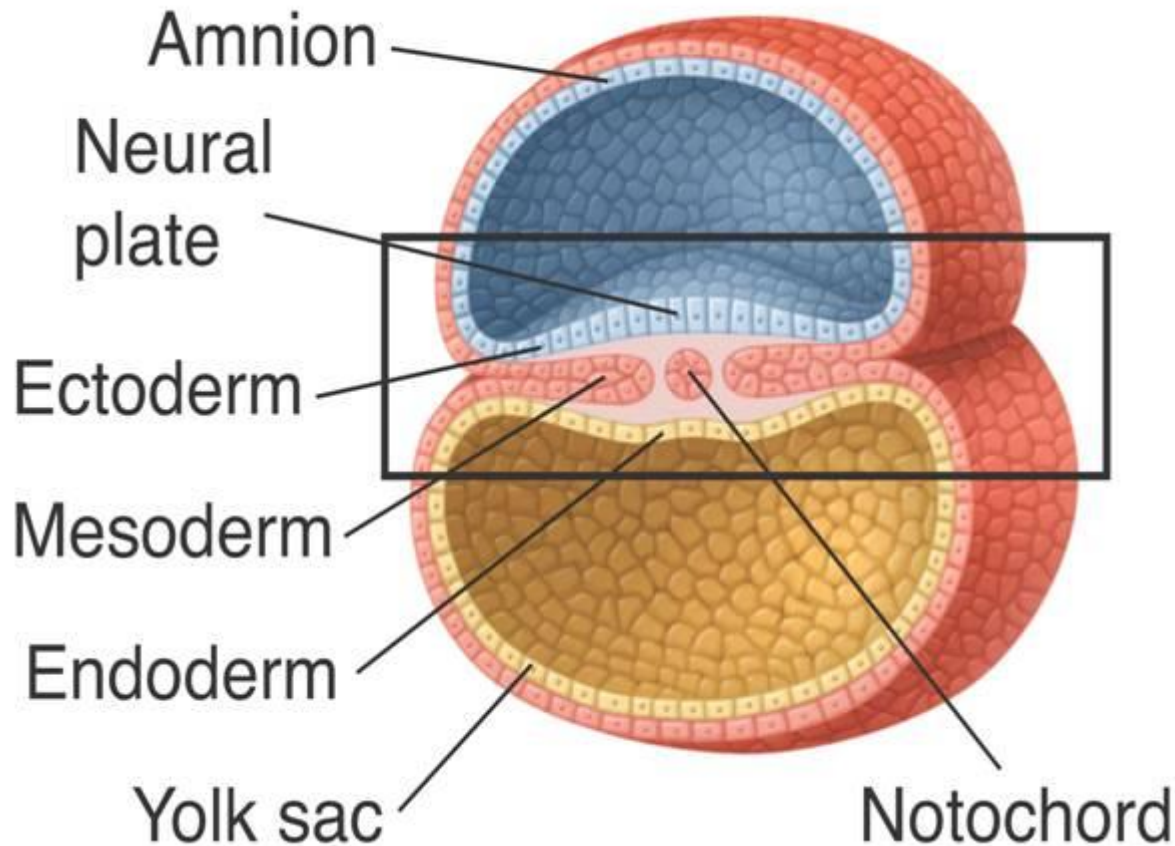
## Neurulation

Gastrulation is followed by neurulation.

**Neurulation** is the development of the nervous system.

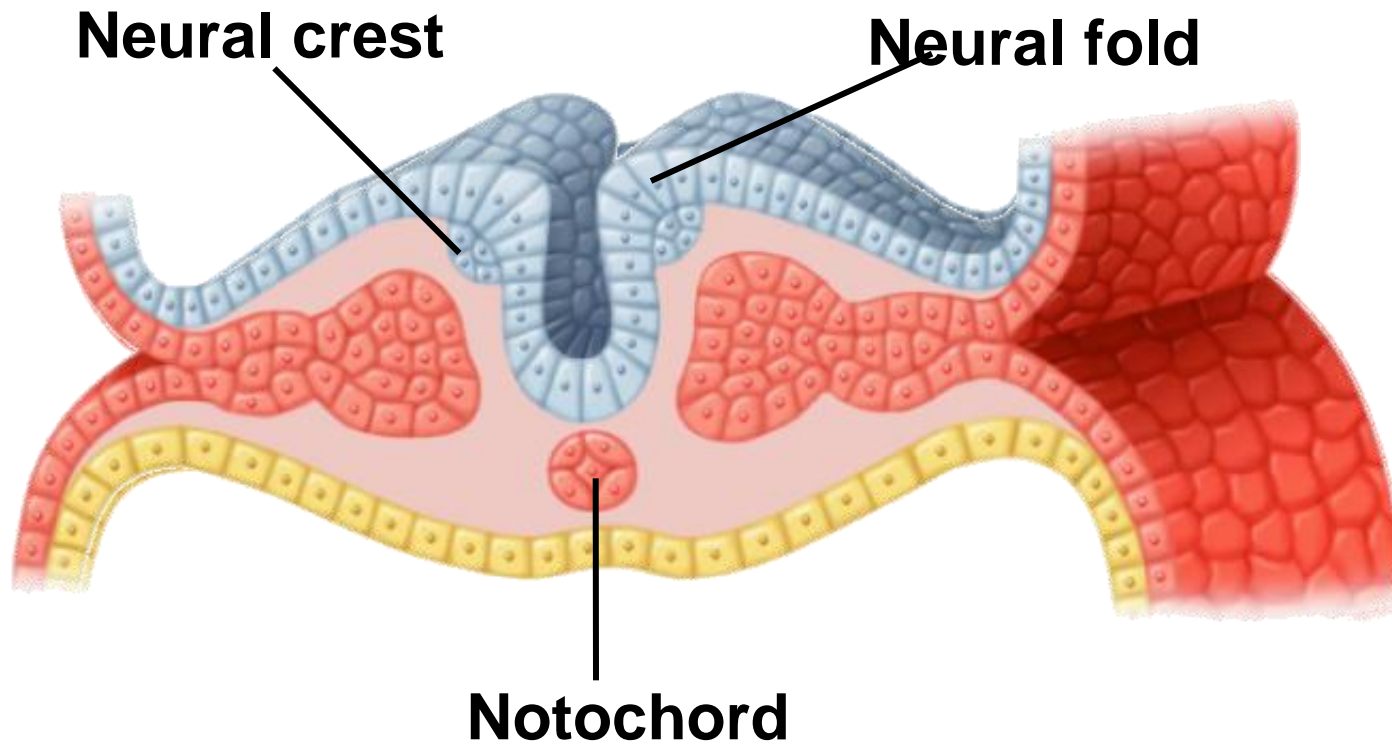
# 39-4 Fertilization and Early Development

Shortly after gastrulation is complete, a block of mesodermal tissue begins to differentiate into the notochord.



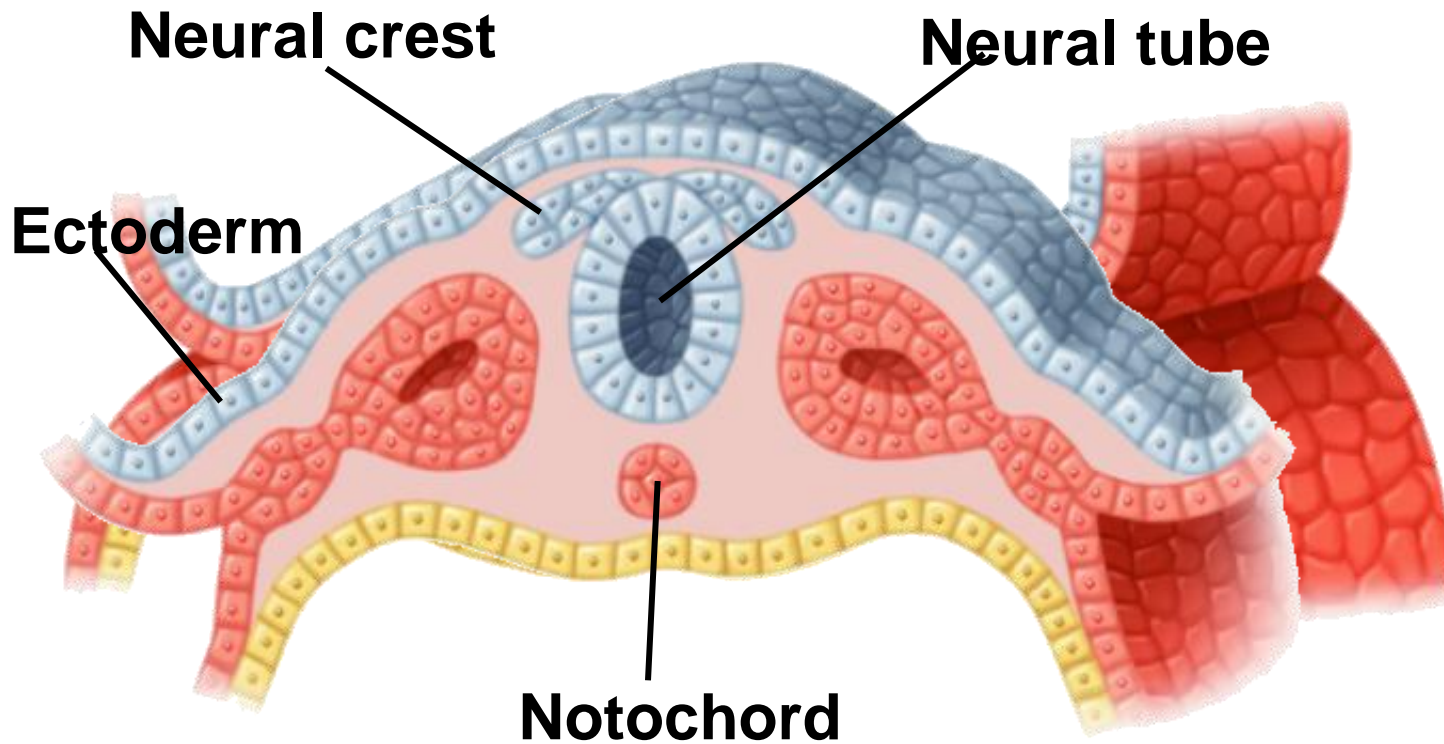
# 39-4 Fertilization and Early Development

As the notochord develops, the neural groove changes shape, producing neural folds.



# 39-4 Fertilization and Early Development

Gradually, these folds move together to create a neural tube from which the spinal cord and the nervous system develop.



## Extraembryonic Membranes

As the embryo develops, membranes form to protect and nourish the embryo.

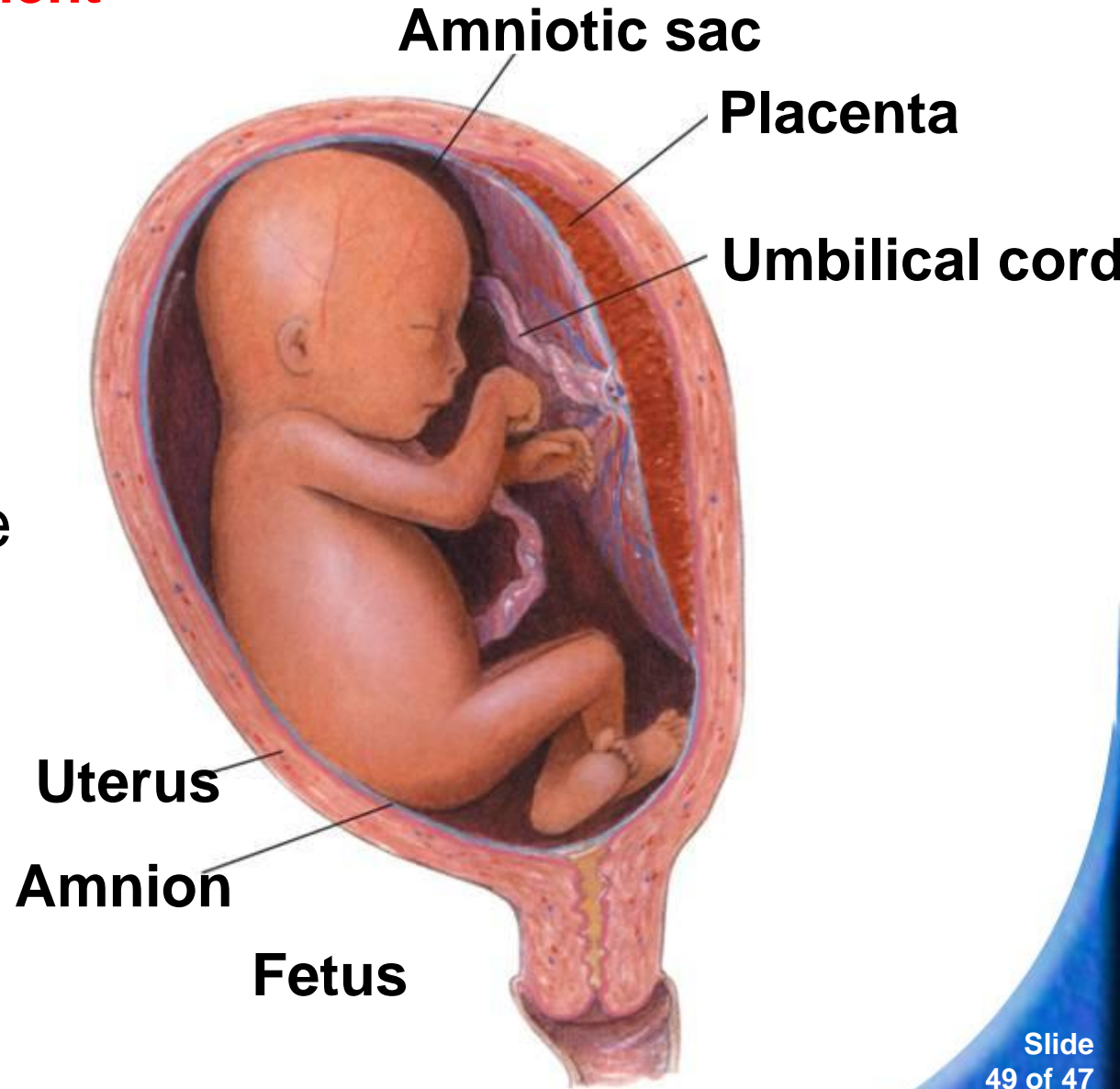
Two of these membranes are the amnion and the chorion.



# 39-4 Fertilization and Early Development

## Development

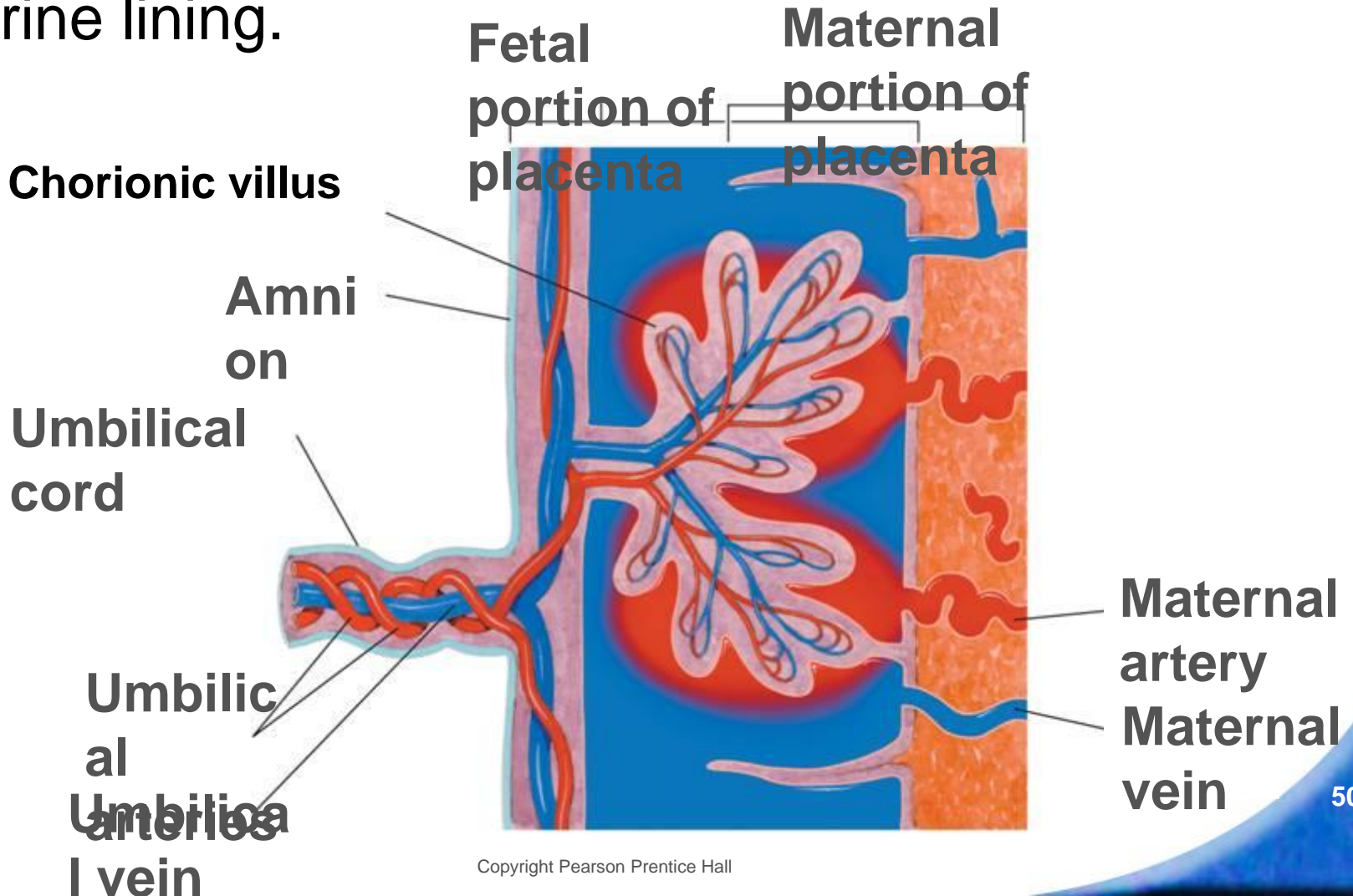
The amnion develops into a fluid-filled amniotic sac, which cushions and protects the developing embryo.



# 39-4 Fertilization and Early Development

## Development

Fingerlike projections called chorionic villi form on the outer surface of the chorion and extend into the uterine lining.



# 39–4 Fertilization and Early Development

## Development



**The placenta is the embryo's organ of respiration, nourishment, and excretion.**

## 39–4 Fertilization and Early Development

### Development

The placenta acts as a barrier to some harmful or disease-causing agents.

Some disease causing agents, such as German measles and HIV can cross the placenta.

Some drugs, including alcohol and medications also can penetrate the placenta and affect development.

## 39–4 Fertilization and Early Development

After eight weeks, the embryo is called a **fetus**.

After three months, most major organs and tissues are formed. During this time, the umbilical cord also forms.

The umbilical cord connects the fetus to the placenta.

## Control of Development

The fates of many cells in the early embryo are not fixed.

The inner cell mass contains embryonic stem cells, unspecialized cells that can differentiate into nearly any specialized cell type.

Researchers are still learning the mechanisms that control stem cell differentiation.

## Later Development

4–6 months after fertilization:

- The heart can be heard with a stethoscope.
- Bone replaces cartilage that forms the early skeleton.
- A layer of soft hair grows over the fetus's skin.
- The fetus grows and the mother can feel it moving.

## 39–4 Fertilization and Later Development

### Development

During the last three months, the organ systems mature.

- The fetus doubles in mass.
- It can now regulate its body temperature.
- The central nervous system and lungs completely develop.



# 39–4 Fertilization and Childbirth Development

## Childbirth

About nine months after fertilization, the fetus is ready for birth.

A complex set of factors affects the onset of childbirth.

## 39–4 Fertilization and Childbirth Development

The mother's posterior pituitary gland releases the hormone oxytocin, which affects involuntary muscles in the uterine wall.

These muscles begin rhythmic contractions known as labor.

The contractions become more frequent and more powerful.

## 39–4 Fertilization and Childbirth Development

The opening of the cervix expands until it is large enough for the head of the baby to pass through it.

At some point, the amniotic sac breaks, and the fluid it contains rushes out of the vagina.

Contractions force the baby out through the vagina.

## 39–4 Fertilization and Childbirth Development

The baby now begins an independent existence.

Its systems quickly adapt to life outside the uterus, supplying its own oxygen, excreting waste on its own, and maintaining its own body temperature.

## 39-4 Section QUIZ

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## 39–4 Section QUIZ

1 Fertilization takes place in the

a. ovary.

A

b. Fallopian tube.

c. cavity of the uterus.

d. cervix.

**2** The process in which a blastocyst attaches to the wall of the uterus is called

a. fertilization.

**A** b. implantation.

c. gastrulation.

d. neurulation.

3 The central nervous system develops during which phase of early development?

a. gastrulation

A b. neurulation

c. implantation

d. fertilization



- 4** The placenta is a structure that
- a. belongs entirely to the mother.
  - b. belongs entirely to the fetus.

**A** c. brings blood from the mother and fetus close together.

- d. provides an impermeable barrier between the mother and the fetus.

**5** Which of the following is NOT a primary germ layer?

**A** a. neural tube

b. endoderm

c. ectoderm

d. mesoderm

**END OF SECTION**