HL IB Psychology

Hormones & Pheromones

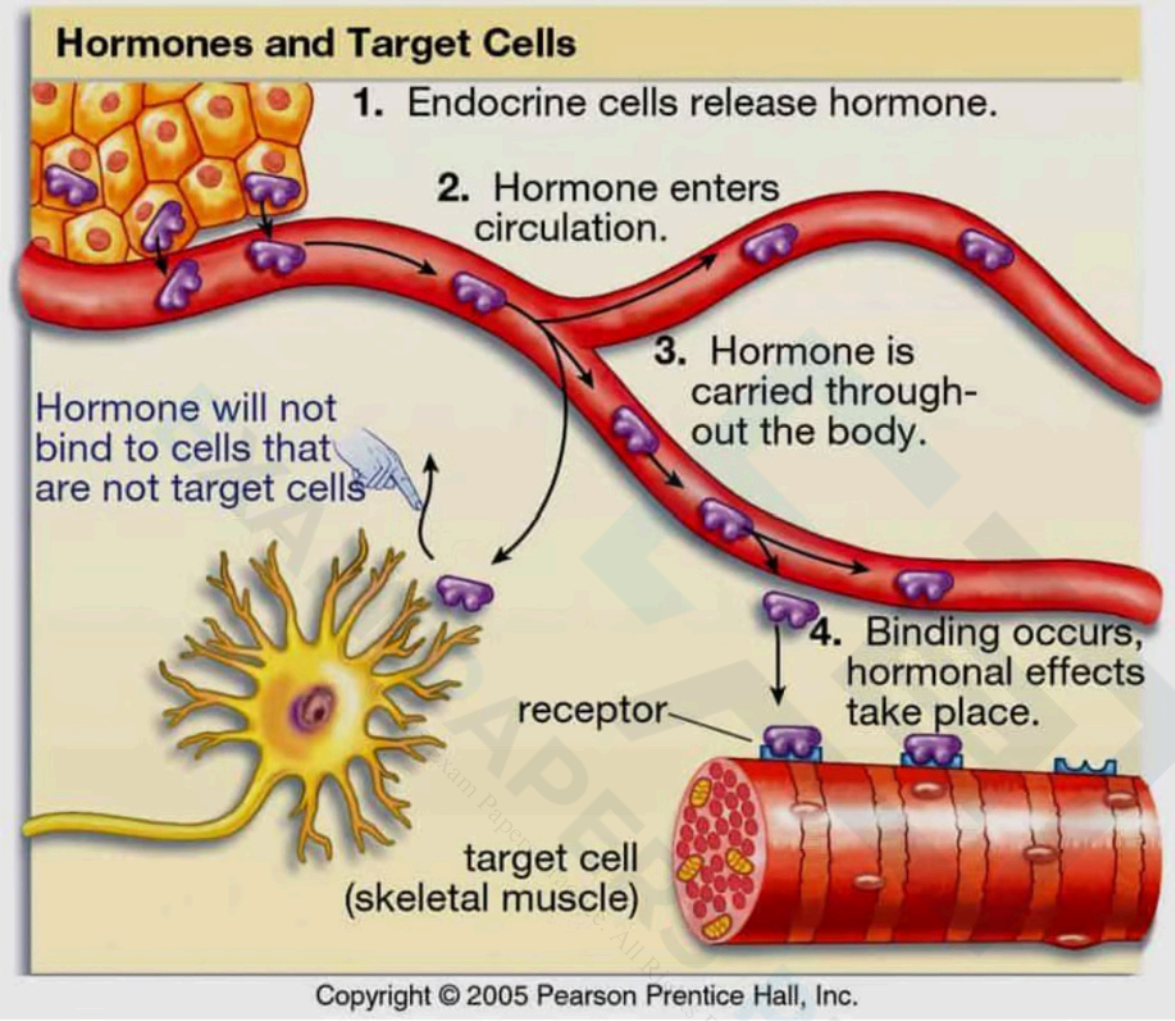
Contents

What are Hormones?

Hormones & Their Effect on Behaviour – What are hormones?

What is a hormone?

- A **hormone** is a chemical that is secreted by the **endocrine glands** into the blood stream which then distributes it around the body
- The major endocrine gland is the **pituitary gland** which regulates the secretion of all hormones
- Hormones act slowly (unlike **neurotransmitters** which act fast) and may take years to fully have an effect: e.g. puberty involves the slow release of **testosterone** (males) **oestrogen** (females)
    - *Testosterone and oestrogen are, respectively, the male and female sex hormones which control **primary** and **secondary sexual characteristics***
    - *Testosterone and oestrogen also regulate key milestones such as puberty, sperm production (testosterone), the **menstrual cycle** and **menopause** (oestrogen)*
- The major gland which regulates hormones is the **pituitary gland**, located at the base of the **hypothalamus**
- Hormones will have different effects on the body and on behaviour, depending on the nature of the hormone itself: e.g. **cortisol** is known as the **stress hormone** as it is secreted during times of stress/**anxiety; melatonin** regulates the **sleep-wake cycle**



Hormones list

Secreted by the pituitary gland:

- **Adrenocorticotropic Hormone (ACTH)**
- **Follicle-stimulating hormone**
- **Growth hormone**
- **Luteinising hormone**
- **Oxytocin**
- **Prolactin**

- **Thyroid-stimulating hormone**
- **Vasopressin**

Secreted by other glands under the control of the pituitary gland:

- **Melatonin**
- **Thyroxine**
- **Calcitonin**
- **Parathryoid**
- **Cortisol**
- **Aldosterone**
- **Adrenaline and noradrenaline**
- **Insulin**
- **Glucagon**
- **Oestrogen**
- **Testosterone**
- **Progesterone**
- **Thymosin**

Hormones: What is Testosterone?

Hormones & Their Effect on Behaviour – Testosterone

What is a hormone?

- A **hormone** is a chemical that is secreted by the **endocrine glands** into the blood stream which then distributes it around the body
- Hormones act slowly (unlike **neurotransmitters** which are fast) and may take years to fully have an effect e.g. puberty occurs over several years
- The major gland which regulates hormones is the **pituitary gland**, located at the base of the **hypothalamus**
- Hormones will have different effects on the body and on behaviour, depending on the nature of the hormone itself e.g. **cortisol** regulates the **stress response; melatonin** regulates the **sleep-wake cycle**

What is testosterone?

- **Testosterone** is the key **male sex hormone** that regulates fertility, muscle mass, fat distribution and red blood cell production
- Testosterone levels rise during puberty when males begin to show **secondary sexual characteristics** e.g. bodily hair, deepening of the voice
- Females produce testosterone but in much smaller volumes than males
- Testosterone has been linked to behaviours such as **aggression** and competitiveness
- Some research shows that males in prison for violent offences have higher levels of testosterone than male prisoners convicted of non-violent crimes

Which studies investigate the effect of testosterone on behaviour?

- **Zak et al. (2009) –** a **lab experiment** to investigate whether testosterone makes people less generous and less **prosocial** towards strangers
- **Armstrong et al. (2022)** – increased testosterone levels may lead to impulsive and violent criminal behaviour

The study by Zak et al. (2009) can be found in Two Key Studies of Hormones on this site: just navigate the Hormones & Pheromones topic to find it.

Hormones: What is Oxytocin?

What is a hormone?

- A **hormone** is a chemical that is secreted by the **endocrine glands** into the bloodstream which then distributes it around the body
- Hormones act slowly (unlike **neurotransmitters** which are fast) and may take years to fully have an effect - e.g. puberty occurs over several years
- The major gland which regulates hormones is the **pituitary gland**, located at the base of the **hypothalamus**
- Hormones will have different effects on the body and on behaviour, depending on the nature of the hormone itself - e.g. **cortisol** regulates the **stress response**; **melatonin** regulates the **sleep-wake cycle**

What is oxytocin?

- **Oxytocin** is popularly known as the 'cuddle hormone' as it is associated with feelings of trust, bonding and security
  Oxytocin is made in the hypothalamus at the top of the **brain stem**
- Oxytocin is secreted during **childbirth** and breastfeeding and is thought to be an **evolutionary** mechanism allowing mother and baby to bond
- Some research shows that oxytocin can be released as a result of touch, music or exercise

Which studies investigate the effect of oxytocin on behaviour?

- **Morhenn et al. (2008)** – a **lab experiment** to investigate the relationship between oxytocin, massage and sacrifice
- **Scheele et al. (2012)** – oxytocin may increase the distance maintained between people in a **monogamous** relationship and an attractive stranger

The study by Morhenn et al. (2008) can be found in Two Key Studies of Hormones on this site: just navigate the Hormones & Pheromones topic to find it.

What are Pheromones?

What is a pheromone?

- A **pheromone** is a chemical that is secreted by glands to act outside of the body, unlike **hormones** which are secreted internally from the **endocrine glands** into the bloodstream
- The first research on pheromones was conducted on animals and there is compelling evidence to show that animals use pheromones for the purposes of **mate selection** and **territoriality**
- Pheromones communicate their signals to members of the same species i.e. they are **conspecific**

Do pheromones exist in humans?

- Mammals use the **vomeronasal sensory organ (VNO)** to detect pheromones
- The VNO is a collection of **neurons** deep within the nose that transmit signals via the **accessory olfactory bulb** to the **hypothalamus**
- To date there is no real evidence to show that the VNO or the accessory olfactory bulb exist in humans though both of these are present in the **developing foetus** up to 18 weeks of **gestation**
- There may be some **validity** that a 'pheromone nerve' exists in humans: this is known as **cranial nerve 0 (CN0)** or the **terminal nerve**
- Cranial nerve 0 is a pair of nerves that run from the nose directly into the brain in front of **cranial nerve 1**, the **olfactory nerve** ('olfactory' relates to the sense of smell)
- Research into human pheromones have investigated the effect of **androstadienone (AND)** which signals maleness and **estratetraenol (EST)** which signals femaleness: both of these substances are **steroidal hormones**
- Males and homosexual women should be attracted by EST; women and homosexual men should be attracted by AND

Which studies investigate the effect of pheromones on behaviour?

- **Zhou et al. (2014)** – a **lab experiment** in which AND and EST were used to investigate the influence of potential human pheromones on gender perception
- **Hare et al. (2017)** – a lab experiment which investigated the effect of AND and EST on gender perception

The studies by Zhou et al. (2014) and Hare et al. (2017) can be found in 'Two Key Studies of Pheromones' on this site: just navigate the Hormones & Pheromones topic to find it.

Worked Example

ERQ (Extended Response Question) – 22 marks

Discuss the effect of hormones or pheromones on human behaviour. [22]

The following two paragraphs are part of a discussion on the procedure used in Zhou et al.'s (2014) study.

Zhou et al. controlled for the potentially confounding variable of sexual preference in their research on the effect of pheromones as the sample included both heterosexual and homosexual participants. As the study looked at gender recognition linked to AND or EST, it depended on the sexual orientation of the sample (e.g. gay men and straight women should be stimulated by AND) so the inclusion of both straight and gay participants helps to ensure the validity of the responses.

However, appraising gender via the analysis of a light-point figure is an ambiguous task which may have resulted in participants guessing or making arbitrary decisions. Some of the light-point figures may have looked neither male nor female to the participants so it would then be down to personal preference as to which gender was selected. If this happened, then the decision as to gender would have nothing to do with AND or EST which would mean that the study lacked internal validity i.e. it was not measuring what it set out to measure.

Two Key Studies of Hormones & Their Effect on Behaviour: Morhenn et al. (2008) & Zak et al. (2009)

Key Study (Testosterone): Zak et al. (2009)

Aim: To investigate the role played by **testosterone** in **prosocial** behaviour.

Participants: 25 males (mean age = 20.8 years) of whom 44% were Asian; 36% were Caucasian; 8% were Hispanic and 12% were of other ethnicities.

Procedure: A **double-blind** procedure with an **independent variable** of **two conditions**: half of the participants received testosterone in gel form (**Androgel**) while the other half of the participants were given a **placebo**. Testosterone levels were measured via **blood samples** during the **experimental phase**. The participants took part in the Ultimate Game (UG), a **decision-making** task borrowed from economic theory involving making decisions as to whether to donate money.

Results: The participants in the Androgel condition (i.e. heightened testosterone levels) donated 27% less money than their first, pre-experiment **baseline** measurement suggested. The testosterone group were also more likely to agree to share money compared to their own baseline measurements.

Conclusion: Men with heightened testosterone levels may exhibit less prosocial behaviour than those with lower testosterone levels.

Evaluation of Zak et al. (2009)

Strengths

- The study sheds some light on a possible link between heightened testosterone and lack of prosocial behaviour which could be used to inform **therapies** for men who may struggle with aggressive or anti-social behaviour
- The use of **objective measures** such as the blood samples increases the **reliability** and scientific nature of the findings

Limitations

- It is difficult to determine the extent of the males' pre-existing and post-experiment prosocial tendencies as the researchers used a **snapshot** design rather than a **longitudinal** design
- Agreeing to donate or share money in an **artificial** environment and task such as in this study reduces the **ecological validity** of the study - would this be the same result if it were to be tested as a **field experiment**? Might other variables affect whether they donate?

Key terms:

- **Testosterone**
- **Androgel**
- **Prosocial behaviour**

Key Study (Oxytocin): Morhenn et al. (2008)

Aim: To investigate the relationship between oxytocin, massage, and monetary sacrifice.

Participants: 96 students (mean age = 22.3 years, 53% female, 47% male) who were **randomly allocated** to one of three conditions:

- The Massage and Trust group (MT) – the participants received a 15–minute back massage followed by a trust game in which each participant was a decision-maker and had to decide whether to match the donations made by another player (each had been given $10) which was measured as monetary sacrifice made per participant
- The Rest and Trust group (RT) – the participants were asked to rest for 15 minutes and then to play the trust game as described above
- The Massage-only group (M) – the participants received a 15–minute massage

The participants' blood was sampled before and after the procedure to compare the pre-experiment and post-experiment oxytocin levels.

Results: The MT group showed the biggest increase in oxytocin levels (16%) than the RT group. The MT group also sacrificed 243% more money than the RT group with women showing higher levels of oxytocin and more monetary sacrifice overall than men. The M group showed no difference in oxytocin levels, possibly because they were not asked to engage in a trust game i.e. the massage alone was not enough to increase oxytocin. The RT group showed decreased oxytocin levels compared to the other two groups.

Conclusion: Massage followed by a trust game appears not only to increase oxytocin levels but also to **predict** the direction of monetary sacrifice i.e. increasing oxytocin levels is matched by increasing monetary sacrifice.

Evaluation of Morhenn et al. (2008)

Strengths

- Using the M condition as a **control group** ensured that the researchers were able to demonstrate that the combination of touch and trust raised oxytocin and resulted in monetary sacrifice
- Using **objective measures** such as MRS increases the reliability and scientific nature of the findings

Limitations

- Attempting to **operationalise** trust in an artificial game is beset with difficulty as this is a variable which is subjective and may fluctuate according to mood or situation
- The study was conducted in an **individualistic** culture and it could be that a **collectivist** culture would view trust differently

Key terms:

- **Oxytocin**
- **Trust**
- **Sacrifice**

Worked Example

Extended Response Question – 22 marks

Evaluate research into the effect of hormones or pheromones on behaviour. [22]

In an 'Evaluate' ERQ, you need to make sure that you weigh up the strengths and limitations of either a theory, an explanation or research (which can include theories as well as studies). Here are two paragraphs to give you an idea of how to do this:

One strength of Morhenn et al. (2008) is that the participants were randomly allocated to condition (MT, RT, or M) which increases the reliability of the study as it is a control put in place to ensure lack of bias in participant-condition selection. However, a limitation of random allocation to condition is that it is always possible that participants who possess similar qualities or characteristics may end up in the same group. In the case of Morhenn et al. (2008) it could be that participants who were already predisposed to having higher levels of oxytocin and trust were allocated to the MT group. This is a limitation as it impairs the internal validity of the study as the researcher cannot then be confident that the IV has truly affected the DV.

Another strength of the procedure is that both the MT and the M groups were massaged for the same length of time which is a control that ensures that neither group received more massage time than the other. This increases the reliability of the study as it is a standardised procedure which can then be replicated to test for reliability. However, the actual massage itself could not be exactly replicated per participant, even if the same massage technique was used each time. Some participants may have received a slightly softer or more robust massage than others and it is possible that the massage therapist may have become tired as the procedure went on. This is a limitation as it would reduce the reliability.

Two Key Studies of Pheromones & Their Effect on Behaviour: Zhou et al. (2014) & Hare et al. (2017)

Key Study: Zhou et al. (2014)

Aim: To investigate the idea that **androstadienone (AND)** and **estratetraenol (EST)** may function as human pheromones in terms of sexual attraction.

Participants: 24 adult **heterosexual** males; 24 adult heterosexual females; 24 adult **homosexual** males and 24 adult **bisexual** or homosexual females.

Procedure: The participants were exposed to either AND, EST or a **placebo** over the course of three days of testing (this was done via mixing the AND or EST with cloves in a jar which the participants then smelt).
The participants watched a series of figures walking, using dots of lights at specific points on the figure e.g. the head, the pelvis. This was a virtual rendering of the action of the human body in motion with no gender markers on the figures i.e. they were presented as neither male nor female. They were shown each point-light walking figure for 0.5 seconds and then they had to say whether the figure was male or female.

Results: Heterosexual males made more judgments that the walker was female when they had been exposed to EST; heterosexual females made more judgments that the walker was male when they had been exposed to AND; homosexual males made more judgments that the walker was male when exposed to AND.
In essence, heterosexual females and homosexual males showed a similar pattern of results, attributing maleness to figures when they had been exposed to AND. The findings for bisexual or homosexual females were less clear-cut and did not point to any definite conclusion.

Conclusion: Pheromones may be linked to how males and females perceive gender according to their own sexual orientation.

Evaluation of Zhou et al. (2014)

Strengths

- The researchers used a **standardised procedure** e.g. the same point-light figures were viewed across the **conditions** which ensures a **reliable** measure of **control**
- Using point-light figures rather than photographs of real human beings helps to eliminate the possible **confounding variable** of **individual differences** regarding who/what is attractive

Limitations

- The use of synthetic AND and EST does not reflect how these steroids are secreted in real-life situations which impairs the **external validity** of the study

- The task lacks **ecological validity** as it was artificial in nature and does not consider other **variables** that may result in judgements pertaining to masculinity or femininity

Key terms:

- **AND**
- **EST**
- **Point-light figure**

Key Study: Hare et al. (2017)

Aim: To investigate whether AND and EST play a role in the **perception** of gender and level of attractiveness of the opposite sex.

Participants: 94 (51 female; 43 male) white, heterosexual adults (mean age = 24 years) from the University of Western Australia.

Procedure: The participants took part in two tasks on a computer while being exposed to the scent of either AND or EST via a cotton ball taped underneath their nose. In the **experimental condition** the scent was disguised with clove oil. In the **control condition** only clove oil was applied to the cotton ball.
This study used a **repeated measures**, **double-blind** design and employed **counterbalancing** i.e. half of the participants experienced the experimental condition followed by the control condition and the other half experienced the control condition followed by the experimental condition.

For task 1, the participants were shown 5 images of **morphed** gender-neutral faces (the blending male and female faces together) and were asked to identify the gender of each face. For task 2 the participants were shown opposite-sex faces (all **Caucasian**, with only the hairline and face showing). They were asked to rate the level of attractiveness of each photo and the likelihood of each person shown being unfaithful using a **rating scale** from 1–10 (10 indicating a high level of attraction and a strong likelihood that the person would be unfaithful).

Results: The research was inconclusive: the researchers found no evidence that AND or EST affected gender perception or attractiveness rating or unfaithfulness rating.

Conclusion: AND and EST may not function as human pheromones.

Evaluation of Hare et al. (2017)

Strengths

- This use of a repeated measures design increases the **validity** of the findings as it involves each participant being compared with their own performance across conditions
- The use of morphed gender faces helps to ensure that no gender markers were present to influence the decision-making of the participants

Limitations

- Providing a rating of morphed faces shown on a computer is not something that people routinely do as part of everyday life, which makes the study low in **external validity**.
- Using only images of Caucasian faces is a source of **bias** in the study as some of the participants may be more attracted to people who are not of white **ethnic** origin

Key terms:

- **AND**
- **EST**
- **Counterbalancing**