

Section 1: Hormones

• What are hormones?

Hormones are chemical messengers, which are secreted into the blood by ductless glands called endocrine glands. These hormones travel around the body where they stimulate target cells and tissues to respond. For example, growth hormone is produced by a gland beneath the brain called the pituitary gland. Growth hormone stimulates cells all over the body to divide and grow. Insulin is another hormone that instructs the liver and muscles to take up and store glucose from the blood. It is produced by a gland called the pancreas. There are lots of different hormones acting in the body – some have wide ranging effects like growth hormone, others are more specific like insulin. Some act very quickly, like adrenaline, whereas others act over longer time periods, like testosterone and oestrogen.



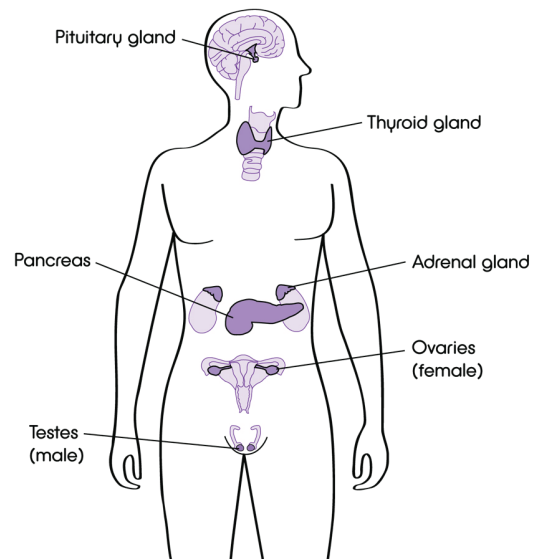
Hormones sometimes produce mood swings in teenagers

DIAGRAM 01:



Major Endocrine Organs

BIOLOGY • BEING HUMAN • HORMONES



Extension Question

Q1. How does the hormone system compare to the nervous system?

Because the hormone system involves chemicals travelling in the bloodstream it doesn't act so quickly. Nervous reactions can occur in fractions of a second, whereas hormones may take minutes or longer to take effect. Hormones, however, tend to have longer lasting effects in the body than nervous responses.

• Why do we need hormones?

Hormones help us respond to our environment and coordinate many of our bodily functions. Some, like adrenaline and cortisol, help the body to prepare and respond to stressful situations. Others, like the sex hormones, control the development of our bodies during puberty.

Extension Question

Q2. What happens if we produce too much or too little of a hormone?

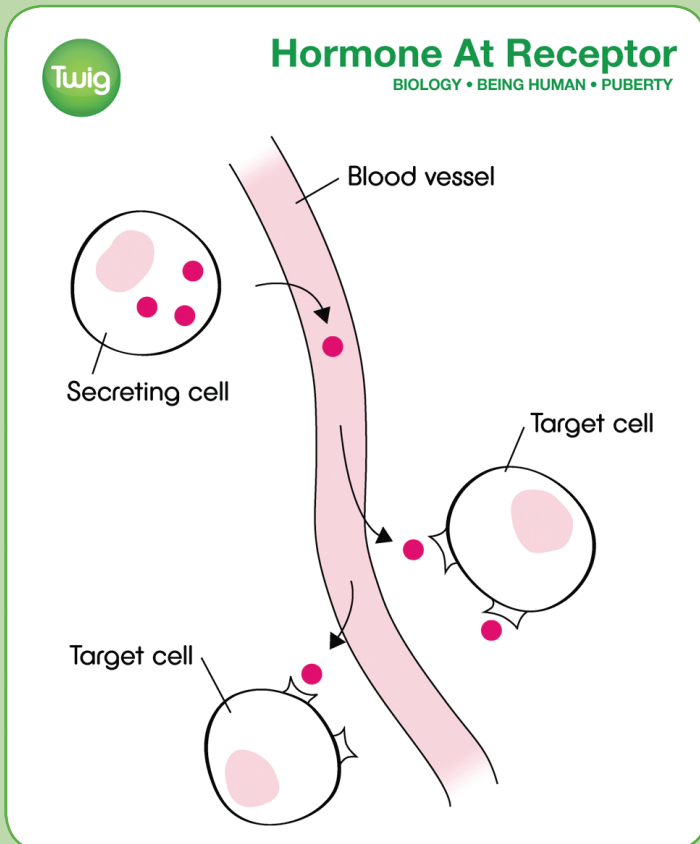
Producing the incorrect amount of a hormone can have dramatic effects on bodily function and in some cases lead to death. Diabetics don't produce sufficient insulin and so are not able to control the level of sugar in their blood unless they inject themselves with the hormone. Some of the tallest people who ever lived reached nearly 9 feet tall (2.7m) because they had a condition in which they overproduced growth hormone.

• Suggested Film

- Introduction to Hormones

• How do hormones work?

DIAGRAM 02:



Most hormones are proteins, though a few are steroids. They have specific structures and so can only bind to and stimulate those cells that have complimentary receptors. Once a hormone has bound to a target cell it will cause the cell to respond in some way. For example, it might cause the cell to divide or to produce another hormone.

Extension Question

Q3. What are the steroid hormones?

The steroid hormones include cortisol, testosterone, oestrogen and progesterone.

Section 2: Puberty

• What is puberty?

Puberty is the phase in the human life cycle when the child's body develops into the adult body, which is capable of reproduction. It happens in response to the sex hormones – testosterone in men and oestrogen in women. Although the onset of puberty varies between individuals, girls generally begin puberty earlier than boys. Girls show the first signs of puberty at about 11 years and boys at about 13 years.

Extension Question

Q4. What causes the levels of testosterone and oestrogen to rise?

Testosterone and oestrogen rise in response to other hormones, including Follicle-stimulating hormone (FSH) and Luteinising Hormone (LH), which are secreted by the pituitary gland beneath the brain. These pituitary hormones in turn are stimulated in response to a hormone released from the brain called gonadotropin releasing factor.

• Suggested Film

- Introduction to Puberty

• What are the effects of testosterone on the male body?

Testosterone is the male sex hormone. It is produced by the testes from puberty until death. At puberty, testosterone levels rise and cause the development of the male secondary sexual characteristics. The voice deepens, the penis grows, pubic hair appears, and the boy slowly turns to man. The body becomes more muscular and, in addition, sperm start to be produced.

Extension Question

Q5. What causes the voice to 'break'?

As a boy goes through puberty his voice box (the larynx) widens and thickens in response to the action of testosterone. The vocal cords inside the larynx lengthen and thicken so his voice gets deeper – a bit like a guitar string. During these changes a boy can't always control his vocal cords very well, so his voice can change pitch very dramatically at times!

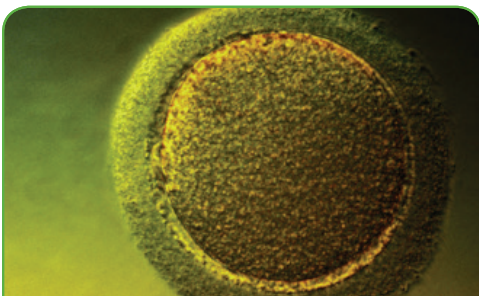


The hormone testosterone causes boys to grow facial hair

• Suggested Film

- Puberty in Boys

• What are the effects of oestrogen on the female body?



In girls, a signal from the pituitary gland causes an egg to be released every month

Oestrogen is the female sex hormone and it is produced by the ovaries. It causes the development of the secondary sexual characteristics in women. The breasts develop, pubic hair grows, and the female menstrual cycle begins. Eggs start to be produced every month and the menstruation begins.

• Suggested Film

- Puberty in Girls

Extension Question

Q6. What is menstruation?

Menstruation is the shedding of the lining of the female uterus, also known as a 'period'. This lining builds up during the first half of the menstrual cycle in preparation for a possible pregnancy. If the woman does not become pregnant the lining is shed at the end of the monthly cycle.

Section 3: The Teenage Brain

• Why do teenagers get spots?

The skin produces an oily secretion called sebum from a gland in the hair follicles. During puberty the increased production of sex hormones causes these glands to produce more sebum, which can become blocked in the hair follicles leading to infection by bacteria and inflammation of the surrounding tissue. This is what causes the spots, also known as acne.

• **Suggested Film**

- FactPack: Why Do Teens Get Spots?

Extension Question

Q7. How is acne treated?

Various strategies can help to reduce the occurrence of acne. Skin can be kept clean to minimise blockages of the pores, certain creams and lotions can be applied to reduce sebum production and reduce swelling. In some cases anti-bacterial compounds can also be used to kill bacteria.

• What causes teenage sleep patterns to change?



Melatonin affects a teenager's sleep pattern

During puberty it is not just the sex hormones which change their pattern of production. Other hormones, such as the sleep-inducing hormone melatonin, also change the way they are produced and this can change the sleep patterns of teenagers. Teenagers tend to stay up later at night and then sleep well into the morning. This is partly due to the fact that melatonin production is shifted back several hours in teenagers. So it's not entirely surprising that teenagers find it so hard to get out of bed in the morning!

Extension Question

Q8. What are anabolic steroids?

Anabolic steroids are chemicals which mimic the action of testosterone. Being chemically similar to testosterone they can bind to testosterone receptors on cells. As a result, they promote greater development of the male secondary sexual characteristics and in particular they enhance muscle growth, which is why body builders and athletes often use them as performance enhancing drugs.

- What happens to the teenage brain during puberty?

In response to the huge hormonal changes taking place, the teenage brain changes and develops dramatically. New connections and pathways are formed leading to new thoughts and behaviours. Interest in sex often increases and changes in mood and outlook can often be observed. A teenager certainly sees the world and behaves in a very different way to the child it used to be and to the adult it is going to become.

- Suggested Film

- Developing Brain: Teenage Brain

Extension Question

Q9. What is neuroplasticity?

Neuroplasticity is the ability of the brain to change and develop new connections and pathways in response to experience. Scientists used to think that little change was possible in the brain after the early years of childhood, but more recent findings suggest that the brain is far more malleable and therefore changeable than previously thought. Fundamentally, this explains why people, including teenagers, can change and learn throughout their lives.

• Quizzes

Introduction to Puberty

Basic

• What is puberty?

- A – the type of hair growing in the armpits
- B – a period of growing up
- C – the phase between childhood and adulthood
- D – the phase of development of the sexual organs to allow for reproduction

• What is the name of the male sex hormone?

- A – oestrogen
- B – adrenaline
- C – testosterone
- D – insulin

• What is the name of the female sex hormone?

- A – oestrogen
- B – adrenaline
- C – testosterone
- D – insulin

Advanced

• What is puberty?

- A – the type of hair growing in the armpits
- B – a period of growing up
- C – the phase between childhood and adulthood
- D – the phase of development of the sexual organs to allow for reproduction

• What is the region of the brain which controls puberty?

- A – cerebrum
- B – cerebellum
- C – ovary
- D – hypothalamus

- A – oestrogen
- B – testosterone
- C – gonadotrophin-releasing hormone
- D – follicle-stimulating hormone

• What are secondary sexual characteristics?

- A – the sex organs you are born with
- B – the bodily features which develop during puberty
- C – the behaviours of an adolescent
- D – whether a person is male or female

Puberty in Boys

Basic

- What is the typical age of puberty in boys?

A – 9 to 11
B – 11 to 13
C – 12 to 15
D – 15 to 17

- What is the name of the male sex hormone?

A – oestrogen
B – adrenaline
C – testosterone
D – insulin

- What organ produces sperm in males?

A – testes
B – penis
C – scrotum
D – bladder

Advanced

- What is the name of the male sex hormone?

A – oestrogen
B – adrenaline
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- Which of the following is a male secondary sexual characteristic?

A – a penis
B – the growth of pubic hair
C – the testes
D – the widening of the hips

- What do the sebaceous glands produce?

A – pubic hair
B – sperm
C – testosterone
D – sebum

Puberty in Girls

Basic

• What is the typical age of puberty in girls?

- A – 8 to 11
- B – 11 to 14
- C – 14 to 17
- D – 17 to 20

• What is the name of the female sex hormone?

- A – oestrogen
- B – adrenaline
- C – testosterone
- D – insulin

• What organ produces eggs?

- A – pituitary gland
- B – uterus
- C – ovary
- D – hypothalamus

• How often does menstruation occur if a woman is not pregnant?

- A – every week
- B – every fortnight
- C – every month
- D – every year

Advanced

• What organ produces oestrogen?

- A – pituitary gland
- B – uterus
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• What is the name of the hormone that stimulates egg production?

- A – oestrogen
- B – testosterone
- C – progesterone
- D – follicle-stimulating hormone

• What organ transfers the egg from ovary to uterus?

- A – the pituitary gland
- B – the pelvis
- C – the fallopian tube
- D – the vagina

• Which of the following is a female secondary sexual characteristic?

- A – a uterus
- B – the ovary
- C – the deepening of the voice
- D – the widening of the hips

• Answers

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