

Menopause is a biological stage in a woman's life when the menstrual cycle permanently stops and the ovaries no longer release eggs for reproduction. The word menopause comes from two Greek words: "men" meaning month and "pause" meaning to stop. In medical terms, menopause is defined as the point when a woman has not had a menstrual period for 12 consecutive months, and the cause is the natural decline of reproductive hormones produced by the ovaries.

To understand menopause, it is important first to understand how the female reproductive system normally functions. The central organs involved are the ovaries, uterus, fallopian tubes, and vagina. The ovaries are two small glands located on either side of the uterus. Their primary functions are producing eggs, also called ova, and releasing reproductive hormones such as estrogen and progesterone. A hormone is a chemical messenger produced by glands in the body that travels through the bloodstream and regulates the activity of organs and tissues.

At birth, the ovaries contain a large number of immature eggs stored in microscopic structures called follicles. A follicle is a small fluid-filled sac that surrounds and nourishes a developing egg cell. Over the course of a woman's reproductive years, these follicles gradually mature and release eggs through a process called ovulation. Ovulation occurs roughly once during each menstrual cycle.

The menstrual cycle is a repeating biological process that prepares the body for possible pregnancy. The cycle is controlled by interactions between the brain, pituitary gland, and ovaries. The pituitary gland, located at the base of the brain, releases hormones known as follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These hormones stimulate the ovaries to mature follicles and release eggs.

During the early phase of the cycle, follicles in the ovary produce estrogen, a hormone responsible for developing female reproductive tissues and regulating the menstrual cycle. Estrogen causes the lining of the uterus—called the endometrium—to thicken. The endometrium is the inner tissue layer of the uterus where a fertilized egg could implant and grow.

Midway through the cycle, a surge in luteinizing hormone triggers ovulation, which is the release of a mature egg from the ovary. After ovulation, the follicle transforms into a structure called the corpus luteum, which produces progesterone. Progesterone helps maintain the uterine lining in preparation for possible pregnancy.

If fertilization does not occur, hormone levels decline. The endometrium then sheds and exits the body through the vagina as menstrual bleeding. This process is known as menstruation, commonly called a period. The cycle then begins again.

Menopause occurs when the ovaries gradually lose their ability to produce mature eggs and produce lower amounts of reproductive hormones. Over time the number of

remaining follicles in the ovaries declines. This decline eventually leads to the cessation of ovulation and the end of menstrual cycles.

The biological transition leading up to menopause is called perimenopause. Perimenopause means “around menopause” and refers to the years during which hormone levels fluctuate and reproductive function gradually decreases. During this stage, ovulation becomes irregular, estrogen levels vary from cycle to cycle, and menstrual periods may become unpredictable.

Menopause itself marks the end of ovarian reproductive function. The ovaries produce much smaller amounts of estrogen and progesterone. Because these hormones regulate the menstrual cycle, their reduction causes menstruation to stop permanently.

The average age of menopause in many populations is approximately 51 years, though the transition can occur earlier or later. Menopause that occurs before age 40 is called premature menopause, while menopause between ages 40 and 45 is sometimes referred to as early menopause. These variations can occur because of genetic factors, medical treatments, surgery, or health conditions affecting the ovaries.

One of the major biological effects of menopause is the reduction in estrogen levels. Estrogen has functions throughout the body beyond reproduction. It influences bone metabolism, blood vessel function, skin elasticity, and aspects of brain signaling. Because estrogen levels decline during menopause, several physiological changes occur.

Bone tissue is constantly remodeled through a process called bone turnover, in which old bone is broken down and new bone is formed. Estrogen helps regulate this balance. When estrogen levels decline, bone breakdown can occur faster than bone formation, which may reduce bone density. Bone density refers to the amount of mineral content within bone tissue.

Estrogen also influences the cardiovascular system, which includes the heart and blood vessels. Blood vessels contain smooth muscle in their walls that can widen or narrow to regulate blood flow. Hormonal changes during menopause can influence vascular function and lipid metabolism, meaning the processing of fats in the bloodstream.

Another system influenced by hormonal changes is the thermoregulatory system, which regulates body temperature. The thermoregulatory center is located in the hypothalamus, a region of the brain responsible for maintaining stable internal conditions. Changes in estrogen levels can affect the hypothalamus and alter how the body regulates heat.

The reproductive tissues themselves also undergo structural changes. The tissues of the vagina and urinary tract contain cells that respond to estrogen. As estrogen declines, these tissues may become thinner and less elastic, a process called atrophy, meaning a reduction in tissue thickness or strength due to decreased cellular activity.

Although menopause marks the end of reproductive fertility, it is a natural stage in the human lifespan rather than a disease. The biological transition reflects the completion of the ovarian reproductive cycle that begins before birth when follicles are first formed in the developing ovaries.

From a biological perspective, menopause represents a major endocrine shift in the female body. The endocrine system, which consists of glands that produce hormones, adjusts to new hormonal levels after the ovaries reduce their reproductive activity. Other glands such as the adrenal glands and fat tissue continue to produce small amounts of estrogen-related compounds, but the primary source of reproductive hormones—the ovaries—has largely ceased activity.

Menopause therefore represents the permanent conclusion of the menstrual cycle and reproductive capability, resulting from the natural depletion of ovarian follicles and the long-term decline of estrogen and progesterone production by the ovaries.