IB Biology Y1 Unit 5: Equilibrium

Teacher(s)	IB Biology Y1 Logue PLC Logue/Trotter	**Subject group and course**	Group 4/IB Biology Y1 SL MHS Y1 SGO		
Course part and topic	Unit 5 Equilibrium C3.1, D3.3	**SL or HL/Year 1 or 2**	SL Y1	**Dates**	7 weeks
Unit description and texts		**DP assessment(s) for unit**			

Homeostasis is a dynamic equilibrium that is maintained in body tissues and organs. It is dynamic because it is constantly adjusting to the changes that the systems encounter. It is an equilibrium because body functions are kept within a normal range, with some fluctuations around a set point.
 	
The maintenance of homeostasis in the body typically occurs using feedback loops that control the body's internal conditions.
 	
Feedback loop is defined as a system used to control the level of a variable in which there is an identifiable receptor (sensor), control center (integrator or comparator), effectors, and methods of communication.
 	
Sickle Cell Theme throughout the course
New IB Biology Guide First Assessment 2025
		• Unit Formative and Summative assessment(s)
		  • Research Paper - How does sickle cell affect homeostasis?
		  • Homeostasis: Negative Feedback Pathways in the Human Body Activity			

Topic Abbreviations:
Themes: A = Unity & Diversity, B = Form & Function, C = Interaction & Interdependence, D = Continuity & Change
Level of Organization: 1 = Molecules, 2 = Cells, 3 = Organisms, 4 = Ecosystems

INQUIRY: Establishing the purpose of the unit

Statement of Inquiry:
In recent years, the basic biochemical unity of all plants, fungi, animals, and microbes has become increasingly apparent.

Phenomenon: The correction of anemia in Sickle Cell Disease requires careful balancing of the detrimental effects of anemia with the potential risks associated with increased blood viscosity.

Crosscutting Concepts

- Systems and System models
- Patterns
- Stability and Change
- Interactions and Equilibrium

CORE IDEAS

- Integration of Body Systems
- Levels of organization
- Nervous System
- Endocrine System
- Brain
- Sleep
- Hormones
- Feedback mechanisms
- Peristalsis
- Homeostasis
- Regulation of Blood Glucose
- Type 1 & 2 Diabetes
- Thermoregulation

SEP:

- Asking Questions and Defining Problems
- Constructing Explanations
- Analyze & Interpret Data

ACTION: teaching and learning through inquiry

Content/skills/concepts—essential understandings **Themes: A = Unity & Diversity, B = Form & Function, C = Interaction & Interdependence, D = Continuity & Change** **Level of Organization: 1 = Molecules, 2 = Cells, 3 = Organisms, 4 = Ecosystems** **GQ - Guiding Questions** **NOS - Nature of Science** **AOS - Application of Skills** **LQ - Linking Question**	**Learning process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
C3.1, D3.3 Students will know the following content/Students will grasp the following concepts: **C3.1 Integration of Body Systems (Interaction and Interdependence - Organisms)** **GQ -** ● **What are the roles of nerves and hormones in integration of body systems?** ● **What are the roles of feedback mechanisms in regulation of body systems?** **Guidance:** **C3.1.1—System integration** This is a necessary process in living systems. Coordination is needed for component parts of a system to collectively perform an overall function. **C3.1.2—Cells, tissues, organs and body systems as a hierarchy of subsystems that are integrated in a multicellular living organism** Students should appreciate that this integration is responsible for emergent properties. For example, a cheetah becomes an effective predator by integration of its body systems. **C3.1.3—Integration of organs in animal bodies by hormonal and nervous signaling and by transport of materials and energy** Distinguish between the roles of the nervous system and endocrine system in sending messages. Using examples, emphasize the role of the blood system in transporting materials between organs.	Learning experiences and strategies/planning for self-supporting learning: Lab Investigations/Activities Lecture Socratic Seminar Small Group/Pair Work PowerPoint Lecture Notes Individual Presentations Group Presentations Student Lecture/Leading the class Interdisciplinary Learning Details: Modeling, Think/Pair/Share, CER, Writing Prompts, Videos, etc. Accommodations: ● *SWD/504 – Accommodations Provided* ● *ELL – Reading & Vocabulary Support* ● *Intervention Support* ● *Extensions – Enrichment Tasks and Project* **Assessment Objectives:**

C3.1.4—The brain as a central information integration organ Limit to the role of the brain in processing information combined from several inputs and in learning and memory. Students are not required to know details such as the role of slow-acting neurotransmitters. **C3.1.5—The spinal cord as an integrating center for unconscious processes** Students should understand the difference between conscious and unconscious processes. **C3.1.6—Input to the spinal cord and cerebral hemispheres through sensory neurons** Students should understand that sensory neurons convey messages from receptor cells to the central nervous system. **C3.1.7—Output from the cerebral hemispheres to muscles through motor neurons** Students should understand that muscles are stimulated to contract. **C3.1.8—Nerves as bundles of nerve fibers of both sensory and motor neurons** Use a transverse section of a nerve to show the protective sheath, and myelinated and unmyelinated nerve fibers. **C3.1.9—Pain reflex arcs as an example of involuntary responses with skeletal muscle as the effector** Use the example of a reflex arc with a single interneuron in the grey matter of the spinal cord and a free sensory nerve ending in a sensory neuron as a pain receptor in the hand. **C3.1.10—Role of the cerebellum in coordinating skeletal muscle contraction and balance** Limit to a general understanding of the role of the cerebellum in the overall control of movements of the body. **C3.1.11—Modulation of sleep patterns by melatonin secretion as a part of circadian rhythms** Students should understand the diurnal pattern of melatonin secretion by the pineal gland and how it helps to establish a cycle of sleeping and waking. **C3.1.12—Epinephrine (adrenaline) secretion by the adrenal glands to prepare the body for vigorous activity** Consider the widespread effects of epinephrine in the body and how these effects facilitate intense	The assessment objectives for biology reflect those parts of the aims that will be formally assessed either internally or externally. It is the intention of this course that students can fulfil the following assessment objectives. 1. Demonstrate knowledge of: A. terminology, facts, and concepts B. skills, techniques, and methodologies. 2. Understand and apply knowledge of: A. terminology and concepts B. skills, techniques, and methodologies. 3. Analyze, evaluate, and synthesize: A. experimental procedures B. primary and secondary data C. trends, patterns, and predictions. 4. Demonstrate the application of skills necessary to carry out insightful and ethical investigations

muscle contraction.

C3.1.13—Control of the endocrine system by the hypothalamus and pituitary gland
Students should have a general understanding, but are not required to know differences between mechanisms used in the anterior and posterior pituitary**.**

C3.1.14—Feedback control of heart rate following sensory input from baroreceptors and chemoreceptors
Include the location of baroreceptors and chemoreceptors.
Baroreceptors monitor blood pressure. Chemoreceptors monitor blood pH and concentrations of oxygen and carbon dioxide. Students should understand the role of the medulla in coordinating responses and sending nerve impulses to the heart to change the heart's stroke volume and heart rate.
C3.1.15—Feedback control of ventilation rate following sensory input from chemoreceptors
Students should understand the causes of pH changes in the blood. These changes are monitored by chemoreceptors in the brainstem and lead to the control of ventilation rate using signals to the diaphragm and intercostal muscles.

C3.1.16—Control of peristalsis in the digestive system by the central nervous system and enteric nervous system
Limit to initiation of swallowing of food and egestion of feces being under voluntary control by the central nervous system (CNS) but peristalsis between these points in the digestive system being under involuntary control by the enteric nervous system (ENS). The action of the ENS ensures passage of material through the gut is coordinated.
LQ -

- **What are examples of branching (dendritic) and net-like (reticulate) patterns of organization?**
- **What are the consequences of positive feedback in biological systems?**

D3.3 Homeostasis (Continuity and Change - Organisms)
GQ -

- **How are constant internal conditions maintained in humans?**
- **What are the benefits to organisms of maintaining constant internal conditions?**

Guidance:
D3.3.1—Homeostasis as maintenance of the internal environment of an organism

Variables are kept within preset limits, despite fluctuations in external environment. Include body temperature, blood pH, blood glucose concentration and blood osmotic concentration as homeostatic variables in humans. **D3.3.2—Negative feedback loops in homeostasis** Students should understand the reason for use of negative rather than positive feedback control in homeostasis and that negative feedback returns homeostatic variables to the set point from values above and below the set point. **D3.3.3—Regulation of blood glucose as an example of the role of hormones in homeostasis** Include control of secretion of insulin and glucagon by pancreatic endocrine cells, transport in blood and the effects on target cells. **D3.3.4—Physiological changes that form the basis of type 1 and type 2 diabetes** Students should understand the physiological changes, together with risk factors and methods of prevention and treatment. **D3.3.5—Thermoregulation as an example of negative feedback control** Include the roles of peripheral thermoreceptors, the hypothalamus and pituitary gland, thyroxin and also examples of muscle and adipose tissue that act as effectors of temperature change. **D3.3.6—Thermoregulation mechanisms in humans** Students should appreciate that birds and mammals regulate their body temperature by physiological and behavioral means. Students are only required to understand the details of thermoregulation for humans. Include vasodilation, vasoconstriction, shivering, sweating, uncoupled respiration in brown adipose tissue and hair erection. **LQ -** • **For what reasons do organisms need to distribute materials and energy?** • **What biological systems are sensitive to temperature changes?**	
Students may be assessed daily with classwork, discussions, group work, and reflections using a variety of formats with a focus on the applications and skills provided in the syllabus.	**Formative assessment:** Quiz/Test Lab Analysis/Report Project/Model

	CER/Reflection Essay/Writing Assignment

Students will be assessed per subtopic and then at the end of the unit (Topic) to ensure understanding using IB exam style questions, modeling, reflection, lab reports, and writing prompts Students may be aware of many of the concepts within this unit, so building on prior knowledge using scaffolding techniques to aid students in a deeper understanding and extending learning to ensure that students can meet the goals set by the unit.	**Summative assessment:** Quiz/Test Lab Analysis/Report Lab Practical Project/Model CER/Reflection Essay/Writing Assignment Differentiation: Affirm Identity - build self-esteem Value Prior Knowledge Scaffold Learning Extend Learning Details: Many concepts may be familiar to the students and others will need more scaffolding and extension.

Approaches to learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see [the guide](#).

Thinking - Asking questions and defining problems
Social Communication- Constructing Explanations
Self-management - Asking questions and defining problems
Research- Developing and using models

Language and learning *Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.*	TOK connections *Check the boxes for any explicit TOK connections made during the unit*	CAS connections *Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*
Activating Background Knowledge Scaffolding for new learning Acquisition of new learning through practice Demonstrating proficiency Poikilotherms (animals that have a variable body temperature) are more effective producers of protein than homeotherms (animals that maintain a regulated body temperature) as they have a higher rate of conversion of food to biomass.	Personal and Shared Knowledge Ways of Knowing Areas of Knowledge The Knowledge Framework Details: The precautionary principle is meant to guide decision-making in conditions where a lack of certainty exists. Is certainty ever possible in the natural sciences?	Creativity Activity Service Details: Modeling and active participation in the learning process. Creating materials to aid their fellow classmates in understanding a particular concept through peer interaction and team/group activities.

International Mindedness/Aims:

International Mindedness: (Research/Reflections/Writing)
How does sickle cell affect homeostasis?
Global migration and the changing distribution of sickle hemoglobin

Aims: (Labs/Activities/Student Reflections/CER Activities)

The course enables students, through the overarching theme of the NOS, to:

1. **develop conceptual understanding that allows connections to be made between different areas of the subject, and to other DP sciences subjects**
2. **acquire and apply a body of knowledge, methods, tools, and techniques that characterize science**
3. **develop the ability to analyze, evaluate and synthesize scientific information and claims**
4. **develop the ability to approach unfamiliar situations with creativity and resilience**
5. **design and model solutions to local and global problems in a scientific context**
6. **develop an appreciation of the possibilities and limitations of science**
7. **develop technology skills in a scientific context**
8. **develop the ability to communicate and collaborate effectively**
9. **develop awareness of the ethical, environmental, economic, cultural, and social impact of science.**

Resources

- Textbook TBD – evaluation of resources
- IB Biology Guide First Assessment 2025
- Van de Lagemaat, R. www.inthinking.net: Andorra la Vella, Andorra, 2019.
- IB Biology Schoology Course
- Discovery Education Biology and Chemistry Resources

Additional Resources: Old Syllabus

- Damon, A.; McGonegal, R.; Tosto, P.; Ward, W. *Standard level biology*; Pearson Education Limited: Harlow, Essex, 2014.
- Greenwood, T.; Pryor, K.; Bainbridge-Smith, L.; Allan, R. Environmental science: student workbook; Biozone International: Hamilton, New Zealand, 2013.
- Hodder Study and Revision Guide for the IB Diploma

Hodder IA Internal Assessment for Biology

Stage 3: Reflection—considering the planning, process and impact of the inquiry

What worked well *List the portions of the unit (content, assessment, planning) that were successful*	What didn't work well *List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	Notes/changes/suggestions: *List any notes, suggestions, or considerations for the future teaching of this unit*