SCQF level 6
Unit Specification

Human Biology: Neurobiology and Communication

SCQF: level 6 (3 SCQF credit points)

Unit code: J20L 76

Unit outline

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of neurobiology and communication. Learners will apply these skills when considering the applications of neurobiology and communication on our lives. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:
divisions of the nervous system and parts of the brain; perception and memory; the cells of the nervous system and neurotransmitters at synapses; communication and social behaviour.
Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Learners who complete this Unit will be able to:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation
2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills

This Unit is available as a free-standing Unit. The *Unit Support Notes* in the Appendix, provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in Unit Assessment Support.
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Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- National 5 Biology Course or relevant Units

Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the Appendix: *Unit Support Notes.*

Standards

Outcomes and Assessment Standards

Outcome 1

The learner will:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation by:

1.1 Planning an experiment/practical investigation
1.2 Following procedures safely
1.3 Making and recording observations/measurements correctly
1.4 Presenting results in an appropriate format
1.5 Drawing valid conclusions
1.6 Evaluating experimental procedures

Outcome 2

The learner will:

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills by:

2.1 Making accurate statements
2.2 Solving problems

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

The key areas covered in this Unit are:
divisions of the nervous system and parts of the brain; perception and memory; the cells of the nervous system and neurotransmitters at synapses; communication and social behaviour.

Evidence can be drawn from a variety of sources and presented in a variety of formats.

The following table describes the evidence for the assessment standards which require exemplification. Evidence may be presented for individual outcomes, or gathered for the unit. If the latter approach is used, it must be clear how the evidence covers each outcome.

Assessment Standard	**Evidence required**
Planning an experiment	The plan should include: ♦ a clear statement of the aim ♦ a hypothesis ♦ a dependent and independent variable ♦ variables to be kept constant ♦ measurements/observations to be made ♦ the equipment/materials ♦ a clear and detailed description of how the experiment/practical investigation should be carried out, including safety considerations
Presenting results in an appropriate format	One format from: table, line graph, chart, key, diagram, flow chart, summary, extended text or other appropriate format
Drawing a valid conclusion	Include reference to the aim
Evaluating experimental procedures	Suggest two improvements with justification
Making accurate statements	At least half of the statements should be correct across the key areas of this Unit
Solving problems	One of each: ♦ make generalisations/predictions ♦ select information ♦ process information, including calculations, as appropriate ♦ analyse information

Exemplification of assessment is provided in Unit assessment support packs.
Advice and guidance on possible approaches to assessment is provided in the Appendix: *Unit Support Notes.*

Assessment Standard Thresholds

Outcome 1

Candidates are not required to show full mastery of the assessment standards to achieve Outcome 1. Instead, five out of the six assessment standards for Outcome 1 must be met to achieve a pass. Candidates must be given the opportunity to meet all assessment standards. The threshold has been put in place to reduce the volume of re-assessment where that is required.

Transfer of evidence
Evidence of Outcome 1 in a unit is transferrable between the other units at SCQF level 6.

Re-assessment
Candidates can be given the opportunity to re-draft their original Outcome 1 report or to carry out a new experiment/practical investigation.

Outcome 2

There is no requirement to pass assessment standard 2.1 (making accurate statements) and assessment standard 2.2 (solving problems) independently. Candidates can be assessed using a single test that contains marks and a cut-off score.
A suitable unit assessment will cover all of the key areas (assessment standard 2.1) **and** assess each of the problem-solving skills (assessment standard 2.2).

Where a candidate achieves 50% or more of the total marks available in a single unit assessment, they will pass Outcome 2 for that unit. Existing unit assessment support packs (UASPs) can be used, or centres can replace the questions with suitable alternatives of a similar standard

Unit assessment support pack 1 contains questions on all of the key areas (AS 2.1) and questions covering each of the problem solving skills (AS 2.2), and may be adapted for use as a single assessment. The number of marks available for each question should be combined to give the total number of marks available. A cut-off score of 50% should be applied to the unit assessments.

Outcome 2: assessment activity 2 – tests contain questions covering assessment standards 2.1 and 2.2 in a single assessment. These do not require to be adapted.

Important note: Centres can continue to assess AS 2.1 and 2.2 separately using the existing UASPs. If this option is chosen, 50% or more of the KU statements (AS 2.1) made by candidates must be correct in the unit assessment and at least one correct response for each problem solving skill (AS 2.2) is required to pass outcome 2. However, if a candidate is given more than one opportunity in a unit assessment to provide a response for a problem solving skill, then they must answer 50% or more correctly.

Re-assessment

SQA's guidance on re-assessment is that there should only be one or, in exceptional circumstances, two re-assessment opportunities. Re-assessment should be carried out under the same conditions as the original assessment. It is at the teacher or lecturer's discretion how they re-assess their candidates. Candidates may be given a full re-assessment opportunity, or be re-assessed on individual key areas and/or problem-solving skills. As there is no requirement to pass assessment standard 2.1 (making accurate statements) and assessment standard 2.2 (solving problems) independently, candidates must achieve 50% of the marks available in the re-assessment.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

1 Literacy

1.2 Writing

2 Numeracy

2.1 Number processes
2.2 Money, time and measurement
2.3 Information handling

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating
5.5 Creating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work.* The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the Appendix: *Unit Support Notes.*

Appendix: Unit support notes

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing this Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Assessment Support packs*

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Approaches to learning and teaching

key areas	Suggested learning activities	Exemplification of key areas
1 Divisions of the nervous system and parts of the brain		The nervous system analyses sensory information from the body and the external environment stores some aspects and makes decisions regarding appropriate responses and behaviours. It makes motor responses by initiating muscular contractions or glandular secretions.
(a)Structures and functions of the central nervous system (CNS).		Sensory and motor neurons of the somatic nervous system (SNS) control the voluntary movement of skeletal muscles. Homeostatic control through sensory neurons and motor neurons conducting involuntary impulses to smooth muscle, cardiac muscle and glands.
(b) Structures and functions of the peripheral nervous system (PNS) to include the autonomic nervous system (ANS) and the somatic nervous system (SNS). The antagonistic action of the sympathetic and parasympathetic systems on heart rate, breathing rate and digestive processes.		Sympathetic 'fight or flight' and parasympathetic 'rest and digest' responses on heart rate, breathing rate, peristalsis and intestinal secretions.
(c) The functions of the medulla and cerebellum in the central core of the brain.		The central core contains the medulla that regulates the basic life processes of breathing, heart rate, arousal and sleep and

key areas	Suggested learning activities	Exemplification of key areas
		the cerebellum which is responsible for controlling balance, posture and movement.
(d) The functions of the limbic system	Case studies investigating the role of the limbic system in regulating fear, anger, aggression, pleasure, pain, addiction, sexual behaviour, thirst or hunger.	Functions include processing information for memories and influencing emotional and motivational states.
(e) The functions of the cerebral cortex in receiving sensory information, coordinating voluntary movement and making decisions in the light of experience.	Examine data on clinical observations of brain injuries and lesions, EEGs, brain scans and split brain studies as evidence of localisation of brain function.	Cerebral cortex is the centre of conscious thought; it also recalls memories and alters behaviour in the light of experience.
(f) Localisation of brain functions to include sensory areas, motor areas and the association areas concerning language, personality, imagination and intelligence. Information from one side of the body is processed in the opposite side of the cerebrum, transfer of information occurs through the corpus callosum.	Examine brain images using PET and fMRI techniques that highlight active regions of the brain: PET highlights areas with an increased demand for glucose and oxygen. fMRI detects changes in blood flow and offers an anatomical and functional brain image.	Some association areas deal with thought processes., The left cerebral hemisphere deals with information from the right visual field and controls the right side of the body and vice versa.
2 Perception and memory (a) Perception is the process by which the brain analyses and makes sense out of incoming sensory information. The three areas of perception involve segregation of objects, perception of distance and recognition.		Perception allows us to segregate objects from one another and their background, recognise what they are and to judge their distance from us.
(i) Segregation of objects.		

key areas	Suggested learning activities	Exemplification of key areas
Perceptual organisation into figure and ground. Perceptual organisation of stimuli into coherent patterns. Visual cues such as relative size, superimposition and relative height in field. (ii) Perception of distance. Binocular disparity in judging distance. Perceptual constancy as objects become nearer and the viewing angle changes. (iii) Recognition. The importance of shape rather than detail in the recognition of objects. Matching perceived shapes to shape descriptions stored in memory and the role of inference in recognition. The influence of perceptual set where past experience, context or expectation influences the way a stimulus is perceived. (b) Memory involves storage, retention and retrieval of information. Memories include past experiences, knowledge and thoughts. All information entering the brain passes through sensory memory and enters short-term memory. Information is then transferred to long-term memory (LTM) or discarded.	Analyse reversible figure and ground images. Carry out experiments on the grouping of stimuli by proximity, similarity, closure, orientation or simplicity. Analyse images of depth perception. Plan and design investigations using the Muller-Lyer illusion. Analyse the appearance of depth created by stereoscopes, 3D slide viewers and 3D movies. Investigate the influence of perceptual set using ambiguous stimuli.	

key areas	Suggested learning activities	Exemplification of key areas
(i) Sensory memory. This lasts a few seconds and retains all of the visual or auditory input. (ii) Short-term memory (STM). This includes memory span, the serial position effect, maintaining items by rehearsal and loss of items by displacement and decay. Improvement of STM by 'chunking'. (iii) Long-term memory (LTM). The transfer of information from STM to LTM due to rehearsal, organisation and elaboration. Information is encoded using shallow encoding or elaborative encoding. Retrieval is aided by the use of contextual cues. (iv) Location of memory in the brain. Episodic and semantic memories are stored in the cortex. Procedural memories (skills) are linked to the motor cortex. Emotional memories involve links between the cortex and the limbic system. Spatial memory is located in the limbic system. **3 The cells of the nervous system and neurotransmitters at synapses** (a) Structure and function of neurons to	Design and carry out an investigation to determine the memory span for letters or numbers. Carry out an investigation on increasing memory span of STM by 'chunking' Carry out an investigation on the serial position effect. Carry out an investigation on the factors which improve retrieval from LTM. Case study on a memory disorder (eg Alzheimer's, stroke/brain injury, Aphasia, Amnesia, Wernicke-Korsakoff Syndrome). Analyse data on the mode of action of memory enhancing drugs (smart drugs).	Working memory is an extension of STM used to perform cognitive tasks. Repetition (shallow encoding) and previous memories (elaborative encoding). Contextual cues relate to the method of coding. Episodic memory (the memory of events and experiences) and semantic memory (the record of facts and concepts). Episodic and semantic memory are stored in the region of the cortex where the sensory information was first received and encoded.

key areas	Suggested learning activities	Exemplification of key areas
include dendrites, cell body and axons. Sensory, motor and inter neurons. Structure and function of myelin sheath in increasing the speed of impulse conduction. Myelination continues from birth to adolescence. Glial cells. Physically support neurons and produce the myelin sheath. They also maintain a homeostatic environment around the neurons and remove debris by phagocytosis. (b) Neurotransmitters at synapses. Chemical transmission at the synapse by neurotransmitters to include vesicles, synaptic cleft and receptors. The need for removal of neurotransmitters by enzymes or reuptake to prevent continuous stimulation of post-synaptic neurons. . Receptors determine whether the signal is excitatory or inhibitory. Synapses can filter out weak stimuli arising from insufficient secretion of neurotransmitters. Summation of a series of weak stimuli can trigger enough neurotransmitter to fire an impulse.	Examine suitable slides and photomicrographs of dendrites, cell body, axon and myelin sheath. Analyse causes, symptoms and treatments of polio, multiple sclerosis and Tay-Sachs disease. Examine data on the action of curare (a muscle relaxant and agonist that binds to acetylcholine receptors) and strychnine (a poison and antagonist that binds to receptors that inhibit motor neurons resulting in fully contracted skeletal muscles). Suitable examples to illustrate the mode of action of neurotransmitters include: Serotonin binding to its receptor is excitatory, GABA binding to its receptor is inhibitory, dopamine can exert an excitatory	Axons are surrounded by a myelin sheath which insulates the axon and increases the speed of impulse conduction from node to node. As a result responses to stimuli in the first two years of life are not as rapid or coordinated as those of an older child or adult. Certain diseases destroy the myelin sheath causing a loss of coordination. Neurotransmitters relay messages from nerve to nerve within and out with the brain. Neurons connect with other neurons, muscle fibres and endocrine at a synaptic cleft. Neurotransmitters are stored in vesicles and released into the cleft on arrival of an impulse. They diffuse across the cleft and bind to receptors on nerve endings.

key areas	Suggested learning activities	Exemplification of key areas
(c) Function of converging, diverging and reverberating neural pathways. Plasticity of response is created when new neural pathways are developed to create new responses, bypass areas of brain damage, to suppress reflexes or responses to sensory impulses.	or an inhibitory effect depending on the type of receptor. Acetylcholine is removed by enzymatic degradation and norepinephrine (noradrenaline) by reabsorption. Investigate suitable examples of pathways include: convergence of neurons from the rods in the retina increasing sensitivity to low levels of illumination through summation, divergence of motor neurons in fine motor control, reverberating pathways in breathing and short-term memory. Analyse data on the neural development of rat brains in stimulating and deprived environments. Analyse data on brain development and sensory deprivation (eg blind cats and feral children). Examine brain injury case histories. Investigate the ability of the brain to suppress reflexes or sensory impulses.	Converging neural pathways increase the sensitivity to excitatory or inhibitory signals. Diverging neural pathways influence several neurons at the same time. Reverberating pathway neurons later in the pathway synapse with earlier ones sending the impulse back through the circuit.
(d) Neurotransmitters, mood and behaviour. The functions of endorphins and dopamine. Endorphins are neurotransmitters that stimulate neurons involved in reducing the intensity of pain. Increased levels are also connected with euphoric feelings, appetite modulation and release of sex hormones. Endorphin production increases in response to severe injury, prolonged and continuous exercise, stress and certain foods. Dopamine induces the feeling of pleasure and reinforces particular behaviour in the reward	Analyse data on the links between base endorphin levels and pain threshold, depression and appetite.	The reward pathway involves neurons which secrete or respond to the neurotransmitter dopamine. The reward pathway is activated on engagement of beneficial behaviours, eg eating when hungry.

key areas	Suggested learning activities	Exemplification of key areas
pathway. Neurotransmitter related disorders and their treatment. Agonists bind to and stimulate receptors mimicking the neurotransmitter. Antagonists bind to specific receptors blocking the action of the neurotransmitter. Other drugs inhibit the enzymes which degrade neurotransmitters or inhibit re-uptake. (e) Mode of action of recreational drugs. Can mimic neurotransmitters. Changes in neurochemistry alter mood, cognition, perception and behaviour. Many recreational drugs affect neurotransmission in the reward circuit of the brain.	Suitable case studies include Alzheimer's (loss of brain cells that synthesise acetylcholine and the use of cholinesterase inhibitors); Parkinson's (loss of dopamine synthesising neurons and the use of L-dopa crossing the blood brain barrier, monamine oxidase inhibitors and the potential use of adult stem cells); schizophrenia (overactive dopamine system and the use of dopamine antagonists); generalised anxiety disorders (imbalance in serotonin and norepinephrin and the use of GABA agonists and beta blockers); depression (low levels of serotonin and norepinephrin re-uptake inhibitors and monoamine oxidase enzyme inhibitors). Suitable case studies include: cocaine blocking dopamine re-uptake channels, cannabis binding to cannabinoid receptors,	Many drugs used to treat neurotransmitter related disorders are similar to neurotransmitters. Recreational drugs may stimulate the release of neurotransmitters, imitate their action (agonists), block their binding (antagonists), and/or inhibit their re-uptake/enzymatic degradation.

key areas	Suggested learning activities	Exemplification of key areas
Drug addiction/tolerance. Sensitisation is an increase in the number and sensitivity of neurotransmitter receptors as a result of exposure to drugs that are antagonists and leads to addiction. Desensitisation is a decrease in the number and sensitivity of receptors as a result of exposure to drugs that are agonists and leads to drug tolerance.	the synthetic hallucinogen MDMA (ecstasy) stimulating serotonin levels and inhibiting its re-uptake, alcohol binding to GABA receptors and elevating dopamine levels, nicotine activating nicotinic receptors increasing the levels of dopamine, serotonin and epinephrine. Analyse data on the influence of alcohol on reaction time. Investigate genetic components of addiction. Examine drug rehabilitation programmes which combat physical tolerance (eg methadone and buprenorphine) and psychological dependency (eg counselling and cognitive-behavioural approaches).	
4 Communication and social behaviour (a) The effect of infant attachment. Infant attachment studies. Early infant attachment is important in laying the foundation for the future formation of stable relationships. Secure attachment and insecure attachment, responses of detachment, anger or inconsistent responses. Socialisation and learning. Humans have a long period of dependency on	Observe, measure and record infant behaviour (for example play, distress and proximity in the strange situation).	Attachment becomes evident between 6 and 9 months. Measures of attachment in 'the strange situation'. Infants that form secure attachments are more likely to investigate their immediate environment helping the development of cognitive abilities. As children develop, different methods of control can influence social competence.

key areas	Suggested learning activities	Exemplification of key areas
adults providing time for socialisation and learning to occur. Authoritative control generally results in greater social competence than permissive control. (b) The effect of communication. The importance of non-verbal communication in the formation of relationships between individuals and how it can signal attitudes and emotions as well as acting as an aid to verbal communication. Verbal communication is used in the transmission of knowledge, development of culture and social evolution. (c) The effect of experience. Learning is a change in behaviour as a result of experience. The repeated use of a motor skill results in a motor pathway being established. Human behaviour may be learned by observation and imitation.	Analyse silent video clips for the six main types of facial expression (happiness, sadness, disgust, fear, anger and surprise). Measure non-verbal communication in video clips by observing and recording, for example, facial expression, eye contact, touching, tone of voice and physical proximity. Design and carry out an investigation on learning using a finger maze. Design and carry out an investigation on the speed of performance of a task by	Language uses symbols to represent information and enables it to be organised into categories and hierarchies thus accelerating learning and intellectual development.

key areas	Suggested learning activities	Exemplification of key areas
Reinforcement, shaping and extinction of behaviour as seen in trial and error learning. Generalisation and discrimination. (d) The effect of group behaviour and social influence. Social facilitation. Increased performance in competitive/audience situations. De-individuation. Loss of personal identity in a group leading to diminished restraints on behaviour. Internalisation is the changing of beliefs as a result of persuasion. Identification is the changing of beliefs to be like an admired	following instructions and by imitation. Case studies of rewarded behaviour, unrewarded behaviour and shaping in learning.	Reinforcement is when behaviour patterns that have positive consequences for the individual are likely to be repeated. Shaping is the rewarding of behaviour that approximates to the desired behaviour. Extinction happens when behaviour patterns are not rewarded and so are likely to disappear. Generalisation and discrimination may result in, for example, a child who has been bitten by a dog to fear all dogs (generalisation) or only to fear large dogs (discrimination). De-individuation is often used to explain the anti-social behaviour of some groups which would not be shown by individuals from these groups on their own.

key areas	Suggested learning activities	Exemplification of key areas
influencing source.	Examine and discuss strategies of persuasion and identifying with respected or admired individuals used in drug education and advertising.	

Administrative information

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Superclass: RH

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	Page 1 – the description of key areas under 'Unit outline' has been revised to give more information Page 4 – in Outcome 1.3, the word 'accurately' has been replaced by 'correctly'. Page 5– the Evidence Requirements have been rewritten to better explain what is required Page 5 – information has been added on Transfer of Evidence	Qualifications Development Manager	August 2014
3.0	Assessment Standards 2.2 & 2.3 removed	Qualifications Development Manager	June 2014
4.0	Updated to ensure consistency of wording of Evidence Requirements with Unit outline and in regard to the mandatory key areas.	Qualifications Manager	April 2015
5.0	Level changed from Higher to SCQF level 6. Unit support notes added. Assessment standard threshold added.	Qualifications Manager	September 2018
6.0	Unit code updated	Qualifications Manager	July 2019