Human Physiology 110

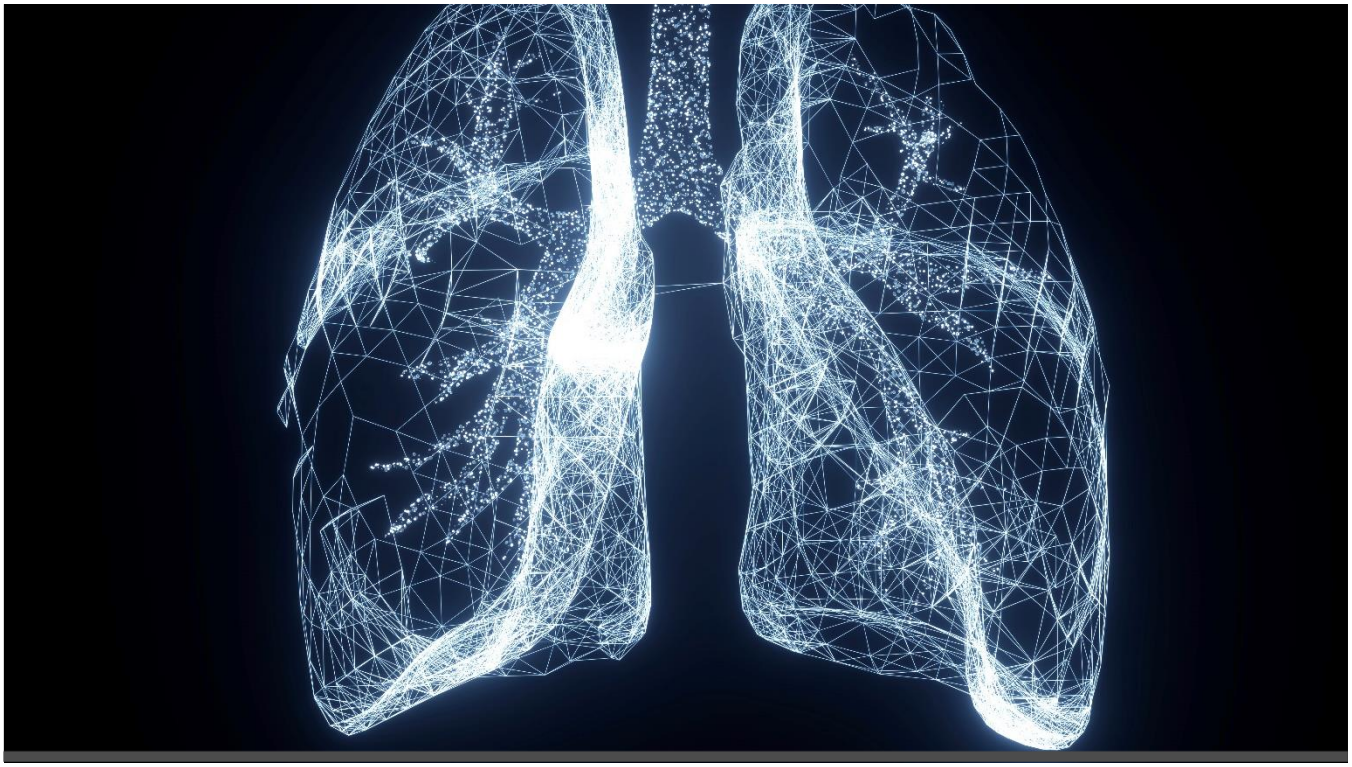
HIGH SCHOOL CURRICULUM COMPANION DOCUMENT

Description and Rationale

This companion document for New Brunswick Human Physiology 110 is designed to help any educator implement the course at their school(s) regardless of their years of teaching, training, or experience.

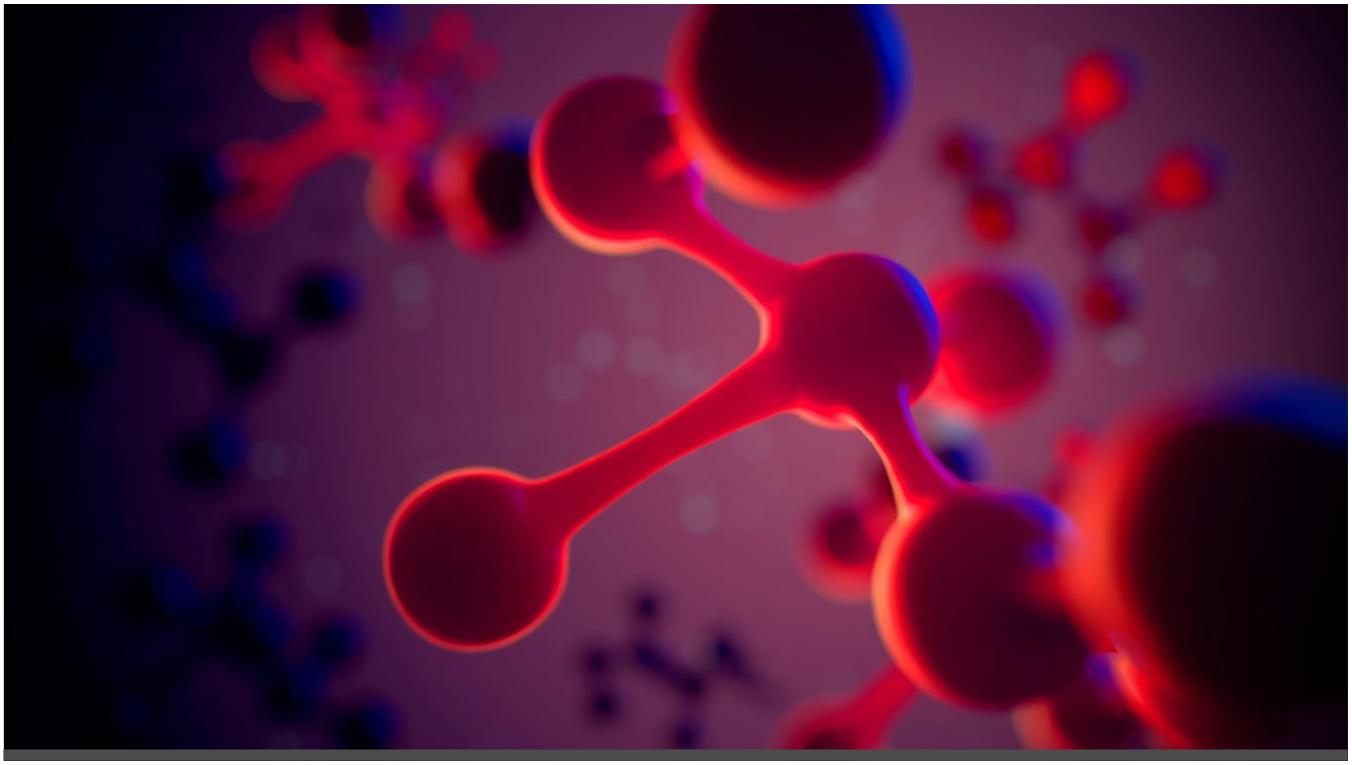
Educators can use this document to support a variety of engaging instructional practices, hands-on investigations, and group activities. To develop scientific literacy, diverse learning experiences provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment. Observations, systems thinking, and inquiry skills are highlighted within this document as instructional practices.

This companion document is a tool aligned to the design of learning areas which includes strands, big ideas and skill descriptors for educators looking to support learners. To use the document effectively, educators will want to become familiar with the prescribed curriculum and understand the knowledge and skills outlined in the achievement indicators that learners will be able to demonstrate. This companion document contains instructional strategies, labs, inquiry opportunities, potential assessments, and background information to support prescribed curriculum delivery.

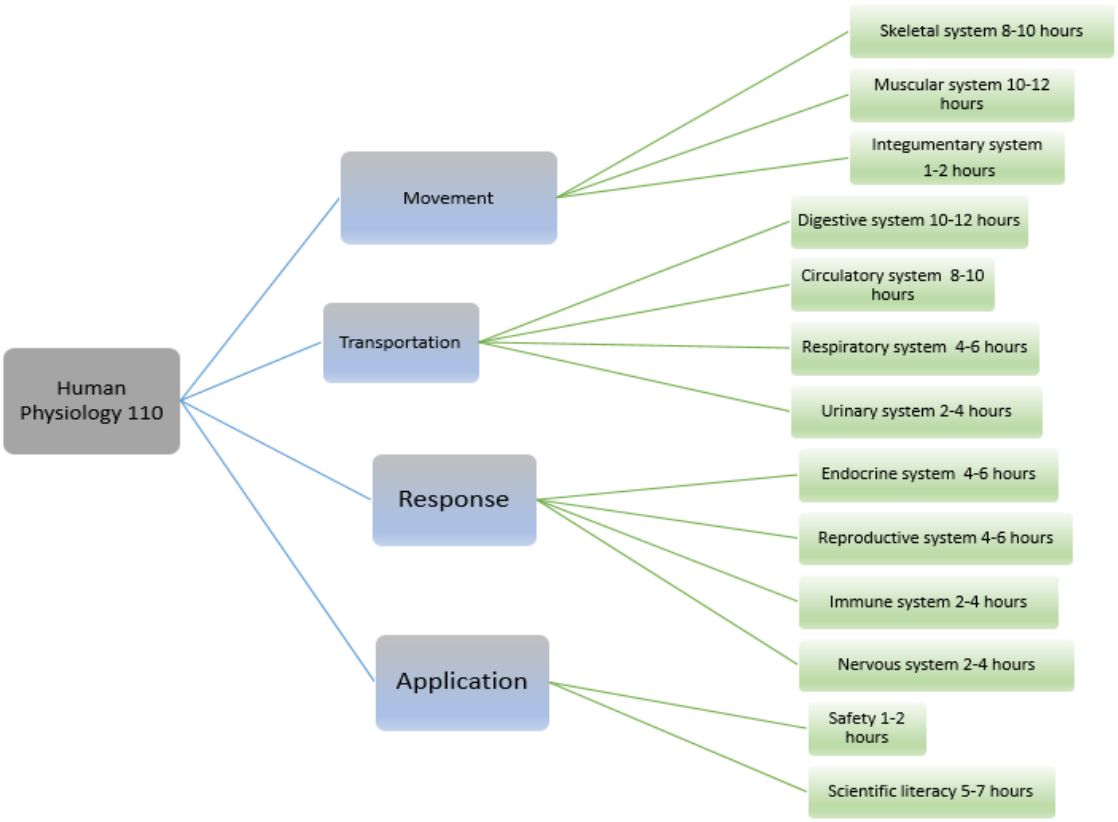


Core Concepts

Context	Movement	Transportation	Response	Application
Concepts	• Body Movement • Skeletal system movement • Muscular system aids movement • Relationship of integumentary system to movement	• Nutrition and Gas Transportation • Nutrient movement through digestion • Factors influencing blood movement • Factors influencing gas movement • Blood filtration through urinary system	• Response to Changes • Hormones • Interactions between reproductive and endocrine • Immune response to pathogens • Nervous system response to stimuli	• Application and practice • Safety • Lab skills • Scientific literacy skills • Human physiology careers



Pacing Guide/Curriculum Mapping



Strand 1: Movement 19-24 hours

Strand 2: Transportation 24-32 hours

Strand 3: Response 12-20 hours

Strand 4: Application 6-9 hours

Flexible: 5-7 hours These hours are to be allotted into above sections in case extra time is needed for mastery or can be used to complete a final demonstration of learning if that is part of the course outline developed by the educator. This time could also be devoted to extension activities.

Assessment

EXAMPLES OF FORMATIVE ASSESSMENT STRATEGIES:

Concept map	Investigation	Think-Pair-Share
Observation	Checklist/rubric	Quiz (low stakes)
Relay race	Response to text/activity	Classroom poll
Demonstration	Reflective scientific journal	Strategic questioning
Presentation	Self- and peer-assessment	Role-play
Escape room	Career portfolio	Hand in, pass out
Technology application	Entrance/exit slip	Mini whiteboards
Quick extension project	Predict-observe-explain	Polly (Microsoft Teams)

Educator Strategies and Templates: This SharePoint site includes Education and Early Childhood Development (EECD) curated suggestions for assessment strategies.

Summative assessment is used to inform the achievement of learning for a reporting period or a program of study. This may be a combination of performance tasks – final presentation, test, project, essay, etc.

- Assessing, Evaluating, and Reporting K-12: this SharePoint site includes report card guideline documents and other New Brunswick education assessment supports.
- Myron Dueck Educational Consulting: this website helps educators generate ideas and navigate issues surrounding grading, assessment, reporting and student voice.

Effective Teaching Strategies

Experiential and inquiry-based learning approaches are effective teaching strategies for Human Physiology 110. These teaching strategies involve active engagement with science experiences, critical thinking and problem-solving that matters to learners and educators. Some suggested strategies and principles come from the New Brunswick Curriculum Framework:

- Holding All Learners in the Highest Regard
- Safe and Positive Spaces for Learning
- Direct Instruction
- Experiential Learning
- Relevant Learning
- Play and Inquiry-Based Learning

Scientific journaling can be completed together with self- assessment and goal setting. Educators can model various examples of famous scientists' journals to showcase the learning and scientific process. Learners can treat the human physiology course in the same way through journals by reflecting on their learning, asking questions, generating hypotheses, outlining next steps, and verbalizing their learning goals (Gregory, Cameron, Davis, 2011).

Field trips provide opportunities for learners to engage in authentic learning experiences. They can be visiting worksites of medical professionals or a science centre visit focused on human physiology. Learners will develop their inquiry, observation, and reflection skills.

Simulations and role play activities provide learners with immersive experiences to explore and practise skills. They provide opportunities for learners to consider alternative perspectives (Sharifi, Ghanizadeh & Jahedizadeah, 2017).

Coaching and mentorship collaborations with individuals involved in human physiology, kinesiology, nursing or medicine can lead to internships and apprenticeships, providing learners opportunities to gain practical experiences and develop career related skills (Harwell-Kee, 2019).

Inquiry – based learning is fundamental to science skill development. Some effective inquiry-based strategies from the Smarter Science Framework, 2011 and the National Research Council A framework for K-12 science education, 2012.

- **Initiate and Plan** - encourage learners to ask questions and help develop their questioning skills by providing prompts and provocations. What evidence do you need? Have learners formed hypotheses from questions and research?
- **Record** - develop observation and recording skills by practising and using a journal or notebook for their observations, thoughts, and reflections. Encourage learners to use tools and/or technology to amplify their senses and record data properly and accurately.
- **Perform** - Provide opportunities for learners to experiment and test their hypotheses and answer questions. Consider knowledge and skills about variables, controls, and the scientific process.
- **Analyze and Interpret** - Create models or simulations of agricultural processes through a variety of materials and techniques to represent their ideas.
- **Communicate** - encourage and provide opportunities to collaborate, share and communicate physiological science concepts and ideas within the classroom and beyond in the wider community.
- **Predict – Explain, Observe – Explain Graphic worksheet**

There are many things to keep in mind when considering how to teach a concept. The following have been adapted from Fizzics Education.

Group dynamics.

Who works well with whom? Who can handle cooperative group situations and who needs time to work by themselves?

Learner ability.

Learner's ability to undertake the work with the materials at hand, not simply science understanding.

Timeframe.
Is the teaching method likely to be successful given how long it takes to get learners on task and the anticipated outcomes?

Context.
How does the scientific concept relate to their lives?

Content.
Which teaching method will help the learners best understand the lesson material?

EXAMPLES OF EDUCATOR- AND LEARNER-CENTERED INSTRUCTION

EDUCATOR-CENTRED

In this approach, direct instruction is the focus. Learners take notes or ask questions through the educator's presentation. This strategy is effective for large groups of learners or for when you need to get through complex concepts. Some key strategies to make the presentation engaging may include inserting graphics, video snippets, animations, science demonstrations, audio grabs, guest appearances via video conference, incorporating learner polling. An advantage of getting active learner feedback is that this formative assessment can help shape your presentation and future lessons to fit the learner's needs.

LEARNER-CENTRED

Incorporate experimental materials where learners work in small groups or by themselves, the lesson has a clear question that learners need to find an answer to with the educator acting as a facilitator. There are different variations:

- Learners follow an experimental procedure with a clear set of instructions and scaffold for their scientific report.
- Learners explore the materials themselves to design and test their own fair experiment, keeping variable testing in mind. This version is effective for learners who already have a clear understanding of the scientific method and are independent thinkers.
- Station-based rotations. Learners rotate around the classroom to explore a variety of hands-on materials that cover an aspect of a lesson topic. Ensure enough time for the learners to complete each activity and access all resources. Stations can be linked via a scenario such as a forensics investigation; some learners will enjoy the role play!

PROJECT-BASED LEARNING (LEARNER-CENTRED)

The hands-on activities above extend to involve learners in a deep dive into a given topic. Time is key as learners will be engaged over an extended period of time in researching their topic, designing their experiment or model, writing a scientific report, creating a poster and presenting their findings in a short talk. In scope and sequence, consider access to resources both within and beyond school and how the learners might be able to involve the community in their research or as an audience for the final presentation at a school science fair. Project Based Learning (PBL) can include several of the following:

- Field journal
- Student Podcast
- Working model
- Science poster
- Research paper
- Video diaries
- Augmented reality or Virtual reality
- App creation

PEER-LED TEAM LEARNING (LEARNER-CENTRED)

Peer-led team learning (PLTL) is about empowering the learners to teach their peers. PLTL can be used when pairing learners with a high level of achievement with peers needing help. With supervision, this approach can be effective for learners to develop leadership skills.

Learning Environment Considerations

PHYSICAL SPACE

Consider alternative learning spaces where the big ideas can be engaged (e.g., outdoors, BBT labs, library, field trips, laboratories, college, and university partnerships). If the regular classroom is the only available space, consider limiting the variety of learner choice to reflect the limitations of time and space.

SETUP

Flexible seating to allow for a variety of learning environments – individual, pair and/or group work. Have materials readily available/accessible for student use (e.g., White boards/project materials).

ROUTINES

Learners can benefit from routine. Learners like to know what to expect. After teaching a new concept, provide learners with an exit slip to inform teaching – do you need to revisit the topic tomorrow? Learner polling is an engaging, interactive way to check for understanding of new vocabulary/concepts.

Science as a Way of Knowing

An inclusive science program recognizes that Western science, or Eurocentric science, are not the only forms of empirical knowledge about nature and aims to broaden learner understanding of ways of knowing the world. The terms “traditional knowledge” and “Indigenous Knowledge” are examples sometimes used when referencing Indigenous or local First Nation knowledge systems. The dialogue between scientific

researchers and traditional knowledge holders continues, and there are examples of individuals who may self-identify or be welcomed within more than one group. Different ways of knowing the world may intersect when asking critical questions like,

- Whose research is it?
- Who owns the research or knowledge?
- Whose interest does the research or knowledge serve?
- Who will benefit from the research or knowledge?
- Who has designed the research questions and framed its scope?
- Who will carry out/who carried out the research? Who will write the research or knowledge?
- How will the research or knowledge be disseminated?

(adapted from Smith, 2012 p. 10)

Enhanced science curriculum supports both Indigenous and Western methods, represents complementary, not separate, or conflicting realities, and broadens the purpose of science education to support nature literacy.

"Two-Eyed Seeing means to see with the strengths of both Indigenous and Western knowledges. At times, certain problems or situations require us to privilege one or the other world view. At other times, the two work together in harmony. The two perspectives are not inherently compatible. For most of us, at least for now, Two-Eyed Seeing requires a great deal of conscious effort to respect the differences between the two perspectives and to focus on, and work from, a position of shared strengths." (Marshall, Marshall and Iwama, p. 177)

INDIGENOUS WAYS OF KNOWING

Traditional knowledge is a cumulative body of knowledge, know-how, practices, and representations maintained and developed by Indigenous Peoples with extended histories of interaction with the natural environment (Battiste, 2013). These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, resource use practices, ceremony, spirituality, and worldview (adapted from International Council for Science, 2002 as cited by Restoule, 2019). As an example, "Our culture is based on oral histories, meaning that what we need to know is passed on from generation to generation through oral histories, mentorship, and hands-on learning experience. The Mi'kmaq used wampum, chewed birchbark, and wrote hieroglyphics; we also etched petroglyphs into stone as physical representations of information" (Mi'kmawey Debert Cultural Centre, 2015 p. 16). To be curious about this body of knowledge and way of knowing will enhance science learning.

SCIENTIFIC WAYS OF KNOWING

Scientific research, Western science, Eurocentric science, are cumulative bodies of knowledge, know-how, practices, and representations that are actively developed and curated by scientists. In mainstream society,

some scientific bodies of knowledge are more widely known or valued, and some are less known or valued. To study the natural world, scientists use empirical methods, grounded in observations and experimentation, and rely on types of evidence and testing.

Indigenous Ways of Knowing, Indigenous methods including observation, storytelling, connection of Indigenous Peoples to the land and ceremony, add value to scientific inquiry and scientific practices.

Resources to Support the Course

SIMULATIONS AND ACTIVITIES:

In the following table, videos, sample simulations and activities have been included as suggestions to support the content of Human Physiology 110. Educators can use professional judgment to determine if these resources complement their teaching style.

Topic	Skill descriptor	Link	Notes
The visible body learn site	Evaluate how skeletal system allows movement.	The visible body	An anatomy and physiology learn site with videos and interactive images for all human body systems.
Bone anatomy viewer	Evaluate how skeletal system allows movement.	Bone anatomy viewer	Explore the parts of a bone and learn about functions. Also allows learners to assess knowledge with a bone parts ID game.
Aurum Science	Evaluate how skeletal system allows movement.	Bone classification colouring activity	Includes a summary table for bone types. Bone classification colouring activity File Science SharePoint
The human body game- STEM learning	Evaluate how muscular system facilitates movement.	Exploring movement activity	Learners make a model of the elbow joint and observe how muscles make the lower arm both bend and straighten. Exploring movement activity File Science SharePoint
CSI web adventures	Apply scientific literacy skills.	No bones about it	Learners examine the relationship between the

			length of various bones and an individual's height. No bones about it File Science SharePoint
Virtual anatomy lab **Muscular system**	Evaluate how muscular system facilitates movement.	Muscle cell types images	Provides images of various muscle tissues on macroscopic and microscopic level.
The visible body-Musculoskeletal system	Evaluate how skeletal system allows movement.	Musculoskeletal lab activity	A combination of articles, images and questions that allow learners to examine bones, muscles, and joints. Musculoskeletal lab activity File Science SharePoint
The biology corner **anatomy and physiology**	Evaluate how muscular system facilitates movement.	The muscular system lessons and more	PowerPoint lessons, colouring pages, and case studies. Muscle colouring worksheet
Aurum Science	Investigate how nutrients move through the four stages of digestion.	Digestive system resources	PowerPoint lecture notes, study guide and other resources to support digestive system topics.
Life science teaching resource community	Investigate how nutrients move through the four stages of digestion.	Digestion simulation lab	In this activity learners will model the anatomy and general mechanisms of digestion and movement of food through the digestive system. Digestion simulation lab File Science SharePoint
Biology corner-anatomy and physiology	Apply scientific literacy skills.	Circulatory system notes	PowerPoint lessons, guided notes, colouring pages, and some case studies related to the circulatory system.
BioInteractive-cardiology virtual lab	Analyze the factors that influence the movement of blood through the circulatory system.	Cardiology virtual lab	This interactive lab explores the tools that doctors use to examine and diagnose patients with heart conditions.
Science buddies	Analyze the factors that influence the movement of	Blood flow model activity	This activity allows learners to investigate what can affect blood flow.

	blood through the circulatory system.		
Nobel Prize.org	Analyze the factors that influence the movement of blood through the circulatory system.	The blood typing game	Includes tutorial on blood types, how to determine blood type, and information to be considered with blood transfusions.
Aurum Science	Analyze the factors that influence the movement of gas through the respiratory system.	Respiratory system resources	PowerPoint lecture notes, study guide, and other resources to support respiratory system topics.
Teach engineering	Analyze the factors that influence movement of gas through the respiratory system.	Create a model of working lungs	Learners can explore the process that occurs in the lungs during respiration.
Inner body	Explore hormones of endocrine system.	Tour of endocrine system	Background information, interactive images of the location of glands, and production of hormones.
Aurum Science	Explore nervous system response to stimuli.	Nervous system resources	PowerPoint lecture notes, study guide, and other resources to support nervous system topics. Reaction time lab File Science SharePoint
BioInteractive- The immune system	Explore the immune response to pathogens.	Immune system virtual lab	This interactive module introduces the anatomy of the immune system and walks through the timeline of a typical immune response. Immunology lab worksheet File Science SharePoint
Careers in human physiology	Explore careers in human physiology.	Careers in physiology	Provides learners with information about possible career paths related to human physiology. Careers in physiology File Science SharePoint

NYU Langone Health	Apply scientific literacy skills.	Highschool bioethics projects	Full lesson plans on a variety of ethical issues.
NYU Grossman School of Medicine	Apply scientific literacy skills.	High school bioethics project learning scenarios	Resources that educators can use to supplement their curricula. Some are short case vignettes, while others include background material, discussion questions, multimedia selections, and suggestions for further reading.

Community Outreach/Curriculum Support

You can contact the following community resources to inquire about virtual or in-person workshops, potential field trips and support for Human Physiology 110.

Name of Organization	Contact Information/Website
Ability New Brunswick	Ability New Brunswick
Brilliant Labs	Brilliant Labs
Canadian Deafblind Association **New Brunswick Region**	Canadian Deafblind Association NB Region
Canadian Diabetes Association **New Brunswick Region**	Diabetes Canada NB Region
Canadian Heart and Stroke Foundation **New Brunswick Region**	Heart and Stroke Foundation NB Region
Canadian Kidney Foundation	Canadian Kidney Foundation
Canadian Liver Foundation **New Brunswick Region**	Canadian Liver Foundation NB Region
Canadian Lung Association **New Brunswick Region**	Canadian Lung Association NB Region

Canadian Mental Health Association **New Brunswick Region**	Canadian Mental Health Association NB Region
Centres of Excellence	COE@gnb.ca
New Brunswick Association of Occupational Therapists	NB Association of Occupational Therapists
New Brunswick Association of Speech-Language Pathologists & Audiologists	NB Association of Speech-Language Pathologists & Audiologists
New Brunswick Physiotherapy Association	NB Physiotherapy Association
Stan Cassidy Centre for Rehabilitation	Stan Cassidy Centre for Rehabilitation
UNB Department of Kinesiology	Faculty of Kinesiology | UNB
WorkSafe NB	WorkSafe NB

Glossary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

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A

Absorption	The passage of the end products of digestion from the gastrointestinal tract to the blood and delivered to cells in the body.
Articular system	The system of the human body that deals with the joints of the body and surrounding tissues.

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B

Blood	The fluid that circulates in the heart, arteries, capillaries, and veins of a vertebrate animal carrying nourishment and oxygen to and bringing away waste products from all parts of the body.

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C

Carbohydrates	Compounds made of carbon, hydrogen, and oxygen atoms. Major source of energy for the human body.
Chemical digestion	The breakdown of food in the mouth, stomach, and small intestine, using acid and enzymes.

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D

Digestion	The process of breaking down food by mechanical and enzymatic action in the digestive tract into substances that can be used by the body.
Digestive system	Human body system made up of the digestive tract and other organs that help the body break down and absorb food.

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E

Egestion	The process of discharging undigested or waste material from the digestive tract.
Endocrine system	The human body system is made up of organs called glands. Glands produce and release different hormones that target specific cells and tissues in the body.
Enzymes	Proteins that help the body break down larger complex molecules into smaller molecules that can be absorbed by the digestive system.

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F

Fats	A biomolecule made up of glycerol and fatty acid. In the human body fats protect body organs, serves as insulation and can be used as an energy source.

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H

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Hormone	A chemical produced in one part of the human body that travel through the bloodstream and affects the activities of cells in another part of the body.

I

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Ingestion	The process of taking in food through the mouth.
Immune system	The human body system that fights infection through the process of producing cells that inactivate foreign substances or cells.
Integumentary system	Human body system that serves as a barrier against infection and injury. The largest component of this system is the skin that contains many sensory receptors to sense pressure, heat, cold, and pain.
Involuntary muscle	Type of muscles that contract or move without conscious control. This type of muscle can be found in respiratory tract, blood vessels and the digestive system.

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M

Mechanical digestion	The physical process of breaking down food into smaller pieces. This process can include chewing or muscle contractions by the stomach.
Muscle	Type of body tissue that controls the internal movement of materials inside the body as well as external body movements.

Muscle contraction	The tightening, shortening, or lengthening of muscles during body activities.
Musculoskeletal system	Term that relates the muscles to the skeletal system of the human body. This includes muscles, bones, joints, ligaments, tendons, and cartilage.
Muscular system	The human body system composed of muscle cells and tissues that brings about movement of an organ or body part.

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N

Nervous system	The human body system that relays messages, processes information, and coordinates the body's response to changes in its internal and external environment. This system consists of the brain, spinal cord, and peripheral nerves.
Nutrients	A chemical substance that is needed by the human body for energy, building materials and the control of bodily processes.

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P

Pathogens	Any disease-causing agent.

Protein	A biomolecule that contains carbon, hydrogen, oxygen, and nitrogen. These biomolecules are needed by the body to grow, repair, and play a role in metabolic functions.

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R

Reproductive system	The human body system that produces reproductive cells, and in females' nurtures and protects a developing embryo.
Respiratory system	The human body system that provides the body with oxygen needed for cell respiration and removes excess carbon dioxide.
Response	A single specific reaction to a change in an organism's environment(stimulus).

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S

Skeletal system	The human body system that supports the body, protects internal organs, stores minerals, and provides a site for blood cell formation.
Stimulus	A change in an organism's environment that sends a signal that that results in a specific reaction in an organ or tissue.

Synovial joint	A connection between two bones consisting of a cartilage-lined cavity filled with fluid, which is known as a diarthrosis joint. Examples include knee joints and knuckles.

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U

Urinary system	The human body system that produces, stores, and eliminates urine. (e.g., liquid waste)

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V

Voluntary muscle	Skeletal muscles that contract and relax under conscious control. These muscles attach to bones and regulate movement of the body.

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