B7 Ecology

What's the science story?

Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.

Previous knowledge:

Year 7 – Organisms – basic cells and the reproductive system. (includes menstrual cycle and puberty)

SMSC: SRE: contraception

Next steps…

N/A

Keywords

Homeostasis	Reflex action	Oestrogen
Stimulus	Endocrine system	Follicle stimulating hormone (FSH)
Receptors	Insulin	Luteinising hormone (LH)
Coordination centres	Glucagon	In vitro fertilisation (IVF)
Effectors	Type 1 diabetes	
	Type 2 diabetes	

Working scientifically skills:

WS4: Ethical arguments
WS8: Writing methods
WS9: Identifying variables
WS10: Selecting the correct equipment and measuring time accurately.
WS15: Collecting and using data – terms reproducible and repeatable
WS17: Making a conclusion

Assessments:

End of unit test (summative) (Out of 30)
Exit tickets x 2/3 (formative)

- RP Caffeine Q
- Evaluating contraceptives using data
- **HT – Interacting hormones in menstrual cycle**

AQA GCSE Combined Science Trilogy (8464)

Lesson No. and Title	Learning objectives	AQA Specification	Practical equipment
1. Principles of Homeostasis	4 – To state the conditions controlled in the human body. 6 – To describe homeostasis. 8 – To explain in detail the importance of homeostasis.	**4.5.1 Homeostasis** Homeostasis maintains optimal conditions for enzyme action and all cell functions. In the human body, these include control of: • blood glucose concentration • body temperature • water levels. These automatic control systems may involve nervous responses or chemical responses. All control systems include: • cells called receptors, which detect stimuli (changes in the environment) • coordination centres (such as the brain, spinal cord and pancreas) that receive and process information from receptors • effectors, muscles or glands, which bring about responses which restore optimum levels.	**Practical**: Keeping water at constant temperature • 250ml beakers • Thermometers/ temperature probes • Ice • 50ml measuring cylinders • Matches • Splints
2.Structure and function of the Human nervous system	4 – To describe the structure and function of the nervous system. 6 – To describe the pathway of impulses from receptor to response. 8 – To apply the pathway of impulses to a range of examples.	**4.5.2 The human nervous system** The nervous system enables humans to react to their surroundings and to coordinate their behaviour. Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS). The CNS is the brain and spinal cord. The CNS coordinates the response of effectors which may be muscles contracting or glands secreting hormones. Stimulus→receptor→coordinator→effector→response	**Practical**: Sensitivity of receptors in the skin • Dice • Bluetak/plasticine • Cocktail sticks (30)
3. Reflex actions	4 – To describe the structures in a reflex arc. 6 – To describe the events involved in a reflex arc. 8 – To fully justify the importance of reflexes.	**4.5.2 The human nervous system** Students should be able to explain how the various structures in a reflex arc – including the sensory neurone, synapse relay neurone and motor neurone – relate to their function. Students should understand why reflex actions are important. Reflex actions are automatic and rapid; they do not involve the conscious part of the brain.	N/A

4. Reaction times (Required Practical)	Biology AT 1 – use appropriate apparatus to record time. Biology AT 3 – selecting appropriate apparatus and techniques to measure the process of reaction time. Biology AT 4 – safe and ethical use of humans to measure physiological function of reaction time and responses to a chosen factor.	**Required practical activity 6**: plan and carry out an investigation into the effect of a factor on human reaction time. **Apparatus and techniques** In doing this practical student should cover these parts of the apparatus and techniques requirements. **Biology AT 1** – use appropriate apparatus to record time. **Biology AT 3** – selecting appropriate apparatus and techniques to measure the process of reaction time. **Biology AT 4** – safe and ethical use of humans to measure physiological function of reaction time and responses to a chosen factor.	Practical: Reaction times RP • Metre rulers • Ipads for online reaction test if required
5. Hormonal control	4 – To Identify the main glands of the human body. 6 – To describe the role hormones have in the body. 8 – To compare the response from the hormonal system to the nervous system.	**4.5.3.1 Human endocrine system** The endocrine system is composed of glands which secrete chemicals called hormones directly into the bloodstream. The blood carries the hormone to a target organ where it produces an effect. Compared to the nervous system the effects are slower but act for longer. The pituitary gland in the brain is a 'master gland' which secretes several hormones into the blood in response to body conditions. These hormones in turn act on other glands to stimulate other hormones to be released to bring about effects. Students should be able to identify the position of the following on a diagram of the human body: • pituitary gland • pancreas • thyroid • adrenal gland • ovary • testes	

6. Control of blood glucose levels	4 – To describe how blood glucose levels are controlled. 6 – To compare type 1 and type 2 diabetes and how they can be treated. **8 – HT To explain what happens when blood glucose is too high or too high in the body.**	**4.5.3.2 Control of blood glucose concentration** Blood glucose concentration is monitored and controlled by the pancreas. If the blood glucose concentration is too high, the pancreas produces the hormone insulin that causes glucose to move from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage. Students should be able to explain how insulin controls blood glucose (sugar) levels in the body. Type 1 diabetes is a disorder in which the pancreas fails to produce enough insulin. It is characterised by uncontrolled high blood glucose levels and is normally treated with insulin injections. In Type 2 diabetes the body cells no longer respond to insulin produced by the pancreas. A carbohydrate-controlled diet and an exercise regime are common treatments. Obesity is a risk factor for Type 2 diabetes. Students should be able to compare Type 1 and Type 2 diabetes and explain how they can be treated. **(HT only) If the blood glucose concentration is too low, the pancreas produces the hormone glucagon that causes glycogen to be converted into glucose and released into the blood.** **(HT only) Students should be able to explain how glucagon interacts with insulin in a negative feedback cycle to control blood glucose (sugar) levels in the body.**	
7. Puberty and hormones	4 – To describe what happens in the human body during puberty. 6 – To explain the functions of the key hormones released during puberty.	**4.5.3.3 Hormones in human reproduction** Students should be able to describe the roles of hormones in human reproduction, including the menstrual cycle. During puberty reproductive hormones cause secondary sex characteristics to develop. Oestrogen is the main female reproductive hormone produced in the ovary. At puberty eggs begin to mature and one is released approximately every 28 days. This is called ovulation. Testosterone is the main male reproductive hormone produced by the testes and it stimulates sperm production.	

8. Menstrual cycle	4 – To describe the menstrual cycle. 6 – To explain the function of each hormone in the menstrual cycle. **8 – HT To explain the interactions of FSH, LH, oestrogen and progesterone during the menstrual cycle.**	**4.5.3.3 Hormones in human reproduction** Several hormones are involved in the menstrual cycle of a woman. • Follicle stimulating hormone (FSH) causes maturation of an egg in the ovary. • Luteinising hormone (LH) stimulates the release of the egg. • Oestrogen and progesterone are involved in maintaining the uterus lining. **(HT only) Students should be able to explain the interactions of FSH, oestrogen, LH and progesterone, in the control of the menstrual cycle.** **(HT only) Students should be able to extract and interpret data from graphs showing hormone levels during the menstrual cycle.**	
9. Contraception	4 – To describe how fertility can be controlled. 6 – To explain a range of different contraceptive methods. 8 – To evaluate the different hormonal and on-hormonal methods of contraception.	**4.5.3.4 Contraception** Students should be able to evaluate the different hormonal and non-hormonal methods of contraception. Fertility can be controlled by a variety of hormonal and nonhormonal methods of contraception. These include: • oral contraceptives that contain hormones to inhibit FSH production so that no eggs mature • injection, implant or skin patch of slow release progesterone to inhibit the maturation and release of eggs for a number of months or years • barrier methods such as condoms and diaphragms which prevent the sperm reaching an egg • intrauterine devices which prevent the implantation of an embryo or release a hormone • spermicidal agents which kill or disable sperm • abstaining from intercourse when an egg may be in the oviduct • surgical methods of male and female sterilisation.	

10. HT Fertility	4 – To state advantages and disadvantages of different contraceptives. 6 – To describe steps of IVF. 8 – To evaluate advantages and disadvantages of IVF.	**4.5.3.5 The use of hormones to treat infertility (HT only)** Students should be able to explain the use of hormones in modern reproductive technologies to treat infertility. This includes giving FSH and LH in a 'fertility drug' to a woman. She may then become pregnant in the normal way. In Vitro Fertilisation (IVF) treatment. • IVF involves giving a mother FSH and LH to stimulate the maturation of several eggs. • The eggs are collected from the mother and fertilised by sperm from the father in the laboratory. • The fertilised eggs develop into embryos. • At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb). Although fertility treatment gives a woman the chance to have a baby of her own: • it is very emotionally and physically stressful • the success rates are not high • it can lead to multiple births which are a risk to both the babies and the mother.	
11. HT Role of negative feedback	4 – To define negative feedback loops. 6 – Describe the function of adrenaline and thyroxine. 8 – Design labelled flow diagrams of negative feedback control.	**4.5.3.6 Feedback systems (HT only)** Students should be able to explain the roles of thyroxine and adrenaline in the body. Adrenaline is produced by the adrenal glands in times of fear or stress. It increases the heart rate and boosts the delivery of oxygen and glucose to the brain and muscles, preparing the body for ‘flight or fight’. Thyroxine from the thyroid gland stimulates the basal metabolic rate. It plays an important role in growth and development. Thyroxine levels are controlled by negative feedback.	