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## **PUBERTY DEPENDS ON BIOLOGICAL DEVELOPMENT**

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Puberty is a period of several years in which rapid physical growth and psychological changes occur, culminating in sexual maturity. The average onset of puberty is at 10 or 11 for girls and age 12 or 13 for boys. Every person's individual timetable for puberty is influenced primarily by heredity, although environmental factors, such as diet and exercise, also exert some influence. These factors can also contribute to precocious and delayed puberty.

Some of the most significant parts of pubertal development involve distinctive physiological changes in individuals' height, weight, body composition, and circulatory and respiratory systems. These changes are largely influenced by hormonal activity. Hormones play an organizational role, priming the body to behave in a certain way once puberty begins, and an activational role, referring to changes in hormones during adolescence that trigger behavioral and physical changes.

Puberty begins with a surge in hormone production, which in turn causes a number of physical changes. It is also the stage of life in which a child develops secondary sex characteristics (for example, a deeper voice and larger Adam's apple in boys, and development of breasts and more curved and prominent hips in girls) as his or her hormonal balance shifts strongly towards an adult stage. This is triggered by the pituitary gland, which secretes a surge of hormonal agents into the blood stream, initiating a chain reaction. The male and female gonads are subsequently activated, which puts them into a state of rapid growth and development; the triggered gonads now commence the mass production of the necessary chemicals. The testes primarily release testosterone, and the ovaries predominantly dispense estrogen. The production of these hormones

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increases gradually until sexual maturation is met. Some boys may develop gynecomastia due to an imbalance of sex hormones, tissue responsiveness or obesity.

Facial hair in males normally appears in a specific order during puberty: The first hair appear to grow at the corners of the upper lip, typically between 14 to 16 years of age. It then spreads to form a moustache over the entire upper lip. This is followed by the appearance of hair on the upper part of the cheeks, and the area under the lower lip. The hair eventually spreads to the sides and lower border of the chin, and the rest of the lower face to form a full beard. As with most human biological processes, this specific order may vary among some individuals. Facial hair is often present in late adolescence, around ages 17 and 18, but may not appear until significantly later. Some men do not develop full facial hair for 10 years after puberty. Facial hair will continue to get coarser, darker and thicker for another 2-4 years after puberty.

The major landmark of puberty for males is the first ejaculation, which occurs, on average, at age 13. For females, it is menarche, the onset of menstruation, which occurs, on average, between ages 12 and 13. The age of menarche is influenced by heredity, but a girl's diet and lifestyle contribute as well. Regardless of genes, a girl must have certain proportion of body fat to attain menarche. Consequently, girls who have a high fat-diet and who are not physically active begin menstruating earlier, on average, than girls whose diet contains less fat and whose activities involve fat reducing exercise (e.g. ballet and gymnastics). Girls who experience malnutrition or are in societies in which children are expected to perform physical labor also begin menstruating at later ages. The timing of puberty can have important psychological and social consequences. Early maturing boys are usually taller and stronger than their friends. They have the advantage in capturing the attention of potential partners and in becoming hand-picked for sports. Pubescent boys often tend to have a good body image, are more confident, secure, and more independent. Late maturing boys can be less confident because of poor body image when comparing themselves to already developed friends and peers. However, early puberty is not

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always positive for boys; early sexual maturation in boys can be accompanied by increased aggressiveness due to the surge of hormones that affect them. Because they appear older than their peers, pubescent boys may face increased social pressure to conform adult norms; society may view them as more emotionally advanced, despite the fact that their cognitive and social development may lag behind their appearance. Studies have shown that early maturing boys are more likely to be sexually active and are more likely to participate in risky behaviors.

For girls early maturation can sometimes lead to increased self-consciousness, though a typical aspect in maturing females. Because of their bodies' developing in advance, pubescent girls can become more insecure. Consequently, girls that reach sexual maturation early are more likely than their peers to develop eating disorders. Nearly half of all American high school' diet is to lose weight. In addition, girls may have to deal with sexual advances from older boys before they are emotionally mature. In addition to having earlier sexual experiences and more unwanted pregnancies than late maturing girls, early maturing girls are more exposed to alcohol and drug abuse. Those who have had such experience tend to perform less well in school than their "inexperienced" age peers.

Girls have usually reached full physical development by ages 15-17, while boys usually complete puberty by ages 16-18. Any increase in height beyond the post-pubertal age is uncommon. Girls attain reproductive maturity about 4 years after the first physical changes of puberty appear. In contrast, boys accelerate more slowly but continue to grow for about 6 years after visible pubertal changes.

### **Growth Spurt**

The adolescent growth spurt is a rapid increase in individuals' height and weight during puberty resulting from the simultaneous release of growth hormones, thyroid hormones, and androgens.

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Males experience their growth spurt about two years later, on average, than female. During their peak height velocity (the time of most rapid growth), adolescents grow at a growth rate nearly identical to that of a toddler-about 4 inches (10.3 cm) a year for males and 3.5 inches (9 cm) for females. In addition to changes in height, adolescents also experience a significant increase in weight (Marshall, 1978). The weight gained during adolescence constitutes nearly half of one's adult body weight. Teenage and early adult males may continue to gain natural muscle growth even after puberty.

The accelerated growth in different body parts happens at different times, but for all adolescents it has a fairly regular sequence. The first places to grow are the extremities-the head, hands and feet-followed by arms and legs, then the torso and shoulders. This non-uniform growth is one reason why an adolescent body may seem out of proportion.

During puberty, bones become harder and more brittle. At the conclusion of puberty, the ends of the long bones close during the process called epiphysis. There are ethnic differences in these skeletal changes: bone density increases significantly more among African-American than white adolescents, which might account for decreased likelihood of African-American women developing osteoporosis and having fewer bone fractures.

Another set of significant physical changes during puberty happen in bodily distribution of fat and muscle. This process is different for females and males. Before puberty, there are nearly no sex differences in fat and muscle distribution; during puberty, boys grow much faster than girls, although both sexes experience rapid muscle development. In contrast, though both sexes experience an increase in body fat, the increase much more significant for girls. Frequently, the increase in fat for girls happens in their years just before puberty. The ratio between muscle and fat among post-pubertal boys is around three to one, while for girls it is about five to four. This may help explain sex differences in athletic performance.

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Pubertal development also affects circulatory and respiratory systems as an adolescents' heart and lungs increase in both size and capacity. These changes lead to increased strength and tolerance for exercise. Sex differences are apparent as males tend to develop “ larger hearts and lungs, higher systolic blood pressure, a lower resting heart rate, a greater capacity for carrying oxygen to the blood, a greater power for neutralizing the chemical products of muscular exercise, higher blood hemoglobin and more red blood cells” .

It is important to note that, despite some genetic sex differences, environmental factors play a large role in biological changes during adolescence. For example, girls tend to reduce their physical activity in preadolescence and may receive inadequate nutrition from diets that often lack important nutrients, such as iron. These environmental influences in turn affect female physical development.

### **Reproduction-Related Changes**

Primary sex characteristics are those directly related to the sex organs. In males, the first stages of puberty involve growth of the testes and scrotum, followed by growth of the penis. At the time that the penis develops, the seminal vesicles, the prostate, and the bilbo-urethral glands also enlarge and develop. The first ejaculation of seminal fluid generally occurs about one year after the beginning of accelerated penis growth, although this is often determined culturally rather than biologically,

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