# Scheme of work

Combined Science: Trilogy

## Biology – Homeostasis and response

This resource provides guidance for teaching the Homeostasis and response topic from our new GCSE in Combined Science; Trilogy (Biology) 8464. It has been updated from the draft version to reflect the changes made in the accredited specification.

Some minor changes have been made to the specification in sections 4.5.1 Homeostasis, 4.5.2, The human nervous system, 4.5.3.2 Control of blood sugar concentration, and 4.5.3.4 Hormones in human reproduction. These alterations have not required changes to the scheme of work.

The scheme of work is designed to be a flexible medium term plan for teaching content and development of the skills that will be assessed.

It is provided in Word format to help you create your own teaching plan – you can edit and customise it according to your needs. This scheme of work is not exhaustive; it only suggests activities and resources you could find useful in your teaching.

### 4.5.1 Homeostasis

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes** *What most students should be able to do* | **Suggested timing** **(hours)** | **Opportunities to develop Scientific Communication skills** | **Opportunities to apply practical and enquiry skills** | **Self/peer assessment****Opportunities and resources***Reference to past questions that indicate success*  |
| --- | --- | --- | --- | --- | --- | --- |
| 4.5.1 | Introduction to homeostasisHomeostasis is the regulation of internal conditions to maintain optimal conditions for enzyme action and cell function.Automatic control systems involve nervous responses and chemical responses.Control systems have receptors, a coordination centre and effectors. | Explain what homeostasis is and why it is important.Describe examples of conditions that need to be controlled.Describe the roles of the nervous system and the endocrine system in homeostasis.Describe the main components of a control system and their functions. | 0.25 | Discussion starters: ‘What would happen if…’ eg ‘you didn’t drink enough water, ate too many sweets.’ Use examples of diseases that can be controlled, eg diabetes, dehydration, gout. Draw a flow diagram to show the main components of a control system and label with the function of each component. Colour code and annotate given diagrams of body with functions related to homeostasis. | Use a model to explain control systems. | [Exampro user guide Powerpoint](http://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-EXAMPRO-UG.PPTX) |

### 4.5.2 The human nervous system

Mapping areas of the brain and investigating and treating brain disorders is Higher Tier only.

Control of body temperature links with enzyme activity in 4.2.2.1 and maintaining water balance in 4.5.3.3.

There are many possible practical activities. Select those which are most appropriate.

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| --- | --- | --- | --- | --- | --- | --- |
| 4.5.2 | Structure and function of the nervous system.Functions: to detect and react to stimuli; to coordinate behaviour.Structure: the CNS is made up of the brain and spinal cord; receptors, different types of neurones, coordinator as brain or spinal cord, effectors, synapses. | Explain the importance of being able to respond to environmental changes and coordinate behaviour.Explain how the nervous system is adapted for its functions.Describe the functions of the main structures in the nervous system.Explain the role of chemicals at synapses.Describe and use different methods to measure reaction time.Required practicalMake a plan to investigate a factor on human reaction time. | 1 | Starter: any short clip that has a ‘surprise’.Explain how detection of stimuli protects the body from danger.Demo: response to different temperatures.Detecting different tastes on the tongue – draw results on diagram of tongue.Investigate sensitivity of different areas of the body.Measure reaction time using different methods, eg Sheep Dash Activity (see resources).Plan for Required practical. | Plan and manage a variety of stimuli to illustrate body responses. Present and analyse results, such as:* response to temperature.
* taste receptors.
* skin sensitivity.

Evaluate different methods for measuring reaction time.Required practical plan a controlled investigation. | Body responses: * three bowls of water – hot, warm and ice-cold
* salt, sugar, coffee and lemon solutions to taste
* hairpins, ruler, blindfolds.

[BBC Bitesize: The nervous system](http://www.bbc.co.uk/education/guides/zkdnb9q/revision)[Reaction time test](http://www.humanbenchmark.com/tests/reactiontime/)[BBC Sheep reaction time test](http://www.bbc.co.uk/science/humanbody/sleep/sheep/)[Nervous system](http://www.abpischools.org.uk/page/modules/nervoussystem/.cfm?coSiteNavigation_allTopic=1) |
| 4.5.2 | Required practical: Reaction time. Plan and investigate the effect of a factor on human reaction time. | Carry out a controlled investigation, present and analyse the results. | 1 | Required practical write up. | Required practicalCarry out a controlled investigation, present and analyse the results.  | See *Practical Handbook* |
| 4.5.2 | Reflex actions; The brainReflex actions are automatic and rapid to protect the body from harm. | Explain the importance of reflex actions and give examples.Describe the differences between voluntary and reflex actions.Describe the stages of a reflex action. | 1 | Use knee-jerk and pupil reflexes as a stimulus for discussion. Students discuss their importance and gather other examples leading into explanation of why they are faster than a voluntary action.Label a diagram of a reflex arc.Draw a flow diagram or use cards to show the sequence in a reflex action.Use BBC activity (see resources) as a summary of the nervous system. | Use a model to describe a reflex action. | Cards to sequence.BBC Bitesize – [The nervous system](http://www.bbc.co.uk/education/guides/zkdnb9q/activity) [PPT: B1.2 The nervous system](http://filestore.aqa.org.uk/subjects/gcsescienceassessment/B1-2-THE-NERVOUS-SYSTEM.PPT) |

### 4.5.3 Hormonal coordination in humans

Treatment for diabetes links with 4.1.2.3 Stem cells.

ADH activity links with section 4.5.3.7 Negative feedback.

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| --- | --- | --- | --- | --- | --- | --- |
| 4.5.3.1 | Human endocrine systemThe system is composed of endocrine glands that secrete hormones into the blood to be carried to a target organ where it has an effect.The positions of the pituitary, thyroid, adrenal glands, ovaries and testes.The pituitary is the master gland. It secretes many hormones that affect other glands.Hormones are chemical messengers.The effects of the endocrine system are slower, but longer acting than the nervous system. | Describe the endocrine system and define the term hormone.Relate hormone release and hormone action to the control system model introduced in 4.5.1.1.Label a diagram of the organs in the endocrine system.Explain why the pituitary gland is often called the master gland.Compare the actions of the nervous and endocrine systems. | 0.5 | Collective memory or Card sort using hormone name, function and location. Self-assess.Pin the tail on the donkey type activity – give each student a card and get them to stick it on a large body outline, self-assess the end result.Label a diagram of the endocrine system using information on the cardsWrite definitions for endocrine system and hormone.Discuss why the pituitary gland is called the master gland.Compare the actions of the endocrine system with the nervous system. | Relate hormone release and hormone action to the control system model. |  |
| 4.5.3.24.5.3.2 | Control of blood glucose concentrationBlood glucose concentration is monitored and controlled by the pancreas. It produces insulin, which causes glucose from the blood to enter cells.Glucose is converted to glycogen in liver and muscle cells for storage.HT: Glucagon is also produced by the pancreas to convert stored glycogen back into glucose when blood glucose levels fall. In Type 1 diabetes the pancreas does not produce enough insulin. Glucose levels may rise too high.Type 1 diabetes is usually treated with insulin injections.In Type 2 diabetes the cells do not respond properly to insulin. Type 2 diabetes is usually treated by diet, exercise and drugs. Obesity is a risk factor for Type 2 diabetes. | Describe how blood glucose concentration is monitored and controlled.Explain when insulin is produced and how it helps to control blood glucose levels.Describe glycogen as a stored carbohydrate.HT: Explain when glucagon is produced by the pancreas and its effect on blood glucose levels.Explain how insulin and glucagon work together to control blood glucose levels.Explain the cause, effects, treatment and problems associated with Type 1 diabetes.Interpret glucose tolerance test results.Evaluate modern methods of treating diabetes.Explain the cause, treatment and problems associated with Type 2 diabetes.Compare the causes, and treatments of Type 1 and Type 2 diabetes. | 1 | Class practical – investigating sugar levels in urine.What disease can cause glucose in urine? Research and produce a report to explain the cause, effects, treatment and problems associated with Type 1 diabetes. [diabetes.org.uk](http://www.diabetes.org.uk) is a good resource.Interpret data on glucose tolerance tests in healthy people and diabetics.Research the work of Banting and Best.Watch video clip about Banting and Best.Research how treatment of diabetes has developed including use of human insulin produced by bacteria, current research into pancreas cell transplants and stem cell research (links with 4.1.2.3).Discuss the causes, treatment and problems associated with Type 2 diabetes. Compare Type 1 and Type 2 diabetes and present the information in a suitable format.Watch a video animation about Type 1 and Type 2 diabetes. | Demo: how doctors used to diagnose diabetes by tasting fake urine, then test with Benedict’s solution and glucose test strips. Evaluate the methods. | Demo materials: * weak tea samples with and without glucose
* glucose test strips
* Benedict’s solution
* water bath.

[BBC Bitesize: Homeostasis](http://www.bbc.co.uk/education/guides/z4khvcw/revision/3)[Insulin and blood sugar control](http://www.abpischools.org.uk/page/modules/homeostasis_sugar/sugar2.cfm?coSiteNavigation_allTopic=1)Banting and Best: [Diabetes – a cure](http://www.bbc.co.uk/education/clips/z64vr82)[‘Explaining diabetes’ animation](https://www.diabetes.org.uk/Guide-to-diabetes/What-is-diabetes/Diabetes-and-the-body/) |
| 4.5.3.34.5.3.3 | Hormones in human reproductionDuring puberty hormones cause sexual characteristics to develop. In females oestrogen is produced by the ovaries. Eggs mature and are released (ovulation) every 28 days. In males testosterone is produced by the testes and stimulates sperm production.The roles of FSH, LH, oestrogen and progesterone in the menstrual cycle of a woman.HT: more detail is required for the roles of these hormones. | Describe secondary sexual characteristics of boys and girls.Explain the cause of these changes in boys and girls and their relevance in reproduction.Describe the menstrual cycle and fertility including the role of hormones.Oestrogen is secreted by the ovaries. It inhibits production of FSH and stimulates release of LH. It makes the uterus lining grow again after menstruation.Progesterone is secreted by the empty follicle in the ovary after ovulation. It inhibits FSH and LH production and maintains the lining of the uterus during the second half of the cycle.HT: explain the interaction between these hormones in the control of the menstrual cycle. | 1 | Watch BBC video clip about puberty.Describe the changes that occur in boys and girls during puberty and discuss what causes these changes.Watch BBC video clips of ovulation and the menstrual cycle. Discuss how hormones control the changes seen. Use a month calendar page to colour code days according to hormone levels (make a flickbook to show changes)Use a model, eg diagram, chart, animation etc to show the names, sites of production and effects of FSH, LH, oestrogen and progesterone in the menstrual cycle. HT will require more detail. |  | [BBC Bitesize: Puberty](http://www.bbc.co.uk/education/clips/zmmr87h)[BBC Bitesize: Ovulation](http://www.bbc.co.uk/education/clips/zffjxnb)[BBC Bitesize: Menstrual cycle](http://www.bbc.co.uk/education/clips/zv32hyc)[PPT B1.2.2 Control in the human body](http://filestore.aqa.org.uk/subjects/gcsescienceassessment/B1-2-2-CONTROL-IN-THE-HUMAN-BODY.PPT) |
| 4.5.3.44.5.3.4 | ContraceptionFertility can be controlled using hormonal and non-hormonal contraceptives.Eg hormonal:* oral contraceptives
* injection
* implant or skin patch.

Eg non-hormonal:* barrier methods
* IUDs
* spermicides
* abstinence
* sterilisation
* surgery.
 | Describe hormonal and non-hormonal methods of contraception.Explain how hormonal and non-hormonal contraceptives work.Evaluate their use.Evaluate their use. | 1 | Watch BBC video clip about history of contraception for women (contains distressing scene). Discuss issues raised.Look at an exhibition of hormonal and non-hormonal contraceptives. Complete a table summarising: method of action, hormone name, how they work, advantages, disadvantages.Produce a report for a teen magazine on the advantages and disadvantages of different types of contraceptives.Invite an outside speaker to discuss contraception, eg women’s health nurse. | Consider personal, social, economic and ethical implications of contraceptive use.Study contraceptives in an exhibition and evaluate the different types. | [BBC Bitesize: Development of the contraceptive pill](http://www.bbc.co.uk/education/clips/zjfqhyc) Exhibition materials can be obtained from the [Family Planning Association](http://www.fpa.org.uk/). |
| 4.5.3.54.5.3.5 | HT: The use of hormones to treat infertility.Women can be given a ‘fertility drug’ containing FSH and LH to stimulate ovulation.In IVF treatment FSH and LH are given to stimulate many eggs to mature. These are collected and fertilised by sperm in a lab. Embryos form, and some are inserted into the woman’s uterus.The advantages and disadvantages of fertility treatment, eg stress, success rate and multiple births. | Describe the use of fertility drugs in women with low FSH levels.Use a model, eg a flow diagram to explain the process of In Vitro Fertilisation (IVF).Evaluate the use of fertility treatments. | 1 | Discuss possible causes of infertility in men and women and treatments available.Research the process of IVF and produce a leaflet for a doctor’s surgery to describe the main stages involved in IVF treatment.UPD8 activity about womb transplants. Discuss the implications of IVF treatment for a couple wanting a baby. | UPD8 – apply different ethical approaches to making a decision about non-vital transplants. | UPD8 – [Womb transplant](http://www.upd8.org.uk/activity/201/Simpletons-an-ethics-tool.html) |
| 4.5.3.6 | HT: Negative feedback.Adrenaline is produced by the adrenal glands in times of stress. It increases heart rate so oxygen and glucose are supplied to the brain and muscles faster.Thyroxine is produced by the thyroid gland. It stimulates BMR and plays an important role in physical and mental development.Adrenaline and thyroxine secretions are controlled by negative feedback mechanisms. | Describe where and when adrenaline is released and its target organs.Describe the effects of adrenaline on the body.Draw a diagram to explain how levels of adrenaline are controlled by a negative feedback system.Describe where thyroxine is produced and its effects on the body.Draw a diagram to explain how its release is stimulated by thyroid stimulating hormone and the levels of these two hormones are controlled by a negative feedback system. | 0.5 | Use a model to show where adrenaline and thyroxine are produced, and their target organs.Research the effects of the two hormones on the body and present the findings in a suitable format. Include diagrams to illustrate negative feedback mechanisms for each hormone. Use ABPI site and internet.Investigate the effect of stress, and removal of stress, on heart rate. | Identify organs on a model.Measure heart rate and/ or blood pressure as indicators of stress. Relate the changes to adrenaline secretion. | TorsoABPI – [Adrenaline and ADH](http://abpischools.org.uk/page/modules/hormones/horm8.cfm)You & Your Hormones – [Adrenaline](http://www.yourhormones.info/Hormones/Adrenaline.aspx)[Stress](http://www.nuffieldfoundation.org/practical-biology/monitoring-body%E2%80%99s-reactions-stress) |