

Biological changes in males and females during puberty

[Science](#), [Biology](#)



The estrogen and testosterone released by gonads bring biological changes and help in the development of breasts in girls and testicular development in boys. Other androgens result in changes in body proportion and function of organ systems. The puberty onset results in physical development, hormonal changes, and sexual maturation which vary both within and between the sexes. During puberty, girls experience pubic hair, breast development, and growth of the reproductive system. Girls increase their height and changes in body proportions while beginning their menarche by age 11-16.

Boys experience changes later than girls involving pubic hair, enlargement of the penis, growth of the scrotum, and development of the reproductive system. The height increases while body proportions and body hair changes experiencing voice changes.

Development of Hypothetical-Deductive Thought and Abstract Thinking in Adolescent Cognitive Development

The adolescent's cognitive development determines the ability of a person to learn, think, reason, and adapt to the environment. Piaget's study of cognitive development theory is mainly based on three principles namely: assimilation, accommodation, and equilibration; while his belief that cognitive development occurred in four stages that are universal as every person passes through all these stages in the same order. These four stages are sensorimotor development, preoperational period, concrete operations, and formal operations.

Each stage corresponds to a certain age but there could be variations as some children enter stage earlier while others enter later. The sensorimotor period lasts from birth to 2 years where babies think by using senses and

motor skills involving an understanding of objects, adapting to the environment with reflexes, and developing object permanence. The preoperational stage lasts from 2 to 6 years where children's thinking becomes language-based and symbolic. Children during this stage struggle with egocentrism, a tendency of the child to think from their own point. Concrete thinking is more logical lasting from 7 to 11 years of age. The child considers multiple aspects of the problem to solve it, understands reversibility, gains the ability of serialization, classification, and delimitate egocentrism by understanding other persons' perspectives. The formal Operational state is the fourth and final stage of cognitive development commencing at age of 11 years to 16 years and characterized by the development of hypothetical deductive reasoning and the ability to think about abstract ideas (abstract thinking).

According to Piaget's experiments, formal operational adolescents tend to determine all possibilities and systematically classify factors individually, observe the results aptly, and lead to appropriate conclusions that differ them from concrete operational children. Individuals in this age engage in hypothetical deductive reasoning that is the reasoning that uses deductive logic and involves generating a hypothesis, stating and considering the implications of the hypothesis, testing the hypothesis, and reaching final conclusions whether this hypothesis works or has more hypotheses.

Children tend to gain abstract thinking during this formal operational stage that can be deductive reasoning that is reasoning from general statements or principles that lead to conclusions or inductive reasoning that is reasoning from any experience or facts to a general conclusion. Thus the adult's

intellectual abilities start to improve during this stage based on knowledge gained and experience.