

## Health Science Implementation Ideas

Human Reproduction and Development	
Knowledge and Understanding	
Content Description	Elaborations
<p><b>Apply</b> the fundamental knowledge of the reproductive systems and their regulation by the endocrine system <b>to evaluate</b> the impact of life experiences <b>across</b> age or sex or demography on the properties and functions of these systems</p>	<p><b>Fundamental knowledge to allow problem solving in health. Diagnostic testing may indicate that some of these topics are known to students from Biology 7-10. Teachers are advised to consider the aspects of the Reproductive Systems relevant to the diseases studied in the unit.</b></p> <ul style="list-style-type: none"> <li>• Identify and describe the structures of the male reproductive system.</li> <li>• Explain the process of spermatogenesis including its hormone regulation, and ensure students know that hormones are chemical messengers</li> <li>• Describe the structure and function of sperm</li> <li>• Identify and describe the structures of the female reproductive system</li> <li>• Explain the process of oogenesis and its connection to the menstrual cycle including its hormone regulation</li> <li>• Describe and explain the process of fertilisation in relation to sperm and oocyte structure</li> <li>• Describe and explain the process of implantation as it relates to the structure of the uterus</li> <li>• Describe and explain the process of embryonic development with a focus on gastrulation and neurulation</li> <li>• Describe and explain the process of labour and childbirth and its hormonal control</li> </ul> <p>Once student have some fundamental knowledge of the topics above, <b>evaluate one or more</b> of the factors below that affect the healthy functioning of the reproductive system by a close study of how the factor interferes or enhances normal function</p> <p>Selected factors that affect the healthy functioning of these systems across scale. Choose one or two topics to <b>evaluate</b> in a series of lessons that build into subsequent learning through the semester.</p> <ul style="list-style-type: none"> <li>• Stress – <b>Evaluate</b> the impact of stressors on paternal and maternal aspects of conception and pregnancy; stages of foetal development; infant development and impact on further development.</li> <li>• Foetal alcohol syndrome- <b>Evaluate</b> the impact of alcohol on foetus development at different stages of gestation considering biochemistry and alcohol as a poison, and subsequent health and clinical and educational outcomes in children and the ethics and policy of alcohol control in vulnerable communities.</li> </ul>

	<ul style="list-style-type: none"> <li>• Smoking- <b>Evaluate</b> the impact of smoking on fertility, conception, and on the foetus at different stages of gestation, considering the biochemistry of nicotine as a poison; and consider subsequent health and developmental outcomes in children effected by foetal smoking; and analyse the ethics and policy of smoking control in vulnerable communities.</li> <li>• Malnutrition- <b>Evaluate</b> the impact of paternal and maternal nutrition on fertility and conception; and of maternal and infant malnutrition at stages of pregnancy and foetal development; and the effect of malnutrition on variabilities in health and further development in children.</li> <li>• Age of conception- <b>Evaluate</b> the impact of the paternal and maternal age on fertility and conception; and on the progress of pregnancy; and on variabilities in health and further development on the child and the mother.</li> <li>• Exercise- <b>Evaluate</b> the impact of exercise on variabilities in fertility and conception; on the passage of pregnancy and foetal development; and subsequent health of child and the mother.</li> <li>• Genetic conditions- <b>Evaluate</b> examples of genetic conditions and the impact on pregnancy, foetal development and health outcomes for mothers and children. Consider also, genetics conditions and sperm health and paternal fertility.</li> <li>• Sexually Transmitted Diseases- <b>Evaluate</b> the impact of the paternal and maternal diseases on fertility, conception and pregnancy and on variabilities in health and further development on the child and the mother.</li> <li>• Other factors that allow evaluation of data and well-founded causal data, and/or challengeable correlative data or urban myths, about impacts on reproductive health and foetal development.</li> </ul> <p><i>This aspect of the unit develops foundational knowledge for further engagement with higher order thinking and development of scientific skills. Care should be taken in scheduling and volume of content to ensure that students engage with the subsequent content description and the development of science inquiry skills.</i></p>
<p><b>Evaluate</b> applications, limitations, and predictions of theories and models relevant to the reproductive system, endocrine system and human development <b>and</b> propose solutions to weaknesses in the model or <b>propose solutions</b> to the issue the model addresses</p>	<p><b>Building on the fundamental knowledge taught above, and the conclusions drawn from the chosen evaluations above, evaluate</b> one or two of the following models or theories to continue the examination of aspects of reproductive health and foetal development. The number of models/theories examined will depend on the complexity of the model/ theory and the nature of the case studies and material used to build student understanding. The number will also depend on the time it takes for students to develop a critical understanding of the topic shown in endorsing or challenging models with evidence, or proposing therapies, treatments or public health information as solutions using evidence.</p> <p>Models/theories that could be considered. Choose <b>one or two</b> to develop <b>higher order thinking and evaluation skills</b> and deeper, nuanced understanding of <b>fundamental knowledge</b>:</p> <ul style="list-style-type: none"> <li>• Natural v medicalised model of childbirth- <b>evaluate</b> advocacy material for contrary models and clinical outcomes claims using scientifically derived data to make own conclusions. Consider regulatory context and ethics of professional practice in this area.</li> <li>• Ovarian reserve theory- <b>evaluate</b> advocacy material for contrary models and clinical outcomes claims using scientifically derived data to make own conclusions. Consider regulatory context and ethics of professional practice in this area.</li> <li>• Hypothalamic-pituitary-gonadal axis model – <b>evaluate</b> the scientific inquiries and data that support the model and its utility in supporting positive health outcomes.</li> </ul>

	<ul style="list-style-type: none"> <li>• Chuckrow’s theory of prenatal origin of music – <b>evaluate</b> cause and correlation and critically analyse alternate explanations for outcomes using scientifically derived data. Design inquiries or propose solutions to enhance health outcomes.</li> <li>• Epigenetics- <b>evaluate</b> cause and correlation and critically analyse alternate explanations for outcomes using scientifically derived data. Propose solutions for avoiding negative outcomes for child development.</li> <li>• Genetic screening models- <b>evaluate</b> cost-benefit of screening by considering the social and ethical consideration that intersect with biological capacity to screen for conditions. Critically analyse disability rights arguments.</li> <li>• Age and impact on fertility and pregnancy- <b>evaluate</b> intersection of biological and social issues to propose solutions and consider the cost-benefit analyses made by potential parents to propose solutions that could be undertaken by government to maximise maternal and child health outcomes.</li> <li>• Other models or theories</li> </ul> <p>Through the model, <b>evaluate</b> the applications, limitations, and predictions of the model by testing its claims against data and examining its methodology <b>and</b> propose solutions to weaknesses in the model or propose solutions to the issue the model addresses</p>
<p><b>Evaluate</b> evidence for the connection between life experiences at different stages of human life and development of disease/conditions <b>and/or</b> the evidence for the efficacy of treatments for the chosen disease or condition</p>	<p><b>Building upon the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the one above or use this as an opportunity to explore a new topic.</b></p> <p>Identify a model/theory on the relationship between life experiences and human development <i>such as age at time of conception etc.</i> <b>Evaluate the validity and reliability</b> by finding and analysing possible sources of data to validate or invalidate the model.</p> <p><b>OR</b></p> <p><b>Evaluate</b> the effect of treatments/therapies/intervention on a disease <i>such as gestational diabetes and the effect of related treatments on the health of the mother and foetus etc</i> by finding and analysing possible sources of data, consider validity and reliability, to validate or invalidate the treatment.</p> <p>Ways to <b>evaluate the validity and reliability</b> of evidence include:</p> <ul style="list-style-type: none"> <li>• Small group studies versus large populations</li> <li>• Primary versus secondary data</li> <li>• Longitudinal versus cross sectional studies</li> <li>• Animal studies versus human studies</li> <li>• Single study versus meta-analysis</li> <li>• Anecdotal evidence versus research data</li> <li>• Other ways to assess evidence</li> </ul> <p><i>These are key information literacy skills in general, as well as significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people.</i></p>

<p><b>Evaluate</b> claims made in scientific texts and in the popular media about health relevant to reproductive and endocrine systems</p>	<p><b>Building upon the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the ones above or use this as an opportunity to explore a new topic.</b></p> <p>Interrogate foundations, methods, and validity of knowledge claims in popular media by <b>evaluating</b> evidence in medical literature against popular media claims.</p> <p>Sample topics that could be considered:</p> <ul style="list-style-type: none"> <li>• Hormone replacement therapy</li> <li>• Sex versus Gender</li> <li>• Breastfeeding versus formula feeding</li> <li>• Prenatal supplements</li> <li>• Pregnancy blogs versus scientific media</li> <li>• Egg freezing</li> <li>• Other examples</li> </ul> <p><i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> bioethical, social policy, cultural and economic influence on science claims and practices related to the reproductive and endocrine systems</p>	<p><b>Building upon one or more of the foundational topics:</b></p> <p>Read and <b>evaluate</b> the arguments found in an editorial or popular science magazine, compare arguments, and adopt and justify an ethical position on the topic:</p> <p><u>Sample topics that could be considered:</u></p> <ul style="list-style-type: none"> <li>• Gene therapies – e.g., Are these too expensive and only for the rich? Is the cost-benefit for the health system worth it?</li> <li>• Stem cell therapy- e.g., Consider objections to these therapies based on foetal rights arguments.</li> <li>• Cloning- e.g., Is cloning organs allowable? Is cloning people appropriate?</li> <li>• Designer babies/sex selection</li> <li>• Surrogacy</li> <li>• Involuntary sterilisation for marginalised females</li> <li>• Termination of children with genetic disorders</li> <li>• Quarantining menstruating females for hygiene reasons</li> <li>• Other topics</li> </ul> <p><i>Building significant ethical capacity, as well as information literacy skills in general, is a significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people. Awareness of the ethical implications of knowledge and scientific capacity is vital learning for future scientists and citizens.</i></p>

Skills	
Content description	Elaborations
<p><b>Design, conduct and improve</b> safe, ethical and original inquiries into human reproduction and development individually and collaboratively, that collect valid, reliable data in response to a complex question</p>	<p>Students need to develop an understanding of how to <b>design</b> an experiment including aim, independent, dependent, and controlled variables, hypothesis, risk assessment, ethical research assessment, materials, and method. These employ and further develop the fundamental knowledge of the topics investigated into more nuanced understanding, and greater retention of concepts and knowledge.</p> <p>Suggested practicals to support the development of skills in this topic area. Internet searches, consultation with colleagues and reading textbooks will provide model methods for alteration for context or improvement:</p> <ul style="list-style-type: none"> <li>• Non-human sperm experiment</li> <li>• Non-human ovary dissection</li> <li>• Research existing data sets</li> <li>• Virtual simulations</li> <li>• Other practicals</li> </ul> <p>Some locations of possible ideas include: <a href="#">Scoilnet.ie</a>; <a href="#">WACE Human Biology</a>; <a href="#">Science in the Classroom</a></p> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> cause and correlation, anomalies, reliability and validity of data and representations, and evaluate errors in response to investigating a complex question about human reproduction and development</p>	<p>In the context of their own experiments or existing research, students need to show the meaning and significance of data by applying basic statistical methods to <b>evaluate</b> quantitative data sets and/or where appropriate, critique qualitative methods. This might be in their own data collection or received data sets.</p> <p><u>Suggested topics to consider:</u></p> <ul style="list-style-type: none"> <li>• Sampling error</li> <li>• Accurate and inaccurate data representations</li> <li>• Misleading data representations e.g. exaggerated scales</li> <li>• Other types of errors</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area.</p> <p><i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>

<p><b>Evaluate</b> research/medical processes and claims about human reproduction and development and provide a critique based on evidence</p>	<p><b>Building upon one or more of the foundational topics:</b></p> <p>Students will need to <b>evaluate</b> past research failures that harmed participants or that did not transfer into human context, to better understand the nature of effective research in Science.</p> <p><u>Suggested studies that could be explored:</u></p> <ul style="list-style-type: none"> <li>• IVF scandals</li> <li>• Tuskegee Syphilis study</li> <li>• Historical treatment of “hysteria” e.g. ‘wandering womb’</li> <li>• Thalidomide</li> <li>• Childhood vaccination and autism</li> <li>• Group B Streptococcus swab prior to giving birth.</li> <li>• Racial disparities in postpartum pain management</li> <li>• Other studies</li> </ul> <p>Investigate innovations in medical/ health research that could result in valid experiments and outcomes.</p> <p><u>Innovations to consider:</u></p> <ul style="list-style-type: none"> <li>• AI assisted research/ analysis.</li> <li>• Simulated models</li> <li>• Organoids</li> <li>• Other innovations</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Reflect</b> with insight on own thinking and that of others, evaluate planning, time management, and use of appropriate independent and collaborative work strategies</p>	<p>Either orally or in writing, as part of an investigation, experiment, or summative exam, or as a stand-alone summative task (e.g. journaling), students are required to <b>reflect</b> on planning, time management, and use of appropriate independent and collaborative work strategies.</p> <p><u>Some suggested methods for reflection include:</u></p> <ul style="list-style-type: none"> <li>• Yarning circles</li> <li>• Kolb’s learning cycle</li> <li>• Rolfe’s framework of reflective practice</li> <li>• Gibb’s reflective cycle</li> <li>• Group/team reflection</li> <li>• Other methods for reflection</li> </ul>

	<i>Students need explicit teaching on how to reflect and opportunities to practice and receive feedback prior to assessment of this skills.</i>
<p><b>Communicate</b> concisely, effectively, and accurately, with scientific literacy in a range of modes, representations, and genres for specific audiences and purposes, and accurate referencing</p>	<p>Students need to be exposed to scientific literacy texts that they are expected to produce in their assessments. This will support:</p> <ul style="list-style-type: none"> <li>• The development of their use of precise scientific vocabulary</li> <li>• Precise text structure within their scientific writing</li> <li>• Choice of referencing (a bibliography alone is insufficient, there must be in-text referencing)</li> </ul> <p>Consider: <a href="#">Science in the Classroom</a>; <a href="#">New Scientist</a></p>

## Health Science Elaborations

Cardiorespiratory Health	
Knowledge and Understanding	
Content Description	Elaborations
<p><b>Apply</b> the fundamental knowledge of the cardiovascular, respiratory and elements of the musculoskeletal systems <b>to evaluate</b> the impact of life experiences <b>across</b> age or sex or demography on the properties and functions of these systems</p>	<p><b>Foundational topics to allow problem solving in health. Diagnostic testing may indicate that some of these topics are known to students from Biology 7-10. Teachers are advised to consider the aspects of the Cardiovascular, Respiratory and Musculoskeletal Systems relevant to the diseases studied in the unit.</b></p> <p>Cardiovascular system:</p> <ul style="list-style-type: none"> <li>• Describe and explain the production and composition of blood and the functions of each of the components</li> <li>• Describe and explain how blood analysis is conducted and the relevance of this analysis</li> <li>• Describe and explain the structure and function of blood vessels, including the role of nitric oxide and endothelin</li> <li>• Describe and explain the structure and function of the heart, including the coronary, pulmonary and systemic blood supply</li> <li>• Describe the structural and functional characteristics of cardiac muscle tissue and the electrical conduction system and its connection to the cardiac cycle</li> </ul> <p>Respiratory system:</p> <ul style="list-style-type: none"> <li>• Describe and explain the anatomical structures of the respiratory system</li> <li>• Describe and explain the processes involved in pulmonary ventilation</li> <li>• Describe and explain the exchange and transport of gases (oxygen and carbon dioxide) in the body</li> </ul> <p>Musculoskeletal system:</p> <ul style="list-style-type: none"> <li>• Describe and explain the structure and function of relevant components of the musculoskeletal system, including the diaphragm, ribcage, and intercostal muscles</li> </ul> <p>Once students have some fundamental knowledge of the topics above, <b>evaluate one or more</b> of the factors that affect the healthy functioning of the systems by a close study of how the factor interferes or enhances normal function</p> <p>Selected factors that affect the healthy functioning of these systems across scale. Choose one or two topics to <b>evaluate</b> in a series of lessons that build into subsequent learning through the semester.</p> <ul style="list-style-type: none"> <li>• Smoking – <b>Evaluate</b> the impact of smoking on cardiorespiratory health, considering the biochemistry of nicotine as a poison; and analyse the ethics and policy of smoking control in vulnerable communities.</li> <li>• Diet- <b>Evaluate</b> the impact of diet, such as nutrients and dietary habits, on cardiorespiratory health in both adults and young children.</li> </ul>



- Pollution – **Evaluate** the effects of environmental pollution on health, with a specific focus on both short-term and long-term outcomes for cardiovascular and respiratory health.
- Heart conditions – **Evaluate** the long-term implications of common heart diseases, such as coronary artery disease, heart failure, and arrhythmias, on overall health and survival rates. Consider how lifestyle factors can further impact life expectancy for individuals with heart conditions.
- Sarcopenia – **Evaluate** the impact of sarcopenia on bone and muscle health, specifically the implications of reduced muscle mass on functional mobility, physical performance, and overall quality of life.
- Osteoporosis- **Evaluate** the impact of osteoporosis on bone density and muscle strength, specifically the implications of reduced muscle mass on functional mobility, physical performance, and overall quality of life.
- Pathogenic infection - **Evaluate** the impact of pathogenic infection on the cardiovascular and respiratory systems, considering the specific mechanisms through which various pathogens affect the structure and function of these systems, the immediate and long-term consequences of infection, and how co-morbidities may exacerbate these effects.
- Scoliosis - **Evaluate** the impact of scoliosis on bone and muscle health, focusing on the specific physiological changes that occur due to the loss of muscle mass and strength. Consider the role of aging, chronic diseases, and lifestyle factors in the development and progression of scoliosis.
- Brittle bone syndrome - **Evaluate** the impact of brittle bone syndrome on bone and muscle health. Consider the long-term consequences of frequent fractures, bone deformities, and musculoskeletal imbalances.
- Blood pressure - **Evaluate** the impact of blood pressure on the cardiovascular system, focusing on the mechanisms by which abnormal blood pressure—both hypertension and hypotension—affects heart function, blood vessels, and overall cardiovascular health.
- Blood lipidemia - **Evaluate** the impact of blood lipidemia on the cardiovascular system, focusing on how elevated levels of lipids contribute to the development of atherosclerosis, coronary artery disease, and other cardiovascular disorders.
- Thalassemia - **Evaluate** the impact of thalassemia on the cardiovascular system, focusing on how the disease affects heart function, blood vessels, and overall cardiovascular health.
- Sickle cell anaemia- **Evaluate** the impact of sickle cell anaemia on the cardiovascular system. Discuss the long-term prognosis for cardiovascular health in sickle cell anaemia patients.
- Heat stress - **Evaluate** the impact of heat stress on the cardiovascular system, focusing on the physiological and pathological responses of the heart and blood vessels to elevated temperatures. Discuss the long-term consequences of chronic heat exposure on cardiovascular health and the implications for vulnerable populations, such as outdoor workers, and individuals with pre-existing cardiovascular conditions.
- Other factors that allow evaluation of data and well-founded causal data, and/or challengeable correlative data or urban myths, about impacts on cardiorespiratory and/or musculoskeletal health.

*This aspect of the unit develops foundational knowledge for further engagement with higher order thinking and development of scientific skills. Care should be taken in scheduling and volume of content to ensure that students engage with the subsequent content description and the development of science inquiry skills.*

**Evaluate** applications, limitations, and predictions of theories and models relevant to the cardiovascular, respiratory, and musculoskeletal systems **and** propose solutions to weaknesses in the model or propose solutions to the issue the model addresses

**Building on the fundamental knowledge taught above, and the conclusions drawn from the chosen evaluations above, evaluate** one or two of the following models or theories to continue the examination of aspects of cardiorespiratory and/or musculoskeletal health. The number of models/ theories examined will depend on the complexity of the model/ theory and the nature of the case studies and material used to build student understanding. The number will also depend on the time it takes for students to develop a critical understanding of the topic shown in endorsing or challenging models with evidence, or proposing therapies, treatments or public health information as solutions using evidence.

Models/theories that could be considered. Choose **one or two** to develop **higher order thinking and evaluation skills** and deeper, nuanced understanding of **fundamental knowledge**:

Models/theories that could be considered:

- Abnormality v normality scales e.g. iron – **evaluate** the application of abnormality versus normality scales in healthcare for evaluating and categorising physiological markers, including blood parameters, body composition, and other health metrics, into normal and abnormal classifications.
- Test results as proxies for conditions (suggestive v diagnostic tests) – **evaluate** the model of using test results as proxies for health conditions in the context of managing cardiorespiratory and musculoskeletal health. Consider the implications for costs and resource allocation.
- Using blood data analysis to compare with known standards and hypothesis conditions – **evaluate** the model of using blood data analysis to compare individual health parameters against established standards and hypothesised conditions in managing cardiorespiratory and musculoskeletal health. Consider result variability, interpretation challenges and patient education.
- Metabolically healthy obesity – **evaluate** the concept of metabolically healthy obesity, examining its implications for health outcomes and the potential risks associated with excess body weight despite normal metabolic markers. Consider ethics of professional practice in this area.
- Bone mineral density models to predict future bone conditions - **evaluate** the efficacy of bone mineral density models in predicting future bone conditions, such as osteoporosis and fracture risk, by analysing the claims made about their predictive power using scientifically derived data. Consider the limitations of these models, including measurement variability and the importance of integrating comprehensive risk assessment, while also addressing the ethical implications of their application in clinical practice.
- Relationship between Blood Alcohol Concentration and breath tests- **evaluate** the relationship between blood alcohol concentration (BAC) and breath test results. Analyse claims about the effectiveness and limitations of breath tests using scientific data and consider factors that may influence accuracy, like testing conditions and individual differences.
- Other models or theories.

Through the model, **evaluate** the applications, limitations, and predictions of the model by testing its claims against data and examining its methodology **and** propose solutions to weaknesses in the model or propose solutions to the issue the model addresses

<p><b>Evaluate</b> the evidence for the connection between life experiences at different stages of human life and development of disease/conditions <b>and/or</b> the evidence for the efficacy of treatments for the chosen disease or condition</p>	<p><b>Building upon one of the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the one above or use this as an opportunity to explore a new topic.</b></p> <p>Identify a model/theory on the relationship between life experiences and human development <i>such as smoking and lung disease etc.</i></p> <p><b>Evaluate the validity and reliability</b> by finding and analysing possible sources of data to validate or invalidate the model.</p> <p><b>OR</b></p> <p><b>Evaluate</b> the effect of treatments/therapies/intervention on a disease <i>such as exercise in the treatment/prevention of heart disease etc</i> by finding and analysing possible sources of data, consider validity and reliability, to validate or invalidate the treatment.</p> <p>Ways to <b>evaluate the validity and reliability</b> of evidence include:</p> <ul style="list-style-type: none"> <li>• Small group studies versus large populations</li> <li>• Primary versus secondary data</li> <li>• Longitudinal versus cross sectional studies</li> <li>• Animal studies versus human studies</li> <li>• Single study versus meta-analysis</li> <li>• Anecdotal evidence versus research data</li> <li>• Other ways to assess evidence</li> </ul> <p><i>These are key information literacy skills in general, as well as significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people.</i></p>
<p><b>Evaluate</b> claims made in scientific texts and in the popular media about health relevant to cardiovascular, respiratory, and musculoskeletal systems</p>	<p><b>Building upon one of the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the ones above or use this as an opportunity to explore a new topic.</b></p> <p>Interrogate foundations, methods, and validity of knowledge claims in popular media by <b>evaluating</b> evidence in medical literature against popular media claims.</p> <p><u>Sample topics that could be considered:</u></p> <ul style="list-style-type: none"> <li>• Nutrients v heart health</li> <li>• Altitude and effect on lung capacity</li> <li>• Pollution and effect on lung health</li> <li>• Drugs/medication and osteoporosis</li> <li>• Nutritional supplements and arthritis</li> <li>• Other examples</li> </ul>

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<p><b>Evaluate</b> bioethical, social policy, cultural and economic influence on science claims and practices related to the cardiovascular, respiratory, and musculoskeletal systems</p>	<p><b>Building upon one or more of the foundational topics:</b></p> <p>Read and <b>evaluate</b> the arguments found in an editorial or popular science magazine, compare arguments and adopt and justify an ethical position on the topic</p> <p><u>Sample topics that could be considered:</u></p> <ul style="list-style-type: none"> <li>• Transplants – e.g., consider issues such as donor consent, organ allocation, and the implications of living versus deceased donations.</li> <li>• Unethical use of organoids – e.g., consider the treatment of human cells, consent, and implications for future research</li> <li>• Do not resuscitate – e.g., consider the ethical considerations surrounding DNR orders and patient autonomy, quality of life, and the role of medical professionals.</li> <li>• Gene therapies – e.g., are these too expensive and only for the rich? Is the cost-benefit for the health system worth it?</li> <li>• Stem cell therapy - e.g., consider objections to these therapies based on foetal rights arguments.</li> <li>• Other examples</li> </ul> <p><i>Building significant ethical capacity, as well as information literacy skills in general, is a significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people. Awareness of the ethical implications of knowledge and scientific capacity is vital learning for future scientists and citizens.</i></p>
<p><b>Skills</b></p>	
<p><b>Content description</b></p>	<p><b>Elaboration</b></p>
<p><b>Design, conduct and improve</b> safe, ethical and original inquiries into cardiovascular, respiratory and musculoskeletal systems individually and collaboratively, that collect valid, reliable data in response to a complex question</p>	<p>Students need to develop an understanding of how to <b>design</b> an experiment including aim, independent, dependent, and controlled variables, hypothesis, risk assessment, ethical research assessment, materials and method. These employ and further develop the fundamental knowledge of the topics investigated into more nuanced understanding, and greater retention of concepts and knowledge.</p> <p>Suggested practicals to support the development of skills in this topic area. Internet searches, consultation with colleagues and reading textbooks will provide model methods for alteration for context or improvement:</p> <ul style="list-style-type: none"> <li>• Blood oxygen levels</li> <li>• Virtual simulations</li> <li>• Research existing data sets for causes of cardiovascular disease</li> <li>• Other practicals</li> </ul> <p>Some locations of possible ideas include: <a href="http://Scoilnet.ie">Scoilnet.ie</a>; <a href="http://WACE Human Biology">WACE Human Biology</a>; <a href="http://Science in the Classroom">Science in the Classroom</a></p>

	<p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and Ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> cause and correlation, anomalies, reliability and validity of data and representations, and evaluate errors in response to investigating a complex question about the cardiovascular, respiratory and musculoskeletal systems</p>	<p>In the context of their own experiments or existing research, students need to show the meaning and significance of data by applying basic statistical methods to <b>evaluate</b> quantitative data sets and/or where appropriate, critique qualitative methods. This might be in their own data collection or received data sets.</p> <p><u>Suggested topics to consider:</u></p> <ul style="list-style-type: none"> <li>• Calibration of instruments</li> <li>• Measurement errors</li> <li>• Risk assessments and ethics</li> <li>• Other types of errors</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen</i></p>
<p><b>Evaluate</b> research/medical processes and claims about cardiovascular, respiratory, and musculoskeletal systems and provide a critique based on evidence</p>	<p><b>Building on one of the foundational topics:</b></p> <p>Students will need to <b>evaluate</b> past research failures that harmed participants or that did not transfer into human context, effectively to better understand the nature of effective research in Science.</p> <p><u>Suggested studies that could be explored:</u></p> <ul style="list-style-type: none"> <li>• High doses of vitamin E and heart health</li> <li>• Endothelin receptor antagonists to treat heart failure</li> <li>• Stents to alleviate chest pain</li> <li>• Lung Volume Reduction Surgery to treat severe emphysema</li> </ul> <p>Investigate innovations in medical/ health research that could result in valid experiments and outcomes.</p> <p><u>Innovations to consider:</u></p> <ul style="list-style-type: none"> <li>• AI assisted research/ analysis.</li> <li>• Simulated models</li> <li>• Organoids</li> </ul>

	<p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Reflect</b> with insight on own thinking and that of others, evaluate planning, time management, and use of appropriate independent and collaborative work strategies</p>	<p>Either orally or in writing, as part of an investigation, experiment or- summative exam, or as a stand-alone summative task (e.g. journaling), students are required to <b>reflect</b> on planning, time management, and use of appropriate independent and collaborative work strategies.</p> <p><u>Some suggested methods for reflection include:</u></p> <ul style="list-style-type: none"> <li>• Yarning circles</li> <li>• Kolb’s learning cycle</li> <li>• Rolfe’s framework of reflective practice</li> <li>• Gibb’s reflective cycle</li> <li>• Group/team reflection</li> </ul> <p><i>Students need explicit teaching on how to reflect and opportunities to practice and receive feedback prior to assessment of this skills.</i></p>
<p><b>Communicate</b> concisely, effectively, and accurately, with scientific literacy in a range of modes, representations, and genres for specific audiences and purposes, and accurate referencing</p>	<p>Students need to be exposed to scientific literacy texts that they are expected to produce in their assessments.</p> <p>This will support:</p> <ul style="list-style-type: none"> <li>• The development of their use of precise scientific vocabulary.</li> <li>• Precise text structure of their scientific writing.</li> <li>• Choice of referencing (a bibliography alone is insufficient, there must be in-text referencing).</li> </ul> <p>Consider: <a href="#">Science in the Classroom</a>; <a href="#">New Scientist</a></p>

## Health Science Elaborations

Human Digestive and Renal Systems	
Knowledge and Understanding	
Content Description	Elaborations
<p><b>Apply</b> the fundamental knowledge of the gastrointestinal and urinary systems <b>to evaluate</b> the impact of life experiences across age or sex or demography on the properties and functions of the body</p>	<p><b>Foundational topics to allow problem solving in health. Diagnostic testing may indicate that some of these topics are known to students from Biology 7-10. Teachers are advised to consider the aspects of the Digestive and Renal Systems relevant to the diseases studied in the unit.</b></p> <p>Gastrointestinal system</p> <ul style="list-style-type: none"> <li>Describe and explain the structures and functions of the gastrointestinal system including the mouth, oesophagus, stomach, small intestines, large intestines, rectum and anus as well as the accessory organs, liver, gall bladder and pancreas.</li> <li>Describe and explain the structure and function of the Autonomic Nervous System and its control of the gastrointestinal system and the relevance of the enteric nervous system in the control of the gastrointestinal system</li> <li>Compare and contrast healthy and unhealth gut flora</li> </ul> <p>Renal (Urinary) system</p> <ul style="list-style-type: none"> <li>Describe and explain the structure and function of the urinary systems including the kidneys, bladder, ureter and urethra.</li> <li>Describe and explain the structure and function of nephrons</li> <li>Describe and explain the structure and function of the Autonomic Nervous System and its control of the urinary system</li> <li>Explain and analyse the components of urine and faecal analysis</li> </ul> <p>Once student have some fundamental knowledge of the topics above, <b>evaluate</b> one or more of the factors that affect the healthy functioning of the systems by a close study of how the factor interferes or enhances normal function</p> <p>Selected factors that affect the healthy functioning of these systems across scale. Choose one or two topics to <b>evaluate</b> in a series of lessons that build into subsequent learning through the semester.</p> <ul style="list-style-type: none"> <li>Diet: <b>evaluate</b> the impact of diet on gastrointestinal (GI) health, focusing on how different dietary patterns affect digestion, nutrient absorption, and gut microbiota. Explore the long-term consequences of poor dietary choices, particularly on vulnerable populations</li> <li>Inflammation: <b>evaluate</b> the impact of inflammation on gastrointestinal (GI) and urinary system health, focusing on how inflammatory processes can disrupt normal function and contribute to conditions. Consider the role of dietary factors, lifestyle choices, and underlying health conditions in modulating inflammatory responses and their implications for gut and urinary tract integrity.</li> </ul>

	<ul style="list-style-type: none"> <li>• Irritable Bowel Syndrome: <b>evaluate</b> the impact of Irritable Bowel Syndrome on gastrointestinal (GI) health, focusing on how this functional disorder affects digestion and overall gut function. Consider the role of dietary patterns, stress, and gut microbiota in exacerbating IBS symptoms.</li> <li>• Crohn’s Disease: <b>evaluate</b> the impact of Crohn's disease on gastrointestinal (GI) health, focusing on how this disease leads to damage in the GI tract, affecting digestion and nutrient absorption. Consider the role of genetic factors, environmental triggers, and dietary choices in exacerbating symptoms.</li> <li>• Infection: <b>evaluate</b> the impact of infection on urinary system health. Consider the role of pathogens, immune response, and underlying health conditions in exacerbating infection severity and recurrence.</li> <li>• Excision: <b>evaluate</b> the impact of excision on urinary system, focusing on how surgical removal of tissues, can affect urinary function and lead to complications like incontinence or urinary retention. Consider the ethical implications of excision procedures, particularly in vulnerable populations such as the elderly or individuals with comorbid conditions.</li> <li>• Incontinence: <b>evaluate</b> the impact of incontinence on urinary system health. Consider the ethical implications of addressing incontinence in different age groups, particularly in elderly populations and individuals with disabilities, emphasizing the importance of informed consent and respect for patient dignity.</li> <li>• Other factors that allow evaluation of data and well-founded causal data, and/or challengeable correlative data or urban myths, about impacts on gastrointestinal and urinary health.</li> </ul> <p><i>This aspect of the unit develops foundational knowledge for further engagement with higher order thinking and development of scientific skills. Care should be taken in scheduling and volume of content to ensure that students engage with the subsequent content description and the development of science inquiry skills.</i></p>
<p><b>Evaluate</b> applications, limitations, and predictions of theories and models relevant to the gastrointestinal and urinary systems <b>and</b> propose solutions to weaknesses in the model or propose solutions to the issue the model addresses</p>	<p><b>Building on the fundamental knowledge taught above, and the conclusions drawn from the chosen evaluations above, evaluate</b> one or two of the following models or theories to continue the examination of aspects of gastrointestinal and urinary health. The number of models/ theories examined will depend on the complexity of the model/ theory and the nature of the case studies and material used to build student understanding. The number will also depend on the time it takes for students to develop a critical understanding of the topic shown in endorsing or challenging models with evidence, or proposing therapies, treatments or public health information as solutions using evidence.</p> <p>Models/theories that could be considered. Choose <b>one or two</b> to develop <b>higher order thinking and evaluation skills</b> and deeper, nuanced understanding of <b>fundamental knowledge</b>:</p> <ul style="list-style-type: none"> <li>• Test results as proxies for conditions (suggestive v diagnostic tests)- <b>evaluate</b> the model of using test results as proxies for health conditions in the context of managing gastrointestinal and urinary health. Consider the implications for costs and resource allocation.</li> <li>• Using blood data analysis to compare with known standards and hypothesis conditions - <b>evaluate</b> the model of using blood data analysis to compare individual health parameters against established standards and hypothesised conditions in managing gastrointestinal and urinary health. Consider result variability, interpretation challenges and patient education.</li> <li>• Other models or theories</li> </ul>



	<p>Through the model <b>evaluate</b> the applications, limitations, and predictions of the model by testing its claims against data and examining its methodology <b>and</b> propose solutions to weaknesses in the model or propose solutions to the issue the model addresses</p>
<p><b>Evaluate</b> the evidence for the connection between life experiences at different stages of human life and development of disease/conditions <b>and/or</b> the evidence for the efficacy of treatments for the chosen disease or condition</p>	<p><b>Building upon one of the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the one above or use this as an opportunity to explore a new topic.</b></p> <p>Identify a model/theory on the relationship between life experiences and human development <i>such as diet and childhood obesity etc.</i> <b>Evaluate the validity and reliability</b> by finding and analysing possible sources of data to validate or invalidate the model.</p> <p><b>OR</b></p> <p><b>Evaluate</b> the effect of treatments/therapies/intervention on a disease <i>such as antibiotics for urinary tract infections etc</i> by finding and analysing possible sources of data, consider validity and reliability, to validate or invalidate the treatment.</p> <p>Ways to <b>evaluate the validity and reliability</b> of evidence include:</p> <ul style="list-style-type: none"> <li>• Small group studies versus large populations</li> <li>• Primary versus secondary data</li> <li>• Longitudinal versus cross sectional studies</li> <li>• Animal studies versus human studies</li> <li>• Single study versus meta-analysis</li> <li>• Anecdotal evidence versus research data</li> <li>• Other ways to assess evidence</li> </ul> <p><i>These are key information literacy skills in general, as well as significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people.</i></p>
<p><b>Evaluate</b> claims made in scientific texts and in the popular media about health relevant to gastrointestinal and urinary systems</p>	<p><b>Building upon one of the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the ones above or use this as an opportunity to explore a new topic.</b></p> <p>Interrogate foundations, methods, and validity of knowledge claims in popular media by <b>evaluating</b> evidence in medical literature against popular media claims.</p> <p>Sample topics that could be considered:</p> <ul style="list-style-type: none"> <li>• Alternative diets such as vegetarian, vegan, keto, paleo v health</li> <li>• Cranberry juice/parsley and Urinary Tract Infections</li> <li>• Probiotics and health</li> </ul>

	<ul style="list-style-type: none"> <li>• Gluten intolerance/sensitivity</li> <li>• Other examples</li> </ul>
<p><b>Evaluate</b> bioethical, social policy, cultural and economic influence on science claims and practices related to the gastrointestinal and urinary systems</p>	<p><b>Building on one of the foundational topics:</b></p> <p>Read and <b>evaluate</b> the arguments found in an editorial or popular science magazine, compare arguments and adopt and justify an ethical position on the topic</p> <p><u>Sample topics that could be considered:</u></p> <ul style="list-style-type: none"> <li>• Pig insulin e.g., ethical concerns regarding animal welfare and patient safety vs continued development of synthetic alternatives.</li> <li>• Unethical use of organoids e.g., consider the treatment of human cells, consent, and implications for future research</li> <li>• Kidney donations e.g., consider education, transparency, and public awareness to navigate the complexities of organ donation and improve health outcomes for patients.</li> <li>• Kidney transplants – referral criteria e.g., ethical concerns about living donations, informed consent, allocation processes, donor education</li> <li>• Kidney dialysis e.g., ethical concerns around access, quality of life, and the emotional and financial burdens on patients and families. Funding for alternatives that enhance patient well-being and dignity throughout the treatment process.</li> <li>• Gene therapies – e.g., Are these too expensive and only for the rich? Is the cost-benefit for the health system worth it?</li> <li>• Stem cell therapy e.g., Consider objections to these therapies based on foetal rights arguments.</li> <li>• Other examples</li> </ul> <p><i>Building significant ethical capacity, as well as information literacy skills in general, is a significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people. Awareness of the ethical implications of knowledge and scientific capacity is vital learning for future scientists and citizens.</i></p>
<b>Skills</b>	
<b>Content Description</b>	<b>Elaborations</b>
<p><b>Design, conduct and improve</b> safe, ethical and original inquiries into gastrointestinal and urinary systems individually and collaboratively, that collect valid, reliable data in response to a complex question</p>	<p>Students need to develop an understanding of how to <b>design</b> an experiment including aim, independent, dependent, and controlled variables, hypothesis, risk assessment, ethical research assessment, materials, and method. These employ and further develop the fundamental knowledge of the topics investigated into more nuanced understanding, and greater retention of concepts and knowledge.</p> <p>Suggested practicals to support the development of skills in this topic area. Internet searches, consultation with colleagues and reading textbooks will provide model methods for alteration for context or improvement:</p> <ul style="list-style-type: none"> <li>• Kidney dissection</li> <li>• Urinalysis 'kit'</li> </ul>

	<ul style="list-style-type: none"> <li>• Fake blood filtration</li> <li>• Histology, Monash Uni – simulation ANS</li> <li>• Other practicals</li> </ul> <p>Some locations of possible ideas include: <a href="#">Scoilnet.ie</a>; <a href="#">WACE Human Biology</a>; <a href="#">Science in the Classroom</a></p> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> cause and correlation, anomalies, reliability and validity of data and representations, and evaluate errors in response to investigating a complex question about the gastrointestinal and urinary systems</p>	<p>In the context of their own experiments or existing research, students need to show the meaning and significance of data by applying basic statistical methods to <b>evaluate</b> quantitative data sets and/or where appropriate, critique qualitative methods. This might be in their own data collection or received data sets.</p> <p><u>Suggested topics to consider:</u></p> <ul style="list-style-type: none"> <li>• Accurate and inaccurate data representations</li> <li>• Misleading data representations</li> <li>• Embarrassment error in self-reporting</li> <li>• Risk assessments and ethics</li> <li>• Other types of errors</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area.</p> <p><i>This important content description develops media literacy, numeracy skills and Ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> research/medical processes and claims about the gastrointestinal and urinary systems and provide a critique based on evidence,</p>	<p><b>Building on one of the foundational topics:</b></p> <p>Students will need to <b>evaluate</b> past research failures that harmed participants or that did not transfer into human context, effectively to better understand the nature of effective research in Science.</p> <p><u>Suggested studies that could be explored:</u></p> <ul style="list-style-type: none"> <li>• Urinary Tract Infections and Cranberry Products</li> <li>• Gut Microbiota Manipulation for Obesity and Metabolic Syndrome</li> <li>• Anti-Inflammatory Agents for Crohn's Disease</li> </ul> <p>Investigate innovations in medical/ health research that could result in valid experiments and outcomes.</p>

	<p><u>Innovations to consider:</u></p> <ul style="list-style-type: none"> <li>• AI assisted research/ analysis</li> <li>• Simulated models</li> <li>• Organoids</li> <li>• Other innovations</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen</i></p>
<p><b>Reflect</b> with insight on own thinking and that of others, evaluate planning, time management, and use of appropriate independent and collaborative work strategies</p>	<p>Either orally or in writing, as part of an investigation, experiment or- summative exam, or as a stand-alone summative task (e.g. journaling), students are required to <b>reflect</b> on planning, time management, and use of appropriate independent and collaborative work strategies.</p> <p><u>Some suggested methods for reflection include:</u></p> <ul style="list-style-type: none"> <li>• Yarning circles</li> <li>• Kolb’s learning cycle</li> <li>• Rolfe’s framework of reflective practice</li> <li>• Gibb’s reflective cycle</li> <li>• Group/team reflection</li> </ul> <p><i>Students need explicit teaching on how to reflect and opportunities to practice and receive feedback prior to assessment of this skills.</i></p>
<p><b>Communicate</b> concisely, effectively, and accurately, with scientific literacy in a range of modes, representations, and genres for specific audiences and purposes, and accurate referencing</p>	<p>Students need to be exposed to scientific literacy texts that students are expected to produce in their assessments. This will support:</p> <ul style="list-style-type: none"> <li>• The development of their use of precise scientific vocabulary</li> <li>• Precise text structure of their scientific writing.</li> <li>• Choice of referencing (a reference list alone is insufficient, there must be in-text referencing).</li> </ul> <p>Consider: <a href="#">Science in the Classroom</a>; <a href="#">New Scientist</a></p>

## Health Science Elaborations

Concepts in Neuroscience	
Knowledge and Understanding	
Content Description	Elaborations
<p><b>Apply</b> the fundamental knowledge of the nervous system <b>to evaluate</b> the impact of life experiences including ageing, mental health, drugs and degenerative conditions on the properties and functions of the body</p>	<p><b>Foundational topics to allow problem solving in health. Diagnostic testing may indicate that some of these topics are known to students from Biology 7-10. Teachers are advised to consider the aspects of the Nervous System relevant to the diseases studied in the unit.</b></p> <ul style="list-style-type: none"> <li>• Describe and explain the structure and role of neurotransmitters in healthy functioning.</li> <li>• Describe and explain the structure of specialised cells such as neuroglia, astrocytes, microglia, ependymal and oligodendrocytes according to subsequent degenerative conditions chosen for study</li> <li>• Explain consequences of ageing on the Nervous system and evaluate the consequences on people’s lives.</li> <li>• Explain the interplay of signal conduction, neurotransmitters and specialised cells and evaluate the impact of life experiences on the development of selected diseases/degenerative conditions such as Alzheimer Disease, Parkinson’s disease and Dementia</li> <li>• Describe and explain the factors that contribute to good Mental health</li> </ul> <p>Once student have some fundamental knowledge of the topics above, <b>evaluate one or more</b> of the factors below that affect the healthy functioning of the nervous system by a close study of how the factor interferes or enhances normal function</p> <p>Selected factors that affect the healthy functioning of these systems across scale. Choose one or two topics to <b>evaluate</b> in a series of lessons that build into subsequent learning through the semester.</p> <ul style="list-style-type: none"> <li>• Schizophrenia – <b>evaluate</b> the impact of schizophrenia on the nervous system, focusing on the neurobiological factors involved. Discuss how these factors contribute to the symptoms and cognitive deficits associated with the disorder.</li> <li>• Multiple Sclerosis – <b>evaluate</b> the impact of Multiple Sclerosis on the nervous system, including the mechanisms of demyelination and their effects on neuronal communication. Discuss how these changes contribute to the range of symptoms experienced by individuals with MS, including cognitive impairments, and consider the role of early diagnosis.</li> <li>• Narcolepsy – <b>evaluate</b> the impact of narcolepsy on the nervous system, focusing on the role of neurotransmitter deficiencies, in regulating sleep-wake cycles. Consider the implications for management strategies and the overall quality of life for individuals living with narcolepsy.</li> <li>• Bipolar Disorder – <b>evaluate</b> the impact of bipolar disorder on the nervous system, focusing on the neurobiological factors that influence mood regulation, including neurotransmitter imbalances and brain structure changes. Consider the importance of early intervention and personalised treatment strategies in improving the management and quality of life for individuals with bipolar disorder.</li> </ul>

	<p><i>This aspect of the unit develops foundational knowledge for further engagement with higher order thinking and development of scientific skills. Care should be taken in scheduling and volume of content to ensure that students engage with the subsequent content description and the development of science inquiry skills.</i></p>
<p><b>Evaluate</b> applications, limitations, and predictions of theories and models relevant to the nervous system and propose solutions to weaknesses in the model or propose solutions to the issue the model addresses</p>	<p><b>Building on the fundamental knowledge taught above, and the conclusions drawn from the chosen evaluations above, evaluate</b> one or two of the following models or theories to continue the examination of aspects of nervous system health. The number of models/theories examined will depend on the complexity of the model/ theory and the nature of the case studies and material used to build student understanding. The number will also depend on the time it takes for students to develop a critical understanding of the topic shown in endorsing or challenging models with evidence, or proposing therapies, treatments or public health information as solutions using evidence.</p> <p>Models/theories that could be considered. Choose <b>one or two</b> to develop <b>higher order thinking and evaluation skills</b> and deeper, nuanced understanding of <b>fundamental knowledge</b>:</p> <ul style="list-style-type: none"> <li>• Allostatic load model - <b>evaluate</b> the scientific research and evidence that underpin the model, highlighting its significant insights into how chronic stress affects the nervous system and its broader implications for health outcomes.</li> <li>• Neurobiological markers – <b>evaluate</b> the role of markers as tools for diagnosing and monitoring neurological disorders, highlighting their ability to offer insights into disease progression and treatment effectiveness. Explore cost-benefit analyses to suggest measures that governments could implement to optimise health outcomes.</li> <li>• Cognitive function assessments – <b>evaluate</b> the use of cognitive function assessments as tools for evaluating mental performance and identifying cognitive impairments in various populations. Highlight their importance in tracking changes over time and informing treatment strategies</li> <li>• Psychological well-being indicators – <b>evaluate</b> the use of psychological well-being indicators in measuring mental health and overall life satisfaction across different populations. Emphasise their significance in identifying areas for intervention and promoting positive mental health and explore cost-benefit analyses to suggest policies that governments could implement to improve mental health services and outcomes.</li> <li>• Cortisol levels – <b>evaluate</b> the use of cortisol as a biomarker for stress and its implications for assessing health and well-being in various populations. Highlight its significance in understanding the physiological effects of chronic stress on the body and explore cost-benefit analyses to propose strategies that governments could implement to address stress-related health issues and enhance public health outcomes.</li> <li>• Other models or theories</li> </ul> <p>Through the model <b>evaluate</b> the applications, limitations, and predictions of the model by testing its claims against data and examining its methodology <b>and</b> propose solutions to weaknesses in the model or propose solutions to the issue the model addresses</p>

<p><b>Evaluate</b> the evidence for the connection between life experiences at different stages of human life and development of disease/conditions <b>and/or</b> the evidence for the efficacy of treatments for the chosen disease or condition</p>	<p><b>Building upon one of the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the one above or use this as an opportunity to explore a new topic.</b></p> <p>Identify a model/theory on the relationship between life experiences and human development such as <i>effect of childhood trauma on mental health conditions</i>. <b>Evaluate the validity and reliability</b> by finding and analysing possible sources of data to validate or invalidate the model.</p> <p><b>OR</b></p> <p><b>Evaluate</b> the effect of treatments/therapies/intervention on a disease <i>such as deep brain stimulation for Parkinson’s Disease etc</i> by finding and analysing possible sources of data, consider validity and reliability, to validate or invalidate the treatment.</p> <p>Ways to <b>evaluate the validity and reliability</b> of evidence include:</p> <ul style="list-style-type: none"> <li>• Small group studies versus large populations</li> <li>• Primary versus secondary data</li> <li>• Longitudinal versus cross sectional studies</li> <li>• Animal studies versus human studies</li> <li>• Single study versus meta-analysis</li> <li>• Anecdotal evidence versus research data</li> <li>• Other ways to assess evidence</li> </ul> <p><i>These are key information literacy skills in general, as well as significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people.</i></p>
<p><b>Evaluate</b> claims made in scientific texts and in the popular media about health relevant to the nervous system</p>	<p><b>Building upon one of the fundamental knowledge and one of the models and theories not chosen above. You might cluster this content description with the ones above or use this as an opportunity to explore a new topic.</b></p> <p>Interrogate foundations, methods, and validity of knowledge claims in popular media by <b>evaluating</b> evidence in medical literature against popular media claims.</p> <p>Sample topics that could be considered:</p> <ul style="list-style-type: none"> <li>• Drugs and brain health</li> <li>• Nutrition and brain health</li> <li>• Head injuries such as concussion and brain health.</li> <li>• Alzheimer Disease treatment drugs</li> <li>• Drinking contaminated water and Parkinson’s disease</li> <li>• Portrayal of Schizophrenia by media</li> <li>• Pain management</li> </ul>

	<ul style="list-style-type: none"> <li>• Other topics</li> </ul> <p><i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> bioethical, social policy, cultural and economic influence on science claims and practices related to the nervous system</p>	<p><b>Building upon one or more of the foundational topics:</b></p> <p>Read and <b>evaluate</b> the arguments found in an editorial or popular science magazine, compare arguments, and adopt and justify an ethical position on the topic:</p> <p><u>Sample topics that could be considered:</u></p> <ul style="list-style-type: none"> <li>• Lobotomy – e.g., relief for severe mental illness when other treatments were unavailable or ethical violation, irreversible side effects, and the loss of autonomy and personality experienced by patient</li> <li>• Electroconvulsive therapy – e.g. an effective treatment for severe depression and other mental illnesses vs potential side effects, including memory loss and cognitive impairment</li> <li>• Psychopharmacological enhancements – e.g., does the improvement in cognitive function, emotional well-being, and quality of life for individuals outweigh the ethical concerns about the potential for misuse and dependency</li> <li>• Unethical use of organoids – e.g., consider the treatment of human cells, consent, and implications for future research</li> <li>• Euthanasia – e.g., consider personal autonomy and choice in end-of-life decisions and ethical concerns</li> <li>• Misdiagnosis and hospital admission to psychiatric wards</li> <li>• Psychiatric prison</li> <li>• Level of investment in dementia research</li> <li>• Melatonin and sleep cycle</li> <li>• Other topics</li> </ul> <p><i>Building significant ethical capacity, as well as information literacy skills in general, is a significant application of scientific knowledge for building social and individual capability and as citizens, potential parents and people. Awareness of the ethical implications of knowledge and scientific capacity is vital learning for future scientists and citizens.</i></p>
<p><b>Skills</b></p>	
<p><b>Content Description</b></p>	<p><b>Elaboration</b></p>
<p><b>Design, conduct and improve</b> safe, ethical and original inquiries into the nervous system individually and collaboratively, that collect valid, reliable data in response to a complex question</p>	<p>Students need to develop an understanding of how to <b>design</b> an experiment including aim, independent, dependent, and controlled variables, hypothesis, risk assessment, ethical research assessment, materials and method. These employ and further develop the fundamental knowledge of the topics investigated into more nuanced understanding, and greater retention of concepts and knowledge.</p>



	<p>Suggested practicals to support the development of skills in this topic area. Internet searches, consultation with colleagues and reading textbooks will provide model methods for alteration for context or improvement:</p> <ul style="list-style-type: none"> <li>• Cognitive tests</li> <li>• Sensory reactions tests</li> <li>• Brain dissection</li> <li>• Sleep study</li> <li>• Other practicals</li> </ul> <p>Some locations of possible ideas include: <a href="#">Scoilnet.ie</a>; <a href="#">WACE Human Biology</a>; <a href="#">Science in the Classroom</a></p> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and Ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> cause and correlation, anomalies, reliability and validity of data and representations, and evaluate errors in response to investigating a complex question about the nervous system</p>	<p>In the context of their own experiments or existing research, students need to show the meaning and significance of data by applying basic statistical methods to <b>evaluate</b> quantitative data sets and/or where appropriate, critique qualitative methods. This might be in their own data collection or received data sets.</p> <p><u>Suggested topics to consider:</u></p> <ul style="list-style-type: none"> <li>• self-reporting error</li> <li>• risk assessment and ethics</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Evaluate</b> research/medical processes and claims about the nervous system, and provide a critique based on evidence</p>	<p><b>Building on one of the foundational topics:</b></p> <p>Students will need to <b>evaluate</b> past research failures that harmed participants or that did not transfer into human context, effectively to better understand the nature of effective research in Science.</p> <p><u>Suggested studies that could be explored:</u></p> <ul style="list-style-type: none"> <li>• Animal models to test stroke treatments</li> <li>• Gene therapy trials for Parkinson’s Disease</li> <li>• Pain management – opioid crisis</li> <li>• PTSD and mushrooms (role of TGA)</li> </ul>

	<ul style="list-style-type: none"> <li>• Melatonin and sleep cycle</li> <li>• Pesticides and Parkinson’s Disease</li> <li>• Other studies</li> </ul> <p>Investigate innovations in medical/ health research that could result in valid experiments and outcomes.</p> <p><u>Innovations to consider:</u></p> <ul style="list-style-type: none"> <li>• AI assisted research/ analysis.</li> <li>• Simulated models</li> <li>• Organoids</li> <li>• Other innovations</li> </ul> <p>This content description can stand alone or be clustered with the content descriptions above that are evaluating aspects of fundamental knowledge in the area. <i>This important content description develops media literacy, numeracy skills and ethical skills. It builds capacity as citizens and enables students to navigate the world more critically and with scientific acumen.</i></p>
<p><b>Reflect</b> with insight on own thinking and that of others, evaluate planning, time management, and use of appropriate independent and collaborative work strategies.</p>	<p>Either orally or in writing, as part of an investigation, experiment or- summative exam, or as a stand-alone summative task (e.g. journaling), students are required to <b>reflect</b> on planning, time management, and use of appropriate independent and collaborative work strategies.</p> <p><u>Some suggested methods for reflection include:</u></p> <ul style="list-style-type: none"> <li>• Yarning circles</li> <li>• Kolb’s learning cycle</li> <li>• Rolfe’s framework of reflective practice</li> <li>• Gibb’s reflective cycle</li> <li>• Group/team reflection</li> </ul> <p><i>Students need explicit teaching on how to reflect and chance to practice and receive feedback prior to assessment of this skills.</i></p>
<p><b>Communicate</b> concisely, effectively, and accurately, with scientific literacy in a range of modes, representations, and genres for specific audiences and purposes, and accurate referencing</p>	<p>Students need to be exposed to scientific literacy texts that students are expected to produce in their assessments. This will support:</p> <ul style="list-style-type: none"> <li>• The development of their use of precise scientific vocabulary</li> <li>• Precise text structure of their scientific writing</li> <li>• Choice of referencing (a reference list alone is insufficient, there must be in-text referencing).</li> </ul> <p>Consider: <a href="#">Science in the Classroom</a>; <a href="#">New Scientist</a></p>