# Scheme of work

## Biology – Homeostasis and response

This resource provides guidance for teaching the Homeostasis and response topic from our new GCSE Biology (8461). It has been updated from the draft version to reflect the changes made in the accredited specification. There have been no changes to the required practicals. However, there have been minor changes to the specification content to sections 4.5.1 Homeostasis, 4.5.2.1 Structure and function, 4.5.2.2 The brain, 4.5.2.3 The eye, 4.5.3.4 Hormones and human reproduction, 4.5.4.1 Control and coordination and 4.5.4.2 Use of plant hormones. These alterations have not required changes to be made 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* |
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| 4.5.1 | Introduction to homeostasis  Homeostasis 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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| 4.5.2.1 | 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.  Required practical: investigate the effect of a factor on human reaction time. | 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 practical  Make 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, eg:   * 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) |
| 4.5.2.1 | Required practical:  Plan and carry out an investigation into 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 practical  Carry out a controlled investigation, present and analyse the results. | See *Practical Handbook* |
| 4.5.2.1 | Reflex actions: the brain.  Reflex 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) |
| 4.5.2.2 | The brain  The brain has billions of interconnected neurones.  Different areas of the brain control different functions.  HT: Mapping areas of the brain has been done using different methods.  Investigating and treating brain disorders is difficult. | Identify the cerebral cortex, cerebellum and medulla on a diagram and describe the function of each.  HT: Describe the techniques used to map areas of the brain to their functions.  Evaluate the benefits and risks of procedures carried out on the brain and nervous system. | 0.5 | Label a diagram of the brain and give the functions of the cerebral cortex, cerebellum and medulla.  Homework: listen to ‘The lobotomists’ (see resources) and evaluate medical research methods.  HT: Discuss how areas of the brain can be mapped to their functions.  Research modern procedures used for brain and nervous system disorders. | Use a model brain to identify different areas.  Evaluate the historical use of lobotomies, considering ethical issues. | Model of brain  BBC Radio 4 [‘The Lobotomists’](http://www.bbc.co.uk/programmes/b016wx0w) |
| 4.5.2.3 | The eye  The eye contains receptors sensitive to light and colour.  The structure of the eye.  Accommodation is the process of changing the shape of the lens to focus on near and far objects.  People may be long or short sighted. These can be corrected using lenses or surgery. | Label a diagram of the eye and describe the function of each structure.  Define the term ‘accommodation’.  Describe how the eye changes to focus on near and distant objects.  Complete simple ray diagrams to show normal vision, long-sightedness and short-sightedness. | 1 | Use a model eye to name the structures and describe their functions limited to: retina, optic nerve, sclera, iris and pupil, ciliary muscles and suspensory ligaments.  Recap iris reflex to bright light.  Label a diagram of the eye.  Dissect a bull’s eye.  Observe the effect of different lenses on light rays.  Use a model eye to demonstrate long and short sight and their correction.  Complete ray diagrams to explain accommodation in order to focus on near and distant objects. | Use a model of the eye.  Dissect a bull’s eye and consider safety issues.  Use a model eye to show long and short sight and their correction.  Complete ray diagrams. | Model eye.  [BBC Bitesize: The eye](http://www.bbc.co.uk/education/guides/zkdnb9q/revision/5)  Eye**:**   * bull’s eyes * gloves * scalpel and scissors * dissecting boards * disposal bags.   [Model eye demonstration](http://www.nuffieldfoundation.org/practical-physics/model-eye-demonstration-flask)  [Nervous system: light sensitive cells](http://www.abpischools.org.uk/page/modules/nervoussystem/nervous8.cfm?coSiteNavigation_allTopic=1) |
| 4.5.2.4  4.5.2.4  4.5.2.4 | Control of body temperature  Body temperature is monitored and controlled by the thermoregulatory centre in the brain. It has receptors sensitive to the temperature of the blood.  Temperature receptors in the skin send impulses to the thermoregulatory centre.  The changes that occur when body temperature is too high, in order to transfer more energy from the skin to the environment, and when body temperature is too low, in order to reduce energy transfer to the environment.  Sweat cools the body as it evaporates from the skin. | Describe different methods to measure body temperature.  Explain how body temperature is monitored and controlled.  Describe and explain the changes that happen when body temperature is too high or too low.  Explain why we drink more fluid during hot weather.  Plot cooling curves. | 2 | Use different methods to measure body temperature. Discuss which method was the best.  Explain why skin temperature varies in different conditions.  Discuss how the body detects and controls core body temperature.  Investigate how exercise affects body temperature and/or sweating and report on the findings.  Look at a model of the structure of the skin.  Describe changes that occur when body temperature is too high and too low and write notes in the form of a table or a flow chart.  Watch a video clip or computer animation showing changes that occur when body temperature is too high or too low and make notes (see resources).  Discuss the effects of sweating on urine formation and why we drink more fluids in hot weather (links with 4.5.3.3).  Watch a video clip about sweating (see resources).  Demonstrate the effect of cooling by ethanol on the skin.  Investigate the effect of evaporation on cooling using ethanol or wet paper towels.  Interpret information about sweating and body temperature. | Evaluate different methods to measure body temperature. Calculate a mean and describe the range of body temperatures for the class.  Measure skin temperature in different conditions.  Investigate the effect of exercise on body temperature and/or sweating.  Use a model of the skin and relate to control of body temperature.  Use the kinetic theory to explain cooling by evaporation.  Investigate the effect of sweating on the rate of cooling using a model - tubes of hot water wrapped in wet and dry paper towels. Plot cooling curves and make conclusions.  Analyse data and interpret information about sweating and temperature. | Body temperature: Clinical and digital thermometers, forehead thermometers.  Skin temperature sensors and data loggers.  Exercise:   * thermometers * cotton wool * tape * balances.   Skin model  [BBC Bitesize: Maintaining body temperature](http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_pre_2011/homeostasis/bodytemprev1.shtml)  Animation: [Maintaining a core body temperature](http://www.abpischools.org.uk/page/modules/homeostasis_sugar/sugar6.cfm?coSiteNavigation_allTopic=1)  [BBC Bitesize: Skin and sweating](weating:%20www.bbc.co.uk/education/clips/zkm2tfr)  Sweating:   * boiling tubes * paper towels * elastic bands * thermometers or temperature sensors * pipettes * timers.   [Interpreting information about sweating and temperature](http://www.nuffieldfoundation.org/practical-biology/interpreting-information-about-sweating-and-temperature)  [PPT B3.3.2 and 3 Temperature and sugar control](http://filestore.aqa.org.uk/subjects/gcsescienceassessment/B3-3-2-AND-3-TEMPERATURE-AND-SUGAR-CONTROL.PPT) |

### 4.5.3 Hormonal coordination in humans

Treatment for diabetes links with 4.1.2.3 Stem cells and 4.7.5.4 Biotechnology using genetically engineered bacteria.

Water and nitrogen balance links with 4.1.3.2 Osmosis and 4.1.3.3 Active transport.

ADH activity links with section 4.5.3.7 Negative feedback.

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| --- | --- | --- | --- | --- | --- | --- |
| 4.5.3.1 | Human endocrine system  The 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 cards  Write 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. | Torso and large image of the human body. |
| 4.5.3.2  4.5.3.2 | Control of blood glucose concentration  Blood 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 and 4.7.5.4).  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/) |
| 4.5.3.3  4.5.3.3 | Water and nitrogen balance  Water leaves the body via the lungs during exhalation.  Water, ions and urea are lost from the skin in sweat.  There is no control over water, ion or urea loss by the lungs or skin.  Excess water, ions and urea are removed via the kidneys in the urine.  If body cells lose or gain too much water by osmosis they do not function efficiently.  HT: urea is produced in the liver by the breakdown of excess amino acids. | Describe where water, ions and urea are lost from the body.  Explain why there is no control over water, ion and urea loss by the lungs and skin.  Explain when cells might gain or lose too much water, in terms of osmosis (links with 4.1.3.2).  Describe the effect of too much or too little water on cells.  Explain how the body responds to different temperature and osmotic challenges in terms of sweat and urine release.  HT: Describe how amino acids are deaminated in the liver to form ammonia, which is converted to urea for excretion. | 0.5 | Label a diagram. Link each organ to the condition it helps to control in the body.  Starter: micrograph images animal cell in normal, concentrated salt and pure water – what caused the changes?  Urine colour chart – how could the colour change depending on the time of year etc?  Use past exam questions on Exampro to balance water loss.  HT: Draw a flow diagram to explain how urea is formed. | Draw animal cells exposed to saline, dilute and concentrated salt solutions. Explain the observations. | Demo materials:   * prepared slides and microscopes * bio-viewers or micrographs of animal cells in saline, dilute and concentrated salt solutions.   [Nutrition and hydration](http://www.peninsulacommunityhealth.co.uk/nutrition-and-hydration.htm) |
| 4.5.3.3 | Kidney function  The kidneys produce urine by filtration of the blood and selective reabsorption of useful substances.  All the sugar and dissolved ions needed by the body and as much water as the body needs are selectively reabsorbed.  Urea, excess ions and water are excreted in urine. | Label a diagram of the excretory system.  Describe how urine is produced.  Describe the absorption of glucose and ions by diffusion and active transport. | 1 | Locate the positions of the liver, kidneys and bladder in the human.Explain the need to excrete urea.  Label a diagram of the excretory system.  Observe the structure of a kidney.  Use cards to sequence how urine is made and produce a flow diagram.  Name the useful substances reabsorbed by the body and relate to diffusion and active transport.  Q11WY3H07 | Use a model torso.  Use a model kidney.  Dissection of pig’s kidney. Use cocktail sticks and stickers to make ‘flags’ for the key features and photograph the labelled kidney to stick in books. | Torso  Model kidney  Dissection:   * pig’s kidneys * scalpel * scissors * dissection board * gloves.   [BBC Bitesize: Excretion in plants and animals](http://www.bbc.co.uk/education/guides/zj7v4wx/revision/1) |
| 4.5.3.3 | ADH  HT: ADH is released by the pituitary gland when the blood is too concentrated. It causes more water to be reabsorbed back into the blood.  ADH control of water in the blood is an example of negative feedback. | HT: Identify the site of production and target organs for ADH.  Describe the effects of ADH on kidney tubules.  Explain, with the aid of a diagram, how ADH controls the concentration of the blood using a negative feedback mechanism (links with 4.5.3.7). | 0.5 | Use a diagram or torso to describe the site of production and target organs for ADH.  Describe the effect of ADH on the kidney tubules and relate to volume of urine produced if you are thirsty.  Use the ABPI activities (see resources) to explain the negative feedback mechanism involved in control of water concentration in the blood.  Draw a diagram to explain ADH negative feedback mechanism. | Model of human body to identify organs.  Predict whether ADH secretion and volume of urine is high or low for different situations, eg person running on hot day. | Torso  [Kidneys and water balance](http://abpischools.org.uk/page/modules/homeostasis_kidneys/kidneys6.cfm) |
| 4.5.3.3  4.5.3.3  4.5.3.3 | Kidney failure  Kidney failure can be treated by kidney transplant or by using kidney dialysis.  How a dialysis machine works. | Describe the advantages and disadvantages of a kidney transplant.  Explain how a kidney machine works.  Explain why dialysis fluid contains sugar and ions at the same concentration as normal blood, but no urea.  Evaluate the use of kidney transplants and dialysis to treat kidney failure. | 2 | Discuss why a kidney transplant is not available for everyone. Discuss the advantages and disadvantages of a transplant.  Design a poster to explain and encourage people to carry organ donor cards.  Use ABPI resources on dialysis and kidney transplants.  Discuss the advantages and disadvantages of dialysis treatment.  Research how a dialysis machine works and produce a script for a new nurse in the dialysis clinic to explain the procedure.  Explain the results for the model dialysis machine (links with 4.1.3.1).  Label a diagram of a kidney dialysis machine and add notes to explain the constituents of the fluid and how the machine restores the concentration of dissolved substances in the blood to normal.  Discuss a moral dilemma – research cost of dialysis and transplants. Discuss considerations in terms of cost as to how kidney patients should be treated – lifetime dialysis, transplant, shortage of kidneys, buying kidneys from healthy people and prioritising lists for surgery. Produce arguments for and against the options.  Identify urine samples from a healthy person, diabetic, person with kidney failure, healthy person who had drink a lot and person who had been doing hard work in hot weather. | Set up a model for dialysis using cellulose tubing. Test for glucose, salt and protein.  Describe the economic, ethical and medical considerations regarding treatment of kidney failure and evaluate the choice of treatments for kidney failure.  Analyse urine samples and identify who each one came from. Give reasons for the conclusions. | Dialysis:   * cellulose tubing * pipettes * fake urine * boiling tubes * test tubes * Benedict’s solution or glucose test sticks * biuret reagent or albustix * nitric acid and silver nitrate solution * dialysis fluid * water * goggles.   [What is dialysis?](http://abpischools.org.uk/page/modules/homeostasis_kidneys/kidneys8.cfm?coSiteNavigation_allTopic=1)  Urine:   * artificial urine samples made with tea – sugar added, protein added, normal colour, dilute, concentrated * biuret reagent or albustix * Benedict’s solution or glucose test sticks * test tubes * water bath * goggles. |
| 4.5.3.4  4.5.3.4 | Hormones in human reproduction  During 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) |
| 4.5.3.5  4.5.3.5 | Contraception  Fertility can be controlled using hormonal and non-hormonal contraceptives.  Hormonal, eg:   * oral contraceptives * injection * implant or skin patch.   Non-hormonal, eg:   * 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/). |
| 4.5.3.6  4.5.3.6 | 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) |
| 4.5.3.7 | 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. | Torso  ABPI – [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) |

### 4.5.4 Plant hormones

| **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* |
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| 4.5.4.1  4.5.4.1 | Control and coordination  Hormones control and coordinate growth and responses to light and gravity in plants.  Responses to light and gravity are controlled by the unequal distribution of auxin which causes unequal growth rates in shoots and roots.  Required practical: Reaction time  Plan and carry out an investigation into the effect of a factor on human reaction time.  HT: Gibberellins are important in initiating seed germination.  Ethene controls cell division and ripening of fruits.  Required practical: Germination  Investigate the effect of light or gravity on the growth of newly germinated seeds.  Record results as both length measurements and as careful, labelled biological drawings to show the effects. | Describe how plant shoots and roots respond to light and gravity.  Draw diagrams to explain the role of auxin in plant responses in terms of unequal distribution in shoots and roots.  Required practical: plan and carry out an investigation into the effect of light on plant shoots.  Observe, present and analyse the results in a later lesson.  Interpret results of plant hormone experiments using secondary sources.  HT: Describe the functions of gibberellins and ethene in plants. | 2 | Discuss what plants are sensitive to.  Demo a plant’s sense of touch.  Demo response to water.  Required practical: use diagrams to explain plant responses in terms of distribution of auxin.  Compare and contrast the ability of different plants to reach light – obstacle course.  Explain positive and negative phototropism.  Interpret Charles Darwin’s investigations into tropisms.  Research gibberellins and ethene and produce a short report. | Use evidence from demos to suggest degrees of plant sensitivity.  Required practical: plan and set up an investigation into the effect of light on growth of shoots.  Optional investigations:  Obstacle course.  Investigate which part of a shoot is sensitive to light.  Effect of gravity on growth of plants  Interpret experiments using agar blocks and seedlings with shoot tips removed. | Demo:   * Venus fly trap * Mimosa * Honeysuckle.   Or from video clips.  Water:   * trough of dry soil with clay plant pot full of water at centre * plant broad beans around clay pot.   Required practical: See *Practical Handbook*  For practical ideas: [Tackling tropisms](http://www.saps.org.uk/secondary/teaching-resources/1239-tackling-tropisms-gravitropism-and-phototropism)  Obstacle course:   * three identical shoe boxes with simple obstacle course and hole at one end * dish of mustard seedlings * germinating broad bean * sprouting potato.   Positive and negative phototropism: Broad bean seedling held by pin in jar with light entering through a slit.  Light sensitivity: Three pots of oat seedlings in three light boxes – tips removed, tips covered and untreated.  Gravity: Grow broad beans in dark jar in different positions, blotting paper. Broad bean seedling in clinostat in dark – rotating and still.  [BBC Bitesize: Plant and animal hormones](http://www.bbc.co.uk/education/guides/z98p34j/revision/3)  [B1.2.3 Control in plants](http://filestore.aqa.org.uk/subjects/gcsescienceassessment/B1-2-3-CONTROL-IN-PLANTS.PPT) |
| 4.5.4.2  4.5.4.2 | HT: Use of plant hormones.  Plant hormones are used in agriculture and horticulture.  The uses of auxins, ethene and gibberellins. | Describe how auxins are used as weedkillers and rooting powders, and to promote growth in tissue culture.  Describe the use of ethene to control the ripening of fruit during storage and transport.  Describe the use of gibberellins to end seed dormancy, promote flowering and to increase fruit size. | 1 | Investigate the effect of rooting hormones on the growth of cuttings and write a short report.  Investigate the effect of weed killer on an area of lawn.  Research the uses of auxins, gibberellins and ethene and produce a poster or PowerPoint presentation. | Plan and carry out an investigation into the effect of rooting hormones on the growth of cuttings. Decide what will be the dependent variable.  Plan and carry out an investigation into the effect of weed killer on an area of lawn. Use a suitable method to measure the results. | Rooting hormone:   * rooting powder * jars of water * plant cuttings.   Weed killer: Selective weed killer solution.  [Plant hormones](http://www.abpischools.org.uk/page/modules/hormones/horm9.cfm)  [BBC Bitesize: Uses of plant hormones](http://www.bbc.co.uk/schools/gcsebitesize/science/add_gateway_pre_2011/living/controlplantgrowthrev2.shtml) |