Q: HOW DOES THE BRAIN DEVELOP?

The brain is a lifelong work in progress. Development is most rapid before birth, maintains a furious pace in infancy and continues briskly through childhood and adolescence, but never ceases altogether.

In the third week of gestation, genes switch on to turn some of the embryo’s stem cells — “blank slate” cells with the potential to become any kind of tissue — into neurons and glia. These newly formed cells multiply, migrate and connect with one another, guided by chemical signals into the webwork of brain anatomy. By week seven, primitive forms of the cortex, cerebellum and brainstem are apparent.

Birth is only the beginning. The brain adds volume at an initial rate of 1 percent per day, growing by two-thirds in the first three months. To fuel its development, it requires 43 percent of the body’s daily energy intake until puberty — which, some experts say, explains why physical growth takes so long in humans, compared with other species.

Neurons aren’t added — in fact, we have more at birth than in adulthood — but grow and connect as specialized circuits form. Sensory centers emerge early, while the hippocampus and amygdala, primitive regions important in emotion and memory, aren’t fully functional until age 3 — which is why we retain virtually no memories of infancy.

Childhood development is a dynamic brain-world interaction. During “critical” periods when regions regulating senses, emotions and language are amped up to make synapses, they must receive appropriate environmental stimulation to connect properly.

Development in adolescence defines brain circuits more sharply, adding new synapses, pruning unnecessary ones and strengthening those that remain. Sensory, language and emotional centers mature. Axons add an insulating sheath of myelin to transmit messages more efficiently.

As adolescence ends, the brain still needs fine-tuning, as indicated by frequent risk taking and poor judgment displayed by some in their early 20s. That the prefrontal cortex, seat of planning and decision making, won’t mature fully for another decade partly explains this behavior, but connections between brain regions also must strengthen to give the intellect meaningful control over emotional impulse.

WHEN DEVELOPMENT GOES WRONG

Mishaps in this complex process before birth or early in childhood result in neurodevelopmental disorders, such as intellectual disability, autism and attention deficit hyperactivity disorder (ADHD). Some suggest that schizophrenia, which typically appears in late teens, develops in a similar way.

Causes of neurodevelopmental disorders may include genetics, toxic exposure, infection and trauma. Research into these problems may facilitate earlier intervention and improve treatment.