

Teaching Guide

Chapter 3: The biological approach to understanding human behaviour

Topic map

Section number and name	Learning outcome	Number of hours (suggested)	Relevant material
3.1 Overview of the biological approach to understanding human behaviour	Behaviour is strongly influenced by the workings of the individual's genes, nervous system and endocrine system.	4	Figures 3.1–3.2 Activity 3.1 Short-answer question at the end of the chapter
3.2 The brain and behaviour	<p>There is an increasing range of effective non-invasive brain scanning methods of studying the workings of the individual brain.</p> <p>Though brain functions tend to be localised, neural networks link them together. Networks can develop or atrophy with age, in response to environmental stimulus and after injury.</p> <p>Neurotransmitters coordinate to promote a wide and complex range of human behaviours, through the nervous system.</p>	6	Figures 3.3–3.10 Activity 3.2 Activity 3.3
3.3 Hormones and their effect on human behaviour	Hormones coordinate to promote a wide and complex range of human behaviours, through the blood system.	4	Figures 3.11–3.12 Self-assessment questions 3.1

3.4 Genetics and human behaviour	<p>Genes appear to influence behaviour. However, the relative importance of genotype and environmental factors on behaviour needs critical evaluation.</p> <p>As genes appear to code for behavioural as well as physical traits, behaviour would also be subject to the same evolutionary pressures as physical traits.</p>	6	<p>Figure 3.13–3.14</p> <p>Table 3.1</p> <p>Activity 3.4</p> <p>Self-assessment questions 3.2</p>
3.5 The value of animal models in psychology research (HL only)	<p>The case for using animal research for understanding human behaviour on the grounds of their biological similarities to humans has to be balanced with critical analysis of their differences with humans, and also ethical considerations.</p>	10	<p>Figures 3.15–3.16</p> <p>Self-assessment questions 3.3</p>

3.1 Overview of the biological approach to understanding human behaviour

Overview

Students should understand that this approach emphasises that behaviour is strongly, though by no means exclusively, influenced by the workings of the individual's brain, nervous system and endocrine system. These in turn have genetic inputs that may or may not be expressed in particular behaviours.

Students should also bear in mind that quantitative research using the biological approach tends to yield data sets that may correlate with one another, judging the extent that observed behaviours show a relationship with scientifically defined and observed biological phenomena such as is found in brain scanning. Often the numbers involved in such studies are small, owing to the time and expense involved.

It is important to emphasise that despite advances in brain scanning techniques, animals continue to be used in research, their findings being applied to humans with various degrees of caution.

Through their studies in biology or sports science, some students may already be familiar with the workings of the nervous and endocrine systems as well as the concepts and terminology of genetics. Though useful, you may need to remind them that psychology considers how these elements influence human behaviour, and how they help the individual to adapt and evolve socially as well as physically to different environments.

Suggested activities

Possible starters

- You could open this area of study with, for example, Sarah-Jayne Blakemore's [The mysterious workings of the adolescent brain](#). This can lead to a lively discussion on why, for example, young men aged 17 to 26 are proportionally over-represented in road accidents and crime convictions. Students could research a particular scenario of criminal conviction and explain how it may be understood in the light of the biological principles explained in the Blakemore presentation.
- See also the brainstorming starter activity for *Section 5.1* of this Teaching Guide; you may prefer to use it at this stage of the course instead.

Main lesson content

- You can introduce the genetics element in the course with the Jim twins, using the Newsflash and Activity 3.1 in the coursebook. There is a supportive video, [Robert Winston – The Jim twins](#), available on YouTube.
- Does heading footballs cause brain damage? A very short video, [Heading a football may not be good for the brain](#), featuring an American–UK joint study, briefly examines how this sport can affect the players' thinking capacities. After viewing, students can debate the motion: No playing football for three months before the IB final exams.
- The research methods and ethical principles outlined in Chapter 2 should be reinforced, and at the same time you can introduce concepts specific to the biological approach. These include brain scanning, genome studies and the use of animal models in research.

Common misunderstandings and misconceptions

The fact that certain behaviour patterns are supported by the individual's genotype does not necessarily mean that they *will* occur. However, particular environmental pressures may well increase the *likeliness* of their happening.

Supporting your students

The ideas above are reinforced in the next sections. This should support students who need some extra time to sharpen their grasp of the basic concepts as they proceed through the material.

Challenging your students

Students can research the debate on whether playing football (or any similar sport) is likely to do lasting damage to thinking and memory capabilities.

Homework suggestion

- This could be an opportunity to develop short-answer question response skills, either as a homework assignment or as a homework-prepared item to be written up under exam conditions in the classroom. A possible question is 'Explain the use of one research method in one study using the biological approach to understanding human behaviour.'

Cross-references with other topics

2.2 Quantitative research methods in psychology

2.3 Qualitative research methods in psychology

2.5 Ethical considerations

3.2 The brain and behaviour

Overview

This extensive topic includes two main areas of inquiry: the ways in which the workings of both brain and neurotransmitters influence behaviour. Rapid progress is being made in researching both fields, promoting greater understanding of biological influences in the cognitive processes examined in Chapter 4.

Suggested activities

Possible starter

The students are likely to have heard of what are popularly called left-brained logical people and right-brained creative people. Elizabeth Waters discusses this common belief in [The left brain vs right brain myth](#). The 'Dig Deeper' section contains some useful follow-up material.

Main lesson content

- Students should understand that methods of investigating the brain's roles in behaviour use data from two main sources: firstly, from brain injuries and, secondly, from electronic brain scanning, which enables researchers to see the images of the soft tissue inside the skull while the person is alive. Activity 3.2 and the Research Idea in the coursebook should help the student to place the landmark studies of the brain in an ongoing developmental framework.
- Harris and Fiske (2006) in the coursebook is just one example of an fMRI-based study. You may consider adding additional research using similar technology, such as the research of Baumgartner et al. (2008) on the functions of the hormone oxytocin.
- The working of neurotransmitters is well presented in the very short introductory video: [What are neurotransmitters and what do they do in the body?](#) The information is comprehensive; you may wish to show it more than once. There is a more detailed explanation by Charles Schallhorn on YouTube called [Neurotransmitters overview](#).
- Under the respective titles of [Getting to know your brain](#) and [The chemical mind](#), Crash Course Psychology produces lively, comprehensive but intense presentations of both the workings of the brain and the nervous and endocrine systems. These studies both review and complement the course content for this topic.
- The concept of neuroplasticity as a way that the brain reorganises itself in response to experiences is explored in [After watching this, your brain will not be the same](#) by Lara Boyd and [My stroke of insight](#) by Jill Bolte Taylor. Both complement the work of Sarah-Jayne Blakemore on the adolescent brain in *Section 3.1*. Students may be able to bring experiences of their own or others to illustrate the way they have reorganised their own brains, such as learning a musical instrument or advanced gymnastic achievements. It can lead to a discussion on whether we can do whatever we choose to do if we have the motivation.

Common misunderstandings and misconceptions

- It is important to stress that the use of brain scanning at the present time does not necessarily invalidate the contribution of pioneer studies such as Milner and Klein (2015) on HM (Henry Molaison, 1926-2008) and Sperry (1968) on the effect of severing the corpus callosum that connects the left and right brain hemispheres as a treatment for epilepsy.
- Short-answer questions on brain function localisation requiring reference to a research study should consider Harris and Fiske (2006) or Milner and Klein (2015), rather than the case study of Phineas Gage.
- Ensure that students do not confuse neurotransmitters with hormones. Bear in mind that some biochemical substances such as oxytocin serve as both neurotransmitters and hormones. Students writing about such a substance in an examination must be clear on whether they are writing about its function as a hormone or as a neurotransmitter.
- Detailed studies of neural transmission mechanisms are not required, as long as students know that nerve impulses travel along a neuron until they reach a synapse, and that various neurotransmitters cross the synapse from neuron to neuron, fitting into the destination neuron as a key into a lock, and may also be reused in the re-uptake process.

Supporting your students

- Some students might find this topic confusing and difficult. The material can be broken down so that it covers no more than the minimum conceptual framework required by the syllabus. Present them with diagrams of the brain that illustrate the regions under study only, rather than complex, comprehensive diagrams mapping the whole brain. With such students, a series of point-specific simple diagrams rather than a single complex one should be more effective. In addition, stress the psychological functions of those brain regions rather than the complex biological workings of the brain.
- Use analogies where possible, such as the lock and key model for explaining neurotransmitters, as in the video resources above.

Challenging your students

There are more complex studies on the working of neurotransmitters, such as the experimental study of Rogers and Kesner (2003) using rats. This study focuses on the role of the neurotransmitter acetylcholine in the formation of memories. In addition, it applies the biological approach to the cognitive function of memory, as does Sharot et al. (2007) in Chapter 4. Rogers and Kesner (2003) also serves HL students with an example of the use of an animal model in researching human behaviour. This study is well reviewed on the [IB Psychology InThinking](#) website. The students can summarise this research under (a) the aim, design and method of the experiment, identifying the dependent and independent variables, (b) the results and conclusions in terms of the effects of neurotransmitters on the cognitive function of memory, (c) the strengths and limitations of using rats, and (d) the ethics of the study.

Homework suggestions

- Activity 3.2 and the Research Idea in the coursebook should help students to obtain a developmental perspective of our knowledge of the workings of the brain. In addition, students could try to list five things that we do not yet know about brain functioning (such as identifying precise thoughts in the brain), and display them suitably beyond the end of the Research Idea's timeline. More advanced students can incorporate the research under 'Challenging your students', above.

Cross-references with other topics

- 2.5 Ethical considerations
- 3.5 The value of animal models in psychology research (HL only)
- 4.2 Cognitive processing: memory, schema theory, and thinking and decision-making processes
- 4.4 Emotion and cognition
- 10.1 Introduction to research methods in psychology
- 10.2 Elements of researching behaviour

3.3 Hormones and their effect on human behaviour

Overview

This topic explores the ways in which the endocrine system influences human behaviour. Hormones coordinate to promote a wide and complex range of human behaviours, through the blood system.

Suggested activities

Possible starter

The TED Talk by Dawn Maslar, [How your brain falls in love](#), combines roles of neurotransmitters of the last topic with the hormones of this topic. It introduces the biology of love and should present the roles of oxytocin and testosterone as an opener to the main content below.

Main lesson content

- The experimental study of Baumgartner et al. (2008) that shows the effect of the hormone oxytocin on human behaviour may be supplemented by Paul Zak's TED talk, [Trust, morality – and oxytocin](#).
- Under the title of [How hormones work](#), Hank Green of Crash Course gives an engaging 12-minute presentation of what hormones are and how they work. Though biological in orientation, much of the talk focuses on human behaviours and should be of particular interest to students studying psychology with biology. Although recommended for more advanced students, note that the detailed biology of the composition and working of hormones found in this TED talk is beyond the scope of this course.
- Do we exude smell molecules that sexually excite other people? Oxford zoologist Tristram Wyatt does not reject the possible existence of human pheromones that send out such signals, but does expose the flaws in much of the research on this currently controversial topic – see [The smelly mystery of the human pheromone](#). This TED talk could promote some lively discussions, especially among those who have used products claiming to have these effects.

Common misunderstandings and misconceptions

Though the speculation that humans exude pheromones has attracted considerable public interest and the marketing of products claiming to include such substances, there is currently neither conclusive support for the existence of human pheromones, nor evidence that individuals affect the behaviour of other humans by such physiological processes.

Supporting your students

As with *Section 3.2*, some students are unlikely to find the intricacies of this topic to be straightforward. As with the brain and behaviour, the influence of hormones can be broken down so that it covers no more than the minimum conceptual framework required by the syllabus. Present them with diagrams of the endocrine system (hypothalamus, pituitary gland, glands secreting hormones) that illustrate the hormones under study only, rather than complex, comprehensive presentations mapping the full endocrine system. In addition, stress the psychological functions of hormones rather than their complex biological workings.

Challenging your students

The critical thinking exercise in the coursebook should encourage students to research and critically assess the effects of oxytocin on human behaviour.

Homework suggestions

- Zak et al. (2009) is another reasonably straightforward study on the working of hormones, and examines the influence of testosterone on anti-social behaviour. In contrast to oxytocin, raised testosterone levels are associated with a rise in distrust and selfish behaviour. This study is well summarised on the [IB Psychology InThinking](#) website. Students can summarise this research under (a) the aim, design and method of the study, (b) the results and conclusions in terms of the effects of testosterone on aggression, (c) what the study indicates about the functions of hormones in human behaviour, (d) the strengths and limitations of the study, and (e) the ethics of the study.

Cross-references with other topics

3.2 The brain and behaviour

7.2 Interpersonal relationships

3.4 Genetics and behaviour

Overview

Genes appear to influence behaviour. However, the relative importance of genotype and environmental factors on behaviour needs critical evaluation.

As genes appear to code for behavioural as well as physical traits, behaviour would be subject to the same evolutionary pressures as physical traits.

Suggested activities

Possible starter

Activity 3.4 in the coursebook on male fears about dating can promote an interesting discussion on whether some of our fears and cognitions appear to be genetically influenced. The question posed by the activity can be revisited later in this topic, after considering the possible evidence for the role of genes in evolutionary processes.

Main lesson content

- The coursebook aims to present this topic comprehensively as it is a less widely covered area by syllabi at this level. The longitudinal Minnesota study (Bouchard et al., 1990) using concordance rates is still of value, even though it essentially predates the human genome project.
- You can use Caspi et al. (2003) in the coursebook for presenting how genetic variations may affect behaviour patterns. This study is particularly recommended as it illustrates the strengths and limitations of using quantitative studies to demonstrate the association of genotype and behaviours. It is also relevant to the abnormal psychology elective which considers the aetiology of major depression. The same applies to Scott-Van Zeeland et al. (2014) in the coursebook.
- Students almost invariably enjoy the dirty shirt study of Wedekind et al. (1995) in the coursebook. This can lead to an interesting discussion under the heading: 'Are we attracted to people completely unlike ourselves?' It can incorporate the idea of possible genetic support for interest in partners completely unlike us. Some students may wish to go further and consider how far such relationships may enjoy long-term success.
- You can bring an additional dimension to behavioural genetics through Dean Ornish's short TED talk, [Your genes are not your fate](#), on how healthier lifestyle habits can affect the individual at genetic level.

Emphasise to the students that the study of genotypes and phenotypes in behaviour is in its infancy. Though research in genome-wide association studies (GWAS) analysis is fast advancing, few if any behaviours have currently been identified as originating from one particular combination of genes to the exclusion of all others. We have therefore not reached the stage of being able to knock in or knock out genes in order to determine the behaviours of future children according to our wishes.

Supporting your students

The conceptual framework for this topic will need to be scaffolded. One starting point can be the analogy of the smartphone. The apps compare to genes, and a decision can be taken as to whether to activate them or leave them to genetic expression. The 'decision to touch the apps' can be compared to the environmental factors that 'touch' the genes.

You can also reinforce the key terms and concepts for this topic in the form of a matching or cloze exercise.

Challenging your students

Does success in the IB diploma programme depend on the student's genes? Or can the gifted teacher effectively assist those with less genetic support to reach the required standard? Ask students to read this article from *The Guardian* (UK): [Genetics outweighs teaching, Gove adviser tells his boss](#) (11 October 2013). They should summarise the points made and critically assess their validity in the light of your studies of genetics and also brain plasticity in Section 3.2.

Homework suggestions

- Both the critical thinking exercise on assessing the degree that human behaviour is determined by genes and the Theory of Knowledge items should enable students to creatively apply the principles of genetics and behaviour.
- The essay response question in the coursebook should help to consolidate the key principles of this topic, as well as providing suitable practice for this type of examination answer.

Cross-references with other topics

5.2 The individual and the group

5.3 Cultural origins of behaviour and cognition

6.2 Abnormal psychological conditions

3.5 The value of animal models in psychology research (HL only)

Overview

The case for using animal research to understand human behaviour on the grounds of biological similarities to humans has to be balanced with critical analysis of differences between animals and humans, and also conform to ethical guidelines in the treatment of animals. Applications of animal-based findings to human psychology have been widespread, exemplified in the fields of designing effective learning environments, identifying genes influencing specific behaviours and seeking to restore deteriorating cognitive faculties.

This topic could elicit emotionally charged student involvement. The starter activity below should give students the opportunity to present and re-present their position on the basis of informed choice.

Suggested activities

Possible starter

The following videos should inform viewers of the issues and realities of the use of animals in psychological and medical research. They are just a sample: do preview and decide on their suitability for your students.

- TED talk [How do animals experience pain?](#) by Robyn J. Crook demonstrates that animals including invertebrates do experience pain even though they do not express it in the same way as human beings.
- YouTube video [Animal testing ethics](#) by sabbfann explores both sides of the issue in a Californian setting. It also pays attention to the rise in threats of violence from animal rights activists.
- Nicky Campbell at the BBC hosts the topical debate show in the UK: [The 'Big Questions': Is animal testing justified?](#), available on YouTube.

After viewing these or similar links, the students can work in groups and each produce an initial reasoned statement of their position. They can present and debate them in class.

Main lesson content

- Students should be familiar with the professional guidelines for animal research in psychology, in the general terms presented in the coursebook and in the specific terms of their own country if possible.
- The studies in the coursebook sample the range of classical, recent and current/future research. There are many more suitable possibilities such as the experimental study of Rogers and Kesner (2003), which used rats in studying the role of acetylcholine in the formation of memories (see *Section 3.2*). Students can discuss how far the research would be ethically acceptable by today's standards.
- At the end of this lesson they should revisit their original position in the starter activity. At this point, introduce the animal rights and speciesism (humans rights are more important than animal rights) arguments, contrasting them with the opposing utilitarian arguments that favour the use of animals in research.

Common misunderstandings and misconceptions

Students should be aware that trained academics may use animals only after obtaining special approval from the relevant ethics board for every research study. This is granted only after satisfying the board that their work is ethically justified, that the sought information may not be obtained in any other reasonable way and that any suffering to animals is minimised.

Supporting your students

Students are likely to find this topic relevant and engaging. Conceptual difficulties are unlikely. The framework of ethics in animal research can also be useful in revisiting studies involving animal research in *Sections 3.2 and 3.4*.

Challenging your students

Research the study of Harlow and Harlow (1962) which is mentioned in the coursebook. In groups, pretend that the Harlows have applied to your Professional Ethics Board for permission to conduct their research, and that you are responding according to today's standards rather than those of 1962. You should use the ethical criteria of your country if possible. As a group, present your informed, reasoned decision. If you initially refuse permission, suggest an alternative methodology they may use to obtain similarly valid information.

Homework suggestion

- Students can write a final statement on their position on the use of animals in psychology research. With reference to studies in animal research, they should state and justify their position on the speciesism–utilitarian spectrum.

Cross-referencing with other topics

3.2 The brain and behaviour

3.4 Genetics and behaviour

4.2 Cognitive processing: memory, schema theory, and thinking and decision-making processes

References

- Baumgartner, T., Heinrichs, M., Vonlanthen, A., Fischbacher, U., & Fehr, E. (2008). Oxytocin shapes the neural circuitry of trust and trust adaptation in humans. *Neuron*; 22 May 2008; 58(4): 639–50.
- Bouchard Jr, T. J., Lykken, D. T., McGue, M., Segal, N. L., & Tellegen, A. (1990). Sources of human psychological differences: The Minnesota Study of Twins Reared Apart. *Science*; 250(4978): 223–28.
- Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., McClay, J., Mill, J., Martin, J., Braithwaite, A., & Poulton, R. (2003) Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. *Science, New Series*; 301(5631): 386–89.
- Harlow, H. F., & Harlow, M. K. (1962). Social deprivation in monkeys. *Scientific American*; 207: 136–46.
- Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science*; October; 17(10): 847–53.
- Milner, B., & Klein, D. (2015). Loss of recent memory after bilateral hippocampal lesions: Memory and memories—looking back and looking forward. *Journal of Neurology, Neurosurgery & Psychiatry*; 87(3): 230.

- Rogers, J. L., & Kesner, R. P. (2003). Cholinergic modulation of the hippocampus during encoding and retrieval. *Neurobiology of Learning and Memory*; 80(3): 332–42.
- Scott-Van Zeeland, A. A. et al. (2014). Evidence for the role of *EPHX2* gene variants in anorexia nervosa. *Molecular Psychiatry*; 19: 724–32.
- Sharot, T., Martorella, E. A., Delgado, M. R., & Phelps, E. A. (2007). How personal experience modulates the neural circuitry of memories of September 11. *Proceedings of the National Academy of Sciences of the United States of America*; 2 January; 104(1): 389–94.
- Sperry, R. W. (1968). Hemisphere disconnection and unity in conscious awareness. *American Psychologist*; 23(10): 723–33.
- Wedekind, C., Seebeck, T., Bettens, F., & Paepke, A. J. (1995). MHC-dependent mate preferences in humans. *Proceedings in Biological Sciences*; 260(1359): 245–49.
- Zak, P. J., Kurzban, R., Ahmadi, S., Swerdloff, R. S., Park, J., Efremidze, L., et al. (2009). Testosterone administration decreases generosity in the ultimatum game. *PLoS ONE*; 4(12): e8330.