

Mehta, P. H., & Josephs, R. A. (in press). Testosterone. In R. Baumeister & K. D. Vohs (Eds.), *Encyclopedia of Social Psychology*. Thousand Oaks, CA: Sage.

## **Testosterone**

### **Definition and Summary**

Derived from cholesterol, testosterone is a steroid hormone that is responsible for the development and maintenance of masculine characteristics. Testosterone is secreted in large amounts by the testes (testicles) in males, and to a lesser extent, by the adrenal cortex and ovaries in females. Like all hormones, testosterone travels through the bloodstream and binds to other tissue in order to influence physiological activity. Testosterone belongs to a class of hormones called androgens, which are those steroid hormones that have masculinizing effects on individuals. Testosterone exerts its effects during three different life stages: the perinatal period (gestation and shortly after birth), puberty, and adulthood. Not only does testosterone influence the growth and development of masculine physical features, such as the penis and the beard, but testosterone is also related to a variety of social behaviors of interest to social psychologists, including aggression, power, sexual behavior, and social dominance. In addition, social experiences such as competition can cause testosterone levels to rise or fall.

### **Background and History**

The history of testosterone research dates back to ancient times, when farmers observed that castrated animals were more docile and had lower sex drives. Castrated humans showed similar behavioral changes. For example, eunuchs in Asia were employed as guards over harems because of their decreased sexual interest.

In 1849, German scientist Arnold Berthold conducted the first formal endocrinology experiment. It was already known that that

when chickens were castrated during development, they developed into docile capons instead of normal roosters. These capons refrained from fighting and failed to exhibit mating behavior. However, when Berthold implanted into the abdominal cavity of some of the castrated capons testes from other birds, they developed into normal roosters. Because the newly implanted testes were no longer connected to nerves, Berthold concluded that the testes must influence behavior by secreting a substance into the bloodstream.

In 1935, Dutch researchers identified a hormone from the testes, which they named testosterone, and later the same year, another group of researchers developed a method for synthesizing testosterone from cholesterol. Though the development of a method called radioimmunoassay in the 1960s, researchers were able to measure the amount of naturally occurring levels of testosterone circulating in the blood of individuals (called endogenous testosterone), and shortly after that, a technique was developed to measure testosterone levels in saliva. The ability to measure testosterone levels through saliva rather than blood has made it easier and more practical to conduct research in humans.

### **Perinatal Period**

During the perinatal period, testosterone release influences the development of the sexual organs, but animal studies show that greater perinatal testosterone release also masculinizes the nervous system and influences adult behaviors. The evidence in humans is less clear, but some studies have found an effect of perinatal testosterone exposure in females but not males. For example, perinatal testosterone exposure in females has been associated with masculine or feminine behaviors in early childhood,

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and in adulthood, perinatal testosterone has been linked to personality traits such as sensation seeking and neuroticism. More research on perinatal testosterone exposure is necessary, but the existing human evidence points to greater effects in females than in males.

### **Puberty**

Testosterone increases during puberty are related to the deepening of the voice, muscle growth, facial and body hair growth, and increased sex drive. There is also evidence in several animal species that testosterone elevations at the onset of puberty influence direct competitive behavior, including aggressive and dominant behavior, although the findings are less conclusive in humans.

### **Adulthood**

Across a number of animal species, higher testosterone concentrations in adult males seem to be associated with increased sex drive, and seasonal elevations in testosterone typically coincide with a greater frequency of reproductive behaviors. The few controlled studies that have been conducted in humans demonstrate that testosterone tends to increase sex drive and sexual behaviors among men with abnormally low levels of testosterone, but not among men who already have testosterone levels within the normal range.

Testosterone has also been associated with aggression and competition over food and mates in a number of animal species. Seasonal elevations in testosterone are associated with increases in aggression and mate competition. In humans, there also seems to be a small relationship between testosterone and aggression. For example, several studies of male and female prisoners have found that prisoners with higher

testosterone had conducted more violent crimes and tended to break more rules in prison.

Testosterone is also related to power and social dominance. In several animal species, higher testosterone is predictive of higher social status within status hierarchies. In humans, testosterone is associated with more masculine, dominant facial characteristics and with personality styles that align with power and dominance. In addition, high testosterone individuals are more reactive to and pay more attention to status threats, such as losing in a competition.

Testosterone levels fluctuate in both the short-term and the long-term. In humans, testosterone levels peak in the late teens to early twenties and decline slowly but steadily after that. Testosterone levels also change throughout the day - they are highest in the morning, decrease over the course of the day, and rise again in the evening. In a number of animal species, there are seasonal changes in testosterone, and testosterone levels are typically highest during the breeding season. Social experiences can also cause testosterone levels to change. In nonhuman animals and humans, winners of competitions tend to increase in testosterone, and losers tend to drop in testosterone. In addition, testosterone can increase in response to sexual stimuli, such as the presence of a female.

Most of the research on testosterone has focused on males, but more studies have begun examining females. Although females have only about one-seventh the testosterone levels as men, testosterone still seems to play a role. For example, research has found that higher testosterone females tend to smile less often, score higher on tests of social dominance, and are more vulnerable to stereotype threat.

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**See also:**

Hormones; Sex Drive; Aggression;  
Dominance

**Further Readings**

Archer, J. (in press). Testosterone and human aggression: an evaluation of the challenge hypothesis. *Neuroscience & Biobehavioral Reviews*.

Mazur, A., & Booth, A. (1998). Testosterone and dominance in men. *Behavioral & Brain Sciences*, 21, 353-397.