Week 2

Conception, the Zygote, and the Embryo

We begin our foray into the life span with our module on conception, the fertilization of an egg cell by a sperm cell. This marks the beginning of the life span for researchers. We actually need to go even farther back in time, however, to see the effects that preconception factors can have on a child before this union of cells even begins.

Women are born with all the eggs, or female sex cells, they will ever have (or, more correctly, ovarian follicles). Ovulation occurs, on average, once every 28 days, 14 days before a woman's expected menstrual period, or shedding of the uterine lining built up to nourish a fertilized egg. Generally, one egg is released at ovulation, and only lives 24 hours in the fallopian tube (see below) if it is not fertilized.

Egg cells do not continue to be replenished by the body after time. Therefore, as a woman gets older, her egg cells are older as well (as they were formed before she was born). Cells lose their ability to function slowly over the years, and older egg cells are at a higher risk for splitting incorrectly at fertilization. A woman's age at fertilization is used as a marker for potential risks to the pregnancy and for chromosomal disorders, which we will discuss later. Women continue to ovulate until menopause, the cessation of fertility in women, though ovulation may occur less frequently or more sporadically as she gets older.

In contrast, men's production of sperm, the male sex cell, does not begin until puberty. Three hundred million sperm are produced daily by a healthy male, and he can continue to produce new sperm every few days until death if he stays healthy and without physical disorder. With each ejaculation, he releases 180 million sperm, but only 300-500 reach the egg (if the woman has ovulated or will ovulate soon). Unlike the short-lived egg cells, sperm can live up to six days in the fallopian tubes. As men continue to produce new sperm, paternal age is less of a preconception risk factor than maternal age.

A healthy couple having unprotected sex during the week that the woman is ovulating has a 20 percent chance of getting pregnant during that menstrual cycle. In the first two weeks after fertilization, the egg and sperm cells (one of each) fuse into one cell, and the zygote (these first two weeks are called the zygotic period) quickly begins to split and multiply as it moves out of the fallopian tube and into the uterus. The zygote becomes a blastocyst when the cells form a hollow sphere, which implants into the uterine lining between days 7-9 after fertilization. At implantation, the blastocyst begins to be nourished by the uterine lining, and therefore by the mother. Before implantation, nothing that the mother ingests reaches the blastocyst, an important distinction we will see in the link on teratogens.
The developing zygote begins to be protected by amniotic fluid, which fills the amniotic sac and cushions the zygote and regulates temperature. The chorion is a protective membrane surrounding the amniotic sac that projects tiny blood vessels toward the uterine lining. At one area, the chorion vessels thicken and create the placenta, the organ which nourishes and removes waste. The zygote connects to the placenta by the umbilical cord, a long cord containing blood vessels, and the zygote is now referred to as an embryo. Thirty percent of zygotes do not make it to this point, a period of less than two weeks. In such a case, a woman would have bleeding and cramping similar to a menstrual period, and likely would not know that she had been pregnant.

We now move into the embryonic period of prenatal development, lasting between weeks 2 and 8 (counting from fertilization). This is the most vulnerable time of prenatal development, as all physical body parts and systems are forming during this period of rapid growth. The first major development is the division of the hollow ball of cells, the blastocyst, into three layers of cells, which begin to differentiate, or develop more specified functions. The ectoderm, or outermost layer, will later become the nervous system and skin. It is the first and the fastest of the three to develop, and begins with the formation of the neural tube, a primitive spinal cord, the top of which swells to become the brain. The mesoderm, the middle layer, will become musculature, skeleton, circulatory system, and other internal organs. The endoderm, the innermost layer, will become the digestive system, lungs, urinary tract, and endocrine (glandular) systems. During the embryonic period, the focus of development is on setting the major systems in place for later development.

At week 9 after fertilization, the embryo becomes a fetus. At this point, development is focused on the organization, connection, and functioning of the systems set in place during the embryonic period.

References
