Science Resource Package: Grade 5

Meeting Basic Needs and Maintaining a Healthy Body: The Digestive, Excretory, Respiratory and Circulatory Systems

New Brunswick Department of Education

December 2010

Acknowledgements

The Department of Education of New Brunswick gratefully acknowledges the contributions of the following groups and individuals toward the development of the New Brunswick Science Resource Package for Grade 5 *Meeting Basic Needs and Maintaining a Healthy Body: the Digestive, Excretory, Respiratory, and Circulatory Systems*

- The Science Resource Package Development Team:
    - Krista Fournier, School District 2
    - Janet Ramsey, School District 15
    - Judson Waye, School District 16
    - Craig Crawford, School District 15
- Science East:
    - Michael Edwards, Director of Programming
    - Karen Matheson, Director of Education
- Kathy Hildebrand, Learning Specialist, Science and Mathematics, NB Department of Education
- Science Learning Specialists and science teachers of New Brunswick who provided invaluable input and feedback throughout the development and implementation of this document.

Note that at the time of posting, all URLs in this document link to the desired science content. If you observe that changes have been made to site content, please contact Kathy Hildebrand, kathy.hildebrand@gnb.ca, Science Learning Specialist, at the Department of Education.

2010
Department of Education
Educational Programs and Services

TABLE OF CONTENTS

RATIONALE

This resource package models current research in **effective science instruction** and provides an **instructional plan** for one topic selected from the Grade 5 Atlantic Canada Science Curriculum. This curriculum includes STSE (Science, Technology, Society and Environment) outcomes, Skills outcomes, and Knowledge outcomes – all of which are important for building a deep understanding of science and its place in our world.

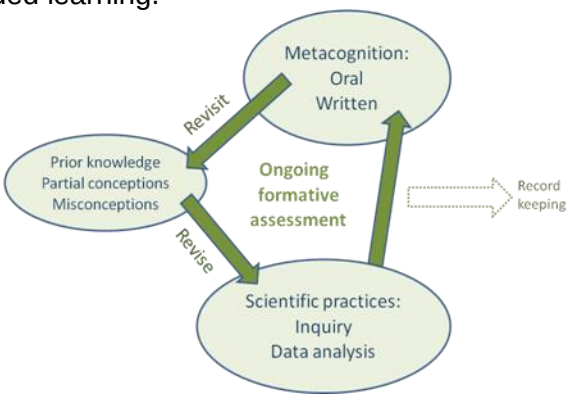
As has been true of our ancestors, we all develop "explanations" about what we observe which may or may not be valid. Once ideas are established, they are **remarkably tenacious** and an alternate explanation rarely causes a shift in thinking. To address these **misconceptions** or alternate conceptions, students must be challenged with carefully selected experiences and discussion.

A key part of this instructional plan is accessing **prior knowledge.** It is recorded in a way that it can and **will be revisited** throughout the topic. The intent is to revise, extend, and/or replace students' initial ideas with evidence-based knowledge.

Science is not a static body of facts. The process of exploring, revising, extending, and sometimes replacing ideas is central to **the nature of science**. Think of science as an **ongoing evidence-based discussion** that began before our time and that will continue after it. Science is often collaborative, and discussion plays a key role. Students' learning of science should reflect this as much as possible.

The intent of this instructional plan is to encourage a **constructivist** approach to learning. Students explore an activity, then share, discuss and reflect. The telling of content by the teacher tends to come after, as an extension of the investigation (or experience) explored by the students.

The learning is **organized into cycles**. The partial conceptions and misconceptions are revisited in each cycle so that students' ideas will be revised. Each cycle will result in deeper and/or extended learning.



Hands-on activities are part of the instructional plan. Inquiry activities tend to be most structured in the first cycle. The teacher provides the question to investigate and gives a procedure to follow. In subsequent cycles, less structure tends to be given. For example, students may be given a question and asked to develop an experimental plan which they then implement. The goal is to **move towards open inquiry** in which students generate a testable question, develop an experimental plan using available materials, implement the plan, record relevant observations, and make reasonable conclusions. The included activities are meant to start this journey.

Discussion and **written reflections** are key parts of the lessons. Discussion (both oral and written) is a vehicle that moves science forward. For example, when scientists publish their evidence and conclusions, other scientists may try to replicate results or investigate the range of conditions for which the conclusion applies. If new evidence contradicts the previous conclusions, adjustments will be required. Similarly, in this instructional plan students first **do**, then **talk**, then **write** about the concept. A section on supporting discussion is included in this resource package.

Assessment tasks are also included in the instructional plan and assess three types of science curricular outcomes: STSE, Skills, and Knowledge. These tasks are meant to be used as tools for letting the teacher and the students know **where they are** in their learning and what the **next steps** might be. For example: Has the outcome been met or is more learning required? Should more practice be provided? Is a different activity needed?

When assessment indicates that outcomes have been met, it will provide **evidence of achievement**. This evidence may be sufficient and further formal testing (paper-pencil tests) may not be required to demonstrate that outcomes have been met.

ⓘBackground Information

Prior Knowledge:

- Organisms need food, water, and shelter (Grade 4 habitats unit).
- Healthy foods and exercise are important for your body.
- Students know some organs in the body such as the heart, lungs, and stomach.

Common Misconceptions:

- The stomach does all of the work in digestion.
- Each organ or system is kind of by itself, not connected.
- Lungs are like an empty plastic bag.
- There are empty spaces inside a body.
- The digestive system isn't very long.
- Students are not sure about the relationship between heart beats and pulse in the wrist.

Did You Know?

The Teacher's Guide for "Body Works" contains valuable background information for the following:

- the digestive system on pages 33 and 39;
- the respiratory system on page 46;
- the circulatory system on page 54;
- the relationship between exercise, breathing and nutrients on page 61; and
- the kidneys and sweat on page 66.

A heart attack takes place when blood flow to the heart muscle is blocked, starving that part of the heart of oxygen. The heart tissue dies without that oxygen, causing pain and also an irregular heartbeat. Without proper coordinated pumping, blood is not moved effectively to the brain and other organs. This can result in death if proper blood flow is not restored within about 5 minutes.

A stroke is the death of brain cells when blood vessels in or to the brain are blocked, starving the brain of oxygen.

To learn more about the digestive system and the heart, visit http://www.medtropolis.com/VBody.asp. This site has animations and "narrated tours" that provide a more visual understanding of each.

An animation and description of respiration can be found at http://www.nhlbi.nih.gov/health/dci/Diseases/hlw/hlw_when.html

A site with student-friendly descriptions of things like burps, farts, bad breath, hiccups, earwax, etc. http://yucky.discovery.com/flash/body/yuckystuff/hiccup/js.index.html#

Instructional Plan

Access Prior Knowledge

Activity

Ask students to make a list of as many organs in the body as they can. Then have students share and write the organ names onto cards or stickies. Accept all answers.

Pick a student and have him/her lay on a piece of craft paper. Make an outline of the student.

As a class place the organ names on the body outline where students think the organ is located. This will be revisited and revised several times during instruction.

Cross-curricular links:
ELA

1. Students will be expected to:
   a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
   c) Explain and support personal ideas and opinions
2. Students will be expected to:
   a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
   b) Use word choice and expression appropriate to the speaking occasion

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

✓ **Assessment:**
Note the concepts and misconceptions students are expressing. You will need to know these to plan effective questions for subsequent activities and discussions so that students will examine and adjust their alternate conceptions.

Post student versions of curricular outcomes on chart paper (see page 23).
Inform students that these outcomes will be addressed over the next portion of the unit. Point out to students which outcomes are being addressed in each activity.

1st Cycle

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

107-5 Provide examples of how science and technology have been used to solve problems in their community and region

107-8 Describe examples of technologies that have been developed to improve their living conditions

107-12 Provide examples of Canadians who have contributed to science and technology

204-1 Propose questions to investigate and practical problems to solve

204-2 Rephrase questions in a testable form

205-7 Record observations using a single word, notes in point form, sentences, simple diagrams and charts

302-5a Describe the structure and function of the major organs (i.e. teeth, tongue, esophagus, stomach, small intestine, and large intestine) of the digestive system

Ask students: *How does the food on your plate get turned into a useful form for your body to use?* Students will suggest it needs to be digested.

How far does the food travel through your body? Have students cut lengths of yarn that show the distance they estimate food travels through the body.

Cross-curricular links:
ELA
2. Students will be expected to:
a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
b) Use word choice and expression appropriate to the speaking occasion
c) Give and follow precise instructions and respond to questions and directions

Activity – Digestive System

Have students work through the stations to explore what happens to food in your body. Student directions are on page 27. They should record their observations for each station in an organized manner of their choice.

Station	Materials	Instructions
Station 1 - teeth	Unsalted soda crackers Timer/clock	Put unbroken cracker in the mouth - no chewing. Measure the time it takes to get soggy and break apart. Repeat but chew the second time.
Station 2 - saliva	Unsalted soda cracker Timer/clock	Chew for 2 minutes without swallowing. Describe taste and texture of cracker.

Station 3 – swallowing and esophagus	Cup Straw Water	Hold tongue and try to swallow. Next bend at the waist, use a straw and take a drink. Can they feel it go down?
Station 4- esophagus	Tennis ball Tube sock or knee-high tights	Move the tennis ball through the tube sock from one end to the other.
Station 5 – stomach	Ziploc bag Banana Unsalted soda crackers Piece of candy	Try to squish up the food items while they are in the fastened bag.

✓ **Assessment:**
During the student activity, make notes on outcomes (or parts of outcomes) you observe being addressed. Process skill outcomes are part of the curriculum and should be assessed. Using the observation chart or the checklist (see pages 29-34) on a clipboard may be helpful to you. Develop your own code for quick notes.

A suggested code:
√ observed and appropriate,
WD with difficulty,
A absent.

This chart may be used on multiple days, using a different coloured pen or pencil each day and putting the date in the corner. You may not have a symbol or note for every child every day. Some teachers like to focus on a group or two each time. However you choose to make note of your observations, you will always have a sense of who you need to take more notice of and who might need extra support. The information will also help you when it is reporting time.

Reflection: Class Discussion

Remind your class about respectful discussion. The discussion tips on pages 20-21 may be helpful.

- Review what the students found at each station. Did everyone have the same results?

Station 1: Crackers

Ask students:

How long did it take to get soggy without chewing? With chewing? Which method is more efficient for breaking food up? Why do you think we have teeth?

Station 2: Saliva

What did you notice about the cracker after a couple of minutes of chewing? (Should get sweet, sticky, dissolve and start to disappear.)

What is in our mouths that would cause this to happen? Beginning of digestion is chewing and mixing saliva with the food to break the food into smaller bits and also to start digesting the large complex sugars into simpler sugars.

Station 3

Could anyone swallow while holding their tongue? (You need your tongue to help swallow.)

If you bend over or stand on your head and swallow, what happens? The esophagus still pushes that food to the stomach.

Station 4

Have students show how they moved the ball from one end of the sock to the other.

The motion with the ball is similar to the pushing movement of the muscles of the esophagus.

Cross-curricular links:
ELA

1. Students will be expected to:
   a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
   c) Explain and support personal ideas and opinions
2. Students will be expected to:
   a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
   b) Use word choice and expression appropriate to the speaking occasion

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

Station 5

Have students show how they squished the food in the stomach. *What happened to the candy? How might the candy be digested?* (It would dissolve slowly if the stomach only had water and food, but stomach acid helps the process along. The stomach plays a small role in digestion. Most of the digestion takes place in the small intestine.)

- This takes students from the mouth to the stomach. Revisit the information on the body outline from the Accessing Prior Knowledge activity (on page 4). Ask: *Are there digestive organs we need to add? Should we change the position of any already on our body?* Cards could be added outside the body shape with a brief note describing the function of each organ.

- Tell students that from the stomach, the food/nutrients enter the small intestine. This is where the nutrients leave the digestive system. *Where do they go? Why do we need the nutrients to travel throughout our bodies?*

To help students visualize food moving through the digestive system, including the small intestine, large intestine and rectum/anus, use one or all of the simulation activities described on pages 24-26

- Ask students to hold up the lengths of yarn they cut when they started the Digestive System. Would they change the amount of yarn they cut? Show students a length of yarn that measures about 9 meters. The longest part of the digestive

system is the small intestine which is about 6-7 meters long. The large intestine, larger in diameter than the small intestine, is only about 1.5-2 meters long.

Ask students: *How is it possible for a digestive system this long fit inside your body?*

- Revisit the information on the body outline from the Accessing Prior Knowledge activity (on page 4). Ask: *Are there digestive organs we need to add? Should we change the position of any already on our body?*

- The concepts in this cycle can be reviewed and extended by using the Bill Nye video "Digestion" from http://learning.aliant.net/.

To access the video, type the title into the search box. Videos are available free of charge at this site. You will need to register, however registration is free. If you try to watch the video without logging in, you will be prompted to do so. Note that a table of contents opens beside the video so that you may select only certain sections for viewing if you wish. There is also the option to watch the video full screen.

Canadian Innovations

A major breakthrough in medicine was the Canadian discovery of Insulin. As part of the digestive system, the body needs to break down food and absorb nutrients. Scientists knew there was a chemical made in the body that was missing in some people, but for many years they did not know which organ produced the chemical. Eventually they identified the organ but could not find, isolate, and identify the chemical. Between 1921 -1923, Banting and Best worked to isolate insulin which helps the body absorb and use sugar for energy. Before the discovery and ability to give people insulin, diabetes meant a very strict starvation-type diet and death.

Reflection: Journaling

Which organ of the digestive system do you find to be most interesting? Explain why by comparing it to other organs of the digestive system.

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
- record and reflect on experiences and their responses to them
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

✓ **Assessment:**

Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Take note of which students are discussing accurate characteristics of digestive organs.

Think like a scientist

Cross-curricular links:
ELA
8a. Students will be expected to:
Use a range of strategies in writing and other ways of representing to
- frame questions and answers to those questions

Asking good questions is an important skill in science. Initially students will need support. Model the skill with the whole class and students will begin to have the confidence to contribute. After some practice, students will be able to generate questions successfully individually.

Present students with a situation and ask them to generate questions that could be investigated scientifically. (These situations and questions do not have to be limited to those that can be done in a classroom.)

Situation:

Quite often kids like foods and drinks that have been sweetened in some way. There are different ways to make things taste sweeter. One option is to add sugar (sucrose) like what we have in our houses for Kool-Aid or baking, or other forms of sugar such as glucose, fructose, concentrated juices from fruits, or corn syrup. Another is to add an artificial sweetener (like Sugar Twin). Parents and researchers are concerned about the impact sugar has on children's abilities to concentrate. Some think sweeteners makes children more hyper.

What is one question concerning sweeteners and children that could be investigated scientifically?

For example:

Does one type of sweetener make children more hyper than another type of sweetener?
How much of each sweetener do you need to eat to see an effect?

Possible Extension:

Compare the human digestive system to those of other mammals. This site may be a starting place http://nature.ca/discover/exm/blddgstvsystm/index_e.cfm

2nd Cycle

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

104-2 Demonstrate and describe processes for investigating scientific questions and solving technological problems
106-4 Describe instances in which scientific ideas and discoveries have led to new inventions and applications
107-5 Provide examples of how science and technology have been used to solve problems in their community and region
107-8 Describe examples of technologies that have been developed to improve their living conditions
107-12 Provide examples of Canadians who have contributed to science and technology
204-1 Propose questions to investigate and practical problems to solve
204-2 Rephrase questions in a testable form
205-1 Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea by controlling major variables
205-7 Record observations using a single word, notes in point form, sentences, simple diagrams and charts
206-2 Compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs
206-3 Identify and suggest explanations for patterns and discrepancies in data
207-5 Identify problems as they arise and work cooperatively with others to find solutions
302-5d Describe the structure and function of the major organs (i.e. heart, blood vessels (arteries, veins, capillaries), and blood) of the circulatory system

Ask students: *Where do you find your heart rate?* If students only suggest where their heart is, ask if they can find other places on their bodies where they can find their heart beat (neck, wrist, leg).

Ask students to count the number of beats for 10 seconds. How do they find out how many beats per minute? If students want to actually listen to each other's hearts and stethoscopes are not available, they could listen through an empty paper towel roll.

Activity – Circulation: Heart Rates

Tell students they will be exploring what factors affect heart rates.

With students, brainstorm a list of possible variables (such as resting quietly, doing jumping jacks, telling a lie, taking a test, running up and down stairs) and a list of possible observations (such as taking pulse rate, counting heart beats, time interval to use) that are relevant to exploring heart rates. Students can use these lists to develop testable questions.

- Students will choose/develop a testable question.
- Students will design a fair test to gather data related to the question. They will need to be provided with a list of possible materials or also be asked to make a list of needed materials.
- Students will carry out the test and record relevant data in an organized way, such as a bar graph.

You may choose to have all students test the same question or allow students to choose their own.

ⓘ Teacher note: Care should be taken to ensure students with heart or breathing problems are given the role of timer, recorder, or are involved in less strenuous activities.

If students have their testable question and experimental procedure developed, you might discuss with the Physical Education teacher about having some of the actual data collection happening as part of one of their classes.

Cross-curricular links:
ELA
2. Students will be expected to:
a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
b) Use word choice and expression appropriate to the speaking occasion
c) Give and follow precise instructions and respond to questions and directions
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- frame questions and answers to those questions
- record and reflect on experiences and their responses to them
b) Expand appropriate note-making strategies from a growing repertoire (e.g., outlines, charts, diagrams)

MATH
N4: Apply mental mathematics strategies for multiplication, such as: using the distributive property

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

Remind your class about respectful discussion. The discussion tips on pages 20-21 may be helpful.

- Review what students identified that changed their heart rates, both for increasing and decreasing heart rate.

What kinds of activities increased heart rate? Do all activities increase heart rate in the same way? Did anyone notice anything else that happened when their heart rate increased? (Possibilities include: increased breathing rate, perspiration, redder skin.)

What kinds of activities decrease heart rate?

What does the heart do for the body? (Brings blood to the entire body; blood contains oxygen and takes away waste.)

Why do you think heart rate changes?

How does the blood travel through the body? (Blood vessels)

- Show students a 1L water bottle and ask them how many bottles are needed to represent the amount of blood in our bodies. Students can do a "think-pair-share" to come up with an answer. (It actually is about 5 L.)

- Ask students to look for blood vessels on their bodies. *Where do they come from and go? Where can they be found? Are they easier to see after exercise?*

  Have students trace their hand (or you may ask your students to choose another part of their body) and draw on the blood vessels that they can see in their actual hands.

- The concepts in this cycle can be reviewed and extended by using the Bill Nye video "Blood and Circulation" from http://learning.aliant.net/.

  To access the video, type the title into the search box. Videos are available free of charge at this site. You will need to register, however registration is free. If you try to watch the video without logging in, you will be prompted to do so. Note that a table of contents opens beside the video so that you may select only certain sections for viewing if you wish. There is also the option to watch the video full screen.

Cross-curricular links:
ELA
1. Students will be expected to:
   a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
   c) Explain and support personal ideas and opinions
2. Students will be expected to:
   a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
   b) Use word choice and expression appropriate to the speaking occasion
3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

- **Canadian innovations**

  John Hopps, 1950. John Hopps was researching hypothermia and trying to use radio frequencies to restore the body's temperature. He accidentally found that when someone's heart stopped, it could be restarted with a mechanical and/or an electrical pulse or shock. The first pacemaker was too large to be implanted into a person, but after 8 years, they were able to decrease the size allowing the pacemaker to be inserted into a person's body. The pacemaker has saved millions of lives.

  Revisit the information on the body outline from the Accessing Prior Knowledge activity (on page 4). Ask: *Are there circulatory system organs we need to add? Should we change the position of any already on our body?*

Reflection: Journaling

Samuel is sleeping quietly. When his alarm goes off, he jumps out of bed and runs downstairs to get his day started. Explain how his heart rate will change from when he is sleeping to when he gets to the bottom of the stairs and why.

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

✓ **Assessment:**

Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

When reading the journal entries, note which students can relate changes in heart rate to level of activity.

3rd Cycle

✪ Curriculum Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

205-2 Select and use tools to manipulate materials and build models
205-7 Record observations using a single word, notes in point form, sentences, simple diagrams and charts
206-2 Compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs
206-3 Identify and suggest explanations for patterns and discrepancies in data
207-5 Identify problems as they arise and work cooperatively with others to find solutions
302-5b Describe the structure and function of the major organs (i.e. kidneys, ureters and urethra, as well as skin and lungs) of the excretory system
302-5c Describe the structure and function of the major organs (i.e. nose, trachea, lungs, diaphragm), of the respiratory system
302-5d Describe the structure and function of the major organs (i.e. heart, blood vessels (arteries, veins, capillaries), and blood) of the circulatory system

Ask students how they would figure out their breathing rate. (They should be able to count the number of breaths they take in 10 seconds and multiply by 6 to get the rate per minute).

Activity 1 - Breathing

Ask students to repeat their heart rate experiment, but this time they will monitor their breathing rate as well as heart rate. Students should use a double bar graph to organize and compare heart rate and breathing rates. *Is there a relationship between the two?*

Cross-curricular links:

ELA

2. Students will be expected to:
a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
c) Give and follow precise instructions and respond to questions and directions

8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- frame questions and answers to those questions
b) Expand appropriate note-making strategies from a growing repertoire (e.g., outlines, charts, diagrams)

MATH

graphs to draw conclusions.

✓ Assessment:

On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

Remind your class about respectful discussion. The discussion tips on pages 20-21 may be helpful.

Ask students: *What did you notice about heart rate and breathing rate?*

Why do we actually breathe? (To bring oxygen to the body and carbon dioxide out of the body)

Why does your breathing rate change? (The body has different needs for oxygen depending on your activity levels.)

How does the air you breathe get to all parts of your body? (The circulatory system – heart, blood and blood vessels carries oxygen all over your body. You may have to remind students of the relationship between heart rate and breathing rate for them to connect the two systems at this level.)

Cross-curricular links:
ELA
1. Students will be expected to:
a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
c) Explain and support personal ideas and opinions
2. Students will be expected to:
a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
b) Use word choice and expression appropriate to the speaking occasion
3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

Waste

The lungs eliminate waste in the form of carbon dioxide. Our digestive system eliminates waste in the form of feces. There is one more type of elimination – liquid – urine and sweat. Blood that passes through the body also passes through the kidneys which filter our blood removing extra water and waste. This water and waste travels to the urinary bladder then through the ureters and urethra to be eliminated (or "peed" out).

Model Circulatory System

Use the following demonstration to model how the circulatory and respiratory systems are connected. This can be brought around for groups to explore while they are making and playing with the model lungs they will make in the next part of this cycle.

Materials:

2 medium Ziploc bags
2 aquarium tubes (each about 60 cm long)
Red food colouring
Pictures of person and lungs (see page 28)
4 rubber bands

Scissors
Water

- Make a small diagonal cut in one corner at the bottom of each Ziploc bag.
- In each bag, make another small hole just under the zip closure, on the opposite side of the bag.
- Cut each rubber band so you have a length of rubber band versus a ring-shaped rubber band.
- Insert one end of the aquarium tubing into the bag. Twist the Ziploc bag around the tubing and secure in place by tying one rubber band around the tube and Ziploc. The key to a tight seal is to wrap the rubber band around the tubing/bag several times without overlapping itself (like ballerina shoe laces going up the leg).
- On one length of tubing, attach a picture of a person which represents the body, and on the other length, attach a picture of the lungs.
- Each Ziploc bag represents one side of the heart. Fill each Ziploc bag about half full and add a few drops of food colouring. Try to push out most of the air as you seal the bag.

Show students how they can push on one bag intermittently like a heartbeat. The blood flows out of one side of the heart into the body, where it delivers oxygen and nutrients and picks up CO_2 and waste, then back to the other side of the heart. The intermittent pushing of blood from one bag through the tube into the other bag is an excellent model of how our blood pulses.

The blood is also pushed from the other side of the heart, through the lungs where it delivers waste and picks up oxygen. It travels back to the other side of the heart to go back into the body.

To get the blood flowing out the desired tube, you need to press your hand to the table surface down the middle of the bag (like a karate chop) to block the blood from going out the wrong way. This is a great way to introduce the fact that the heart

actually has four chambers and valves to prevent blood from going the wrong way and that a model always has limits in how it represents reality.

Activity 2 – Model Respiratory System

Ask students: *Where does the air go when you breathe in?*

What do you feel when you take a deep breath? (Should feel lungs filling, may feel pressure on their stomachs, ribs moving out, air on the back of their tongues)

What about when you cough?

Have students use the "Exploration" on page 24 of the grade 5 "Body Works" to build a Model Lung. One change that can be made to the model is to tape a plastic bag (e.g. bread bag) to the bottom of the 2L bottle instead of a large balloon. The balloon can be difficult to keep in place and often squeezes the bottle.

Materials:

2L bottle
Bread bag
Tape
Small balloon
Straw
Play dough or clay

Students will use the model to observe what happens to the smaller balloon attached to the straw when they gently:

a) pull on the bread bag
b) push on the bread bag
c) cover the end of the straw and pull on the bread bag

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

What happened when you pulled on the bread bag?
(The balloon inflated.)

What happened when you pushed on the bread bag?
(The balloon shrunk.)

What does each piece of the model represent?

The bread bag is like our diaphragm – a huge muscle that helps us breath. When it contracts it moves down, causing our lungs to expand. Air rushes in. When the diaphragm relaxes, it pushes up, forcing air out of our lungs.

The straw is like our mouth/nose and trachea. The trachea is the thing you feel on your throat with the rings. The rings protect your trachea since it has a very vital function.

The balloon is like a lung.

Cross-curricular links:
ELA

1. Students will be expected to:
   a) Contribute thoughts, ideas, and experiences to discussions, and ask questions to clarify their ideas and those of their peers
   c) Explain and support personal ideas and opinions

2. Students will be expected to:
   a) Contribute to and respond constructively in conversation, small-group and whole-group discussion, recognizing their roles and responsibilities as speakers and listeners
   b) Use word choice and expression appropriate to the speaking occasion

3a. Students will be expected to:
Demonstrate an awareness of the needs, rights, and feelings of others by listening attentively and speaking in a manner appropriate to the situation

Any model has its shortcomings. What isn't quite right about this model? (Only one lung, the straw should branch (we have 2 bronchi from the trachea), there is something called an epiglottis that keeps food from going down our trachea, lungs are not empty spaces, but are kind of like sponges. Our lungs are surrounded by a network of blood vessels that transfer the oxygen to our blood cells that is then brought to the body. The blood transfers the carbon dioxide to the lungs for us to exhale.

The animation at http://www.aboutkidshealth.ca/howthebodyworks/Diaphragm-Muscle.aspx?articleID=10152&categoryID=XL-nh1-02a may be useful when discussing how the diaphragm works.

As a class, ask students to fill their mouths with saliva then get them to try to breathe and swallow at the same time. *What happens?*

This website provides an animation for the circulatory system. It shows the path of blood and including the path around/through the lungs to drop off carbon dioxide and pick up oxygen. Some of it is slightly technical, but turning off the volume and narrating the process makes this an excellent animation.
http://www.youtube.com/watch?v=D3ZDJgFDdk0

Revisit information on the chart from the Accessing Prior Knowledge activity (on page 4). Ask: *Is there anything that should be added to or revised? Is there other information we could add? Are there parts of the respiratory system to add to the chart*

paper "person"? Should we change the position of any already on our body?

Reflection: Journaling

Draw and label the model respiratory system. Tell how it works like a real respiratory system. Tell how it is different.

Or

Rick has just run around the school track four times. Explain what his breathing rate is like? Why is it like that?

Cross-curricular links:
ELA
8. Students will be expected to:
a) Use a range of strategies in writing and other ways of representing to
- record, develop, and reflect on ideas, attitudes, and opinions
c) Make deliberate language choices appropriate to purpose, audience, and form, to enhance meaning and achieve interesting effects in imaginative writing and other ways of representing

✓ **Assessment:**

Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

When reading the journal entries, note which students can 1) identify key features of the respiratory system and how they work or 2) relate changes in breathing rate to level of activity.

Supporting Class Discussion

No one person is as smart as all of us together.

Page Keeley, in the book "Science Formative Assessment" (2008), uses the analogy of ping-pong and volleyball to describe discussion interaction. Ping-pong represents the back and forth question-answer pattern: the teacher asks a question, a student answers, the teacher asks another question, a student answers, and so on. Volleyball represents **a different discussion pattern**: the teacher asks a question, a student answers, and other students respond in succession; each building upon the previous student's response. Discussion continues until the teacher "serves" another question.

A "volleyball" discussion encourages **deeper student engagement** with scientific ideas. Students state and **give reasons** for their ideas. Through the interaction, ideas may be challenged and clarified. Extensions and applications of ideas may arise as well. Discussions should **avoid the personal** and always revolve around **ideas, explanations and reasons.** The goal is for students to achieve better understanding.

Share the ping-pong and volleyball analogies with your students. Good discussion **takes practice**. You and your students will improve. Many teachers find discussion works best if all students can see each other, such as in a circle, at least until they become accustomed to listening and responding to each other.

As the teacher, you will need to:
- establish and maintain a respectful and supportive environment;
- provide clear expectations;
- keep the talk focused on the science;
- carefully orchestrate talk to provide for equitable participation.

It is important to **establish discussion norms** with your class. Your expectations may include:
- Everyone has a right to participate and be heard.
- Everyone has an obligation to listen and try to understand.
- Everyone is obliged to ask questions when they do not understand.
- The speaker has an obligation to attempt to be clear.

At first, discussions are apt to seem somewhat artificial. Initially, a bulletin board featuring carton talk bubbles with suggested sentence starters may be helpful.

I respectfully disagree . . .
I had a different result . . .
Could you show how you got that information?
When I was doing ___, I found that . . .
Even though you said ___, I think . . .
The data I have recorded in my notebook is different from what you shared. I found . . .

It is helpful if **teacher questions refer to a big idea** rather than specifics. (Could humans and chickens move their bones without muscles?) Questions should be

phrased so that anyone can enter into the conversation. Opinion questions are especially good for this (What do you think . . . ?
How do you think . . . ? What if . . . ? Why . . . ?).

Provide plenty of **wait time** for students. Students give more **detailed and complex answers** when given sufficient wait time. Allow wait time after student responses. When students are engaged and thinking, they need time to process other responses before contributing. If the discussion is not progressing, have students engage in **partner talk**. Partner talk enables the teacher the opportunity to insert "overheard" ideas.

Helpful teacher prompts:

1. What outcome do you predict?
2. Say more about that.
3. What do you mean by . . . ?
4. How do you know?
5. Can you repeat what ____ said in another way?
6. Does anyone agree or disagree with . . . ?
7. Does anyone want to add to or build on to . . . ?
8. Who understands ___'s idea and can explain it in their own words?
9. Let me see if I have got your idea right. Are you saying . . . ?
10. So you are saying that . . .
11. What evidence helped you to think that?
12. Okay, we do not agree. How does each position fit the evidence? What else could we find out?

References:

Keeley, Page (2008). *Science Formative Assessment.* Thousand Oaks, CA: Corwin Press and Arlington, VA: NSTA Press

Michaels, Sarah, Shouse,Andrew W., and Schweingruber, Heidi A. (2008). *Ready, Set, SCIENCE!* Washington, DC: The National Academies Press

Materials List

Yarn (for digestive system length)
Timer/clock
Unsalted soda crackers
Cup
Straw
Water
Tennis ball
Tube sock or knee-high tights
Ziploc bags
Banana
Piece of candy
Aquarium tubes (each 2 ft long)
Red food colouring
Rubber bands
Scissors
2L bottle
Bread bag
Tape
Small balloon
Play dough or clay

Optional Materials for Kinesthetic Digestive System Activity	Optional Materials for Digestive System Simulation
Large garbage can A bag of peanut-free candies Lots of paper from the recycling bin Ziploc bags Small paper bags Plastic shopping bag (like a white kitchen garbage bag) Tape Spray bottle Paper towels	1 medium Ziploc bag 1 pantyhose leg about 15 cm in length 1 Dixie cup Large garbage bags to cover tables 2 graham crackers ½ banana Cup with water Packing tape 1 elastic Scissors

Grade 5 Science kits given to schools contain:

1 barometer
7 thermometers
7 spring scales
7 stop watches
2 graduated cylinders – 100mL
Clear aquarium tubing – about 120 cm

Student Version of Outcomes

(Blue outcomes are in the French Immersion curriculum but not in the English compacted curriculum)

104-2 I will demonstrate and describe how to carry out a scientific investigation.

106-4 I will describe scientific discoveries that have led to new inventions and applications.

107-5 I will provide examples of how science and technology has been used to solve problems in my community and region.

107-8 I will describe examples of technologies that have been developed to improve people's lives.

107-12 I will provide examples of Canadians who have contributed to science and technology.

204-1 I will propose questions to investigate and problems to solve.

204-2 I will rephrase questions into a testable form.

205-1 When exploring problems, I will carry out procedures and ensure a fair test by controlling major variables.

205-2 I will select and use tools to build models.

205-7 I will record observations using a single word, notes in point form, sentences, simple diagrams and charts.

206-2 I will compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs.

206-3 I will identify and suggest explanations for patterns and discrepancies in data

207-5 I will identify problems as they arise and work with others to find solutions

302-5a I will describe the structure and function of the major organs of the digestive system (i.e. teeth, tongue, esophagus, stomach, small intestine, and large intestine).

302-5b I will describe the structure and function of the major organs of the excretory system (i.e. kidneys, ureters and urethra, as well as skin and lungs).

302-5c I will describe the structure and function of the major organs of the respiratory system (i.e. nose, trachea, lungs, diaphragm).

302-5d I will describe the structure and function of the major organs of the circulatory system (i.e. heart, blood vessels (arteries, veins, capillaries), and blood).

Return to Accessing Prior Knowledge

Digestion Simulations

Option 1

Kinesthetic Activity Simulating Digestion
Adapted from Activity #6 from site http://mypages.iit.edu/~smile/bi9706.html

Materials:

Large garbage can
A bag of peanut-free candies
Lots of paper from the recycling bin
Ziploc bags
Small paper bags
Plastic shopping bag (or a white kitchen garbage bag)
Tape
Spray bottle
Paper towels

To make a food particle:

Fill 5 Ziploc bags with about 5 peanut-free candies. Wrap each bag in crumpled up recycled paper and place those in small paper bags. Place all 5 small bags into a large plastic shopping bag. Fill with paper and tape the bag shut. This is a food particle.

Procedure:

Students will simulate the movement of the food particle from the mouth through the body to the rectum. Assign each student a part of the digestive system. To involve the whole class or even half the class, you will need to have multiple students representing the same organ. Ask the students to stand in two lines, shoulder to shoulder, facing each other about 1 meter apart. They will need to arrange themselves in the order the food passes through the digestive system and will be responsible for describing the job they are doing when they get the food particles. Provide one or two students that are the mouth (saliva), and stomach with spray bottles containing water.

Mouth/teeth/saliva - Pass the first students the food particle and ask students what the first thing to happen will be (teeth will grind it, saliva will be added). The teeth will break or rip the plastic bag and some or all of the paper bags and the mouth/saliva students will spray the food particle. All of the pieces must be passed down the line. (We normally don't chew food and let half of it dribble out of our mouths). The "food particle" should leave the mouth with the large plastic bag ripped open, paper pieces and small Ziploc bags of candies being passed down.

Esophagus – Will move closer together and squeeze the food particle down the line.

Stomach – Will open or tear the small candy-filled Ziploc bags. Some of the stomach can use spray bottles to spray the candies. This is adding stomach acid to help

digest the food. (You can warn the students not to get any of the "acid" in their eyes as it is very strong and could cause damage). They should also spray the plastic shopping bag and pieces of paper since they also move through the stomach. The food, paper and plastic should be dripping wet by the time they leave the stomach.

Small intestine – Will allow the absorption of the food particles – the small candies from the Ziploc bags. Food particles move from the small intestine to the blood (pass the candies to the teacher). The plastic shopping bag and pieces of paper move on to the large intestine.

Large intestine – Will allow the absorption of water from whatever passes through. The large intestines can use paper towels to soak up some of the water from the plastic bags and paper.

Rectum/Anus – Will eliminate what the body doesn't need – put the plastic shopping bag, Ziploc bags and pieces of paper in the garbage can.

Option 2

Digestion Simulation adapted from
www.mun.ca/LTS/files/**Digestive_system**_alternate_activity.doc

This simulation can be done as a demonstration or materials can be provided for groups of students to carry out.

Materials:

1 medium Ziploc bag
1 pantyhose leg about 15 cm in length
1 Dixie cup
Large garbage bags to cover tables
2 graham crackers
½ banana
Cup with water
Packing tape
1 rubber band
Scissors

Digestive System Simulation

Tables should be covered with newspaper or garbage bags to make clean up easier.

To prepare the digestive system, cut a small diagonal hole in one of the bottom corners of a medium-sized Ziploc bag. Insert about 2 cm of the small length of pantyhose/tights into the hole. Fasten in place using tape and wrap with an elastic band. Take a Dixie cup and cut a hole the size of a nickel in the bottom. This will represent the large intestine/rectum/anus.

Ask a student to grind 2 graham crackers with their hands then squish in ½ of a banana.

Add “saliva” (water) as they are grinding. Ask the student to roll it into a ball. The resulting ball may be slightly runny.

The ball can be wrapped in plastic wrap and squeezed down into the Ziploc bag or the student’s hands can act like the esophagus, squeezing the ball into the stomach (Ziploc bag). The Ziploc will have to be opened to add about 20 mL of water (stomach acid). Seal the bag tightly, trying to remove some of the air. What happens when there is too much air in the stomach? (Burp) Continue mashing up the food in the stomach until all of the big chunks are gone. If the bag is not sealed completely, food may push out of the top. This is the equivalent of vomiting.

Food moves to the small intestine. The rubber band (valve) can be released and the contents from the bag pushed into the pantyhose. Ask a student to help with the transfer. As the food is squeezed through the pantyhose, nutrients will leak out. This is very messy so make sure this is done over the newspapers or garbage bags. Paper towels can be used to mop up some of the nutrients (this can be the blood).

The rest of the food is moved from the small intestine to the large intestine (the Dixie cup with a hole in it). Use some paper towels to mop up more of the water from the remaining food.

Lastly, squeeze the remains from the large intestine into another cup, bag or onto the garbage bags. If a lot of water is left, the food has usually moved too quickly through the large intestine and you have diarrhea. If the food has lingered in the large intestine, it is harder and you are constipated.

Option 3

A Virtual Option

Another useful representation of the process of digestion to review and reinforce understanding of digestion for students is at the following site:
http://kitses.com/animation/swfs/digestion.swf

Digestion

Station 1

a) Put an unbroken piece of cracker in your mouth. Time how long it takes to get soggy and break apart.
b) Put another cracker into your mouth, but this time chew the cracker. How long does it take to get soggy?

Which method is more efficient for breaking food up?

Station 2

Chew an unsalted cracker for two minutes without swallowing. Describe what you notice.

Station 3

a) Hold your tongue and try to swallow. Can you do it?
b) Bend at the waist so your head and most of your upper body is upside down. Now use a straw to try to take a drink from a cup of water. Where does the water go?

Station 4

Move the ball from one end of the sock to the other.
Record with pictures and words how you were able to get it through.

Station 5

Squish the food in the stomach. What happens to the contents of the stomach? How might the candy be digested?

Return to Digestion Activity

Body and Lung clip art pictures

Observation Chart Sheet

Outcomes:

name	**name**	**name**	**name**	**name**
name	**name**	**name**	**name**	**name**
name	**name**	**name**	**name**	**name**
name	**name**	**name**	**name**	**name**
name	**name**	**name**	**name**	**name**
name	**name**	**name**	**name**	**name**

Checklist Sheet

Outcomes	Correlations with Cycles	Yes	No
STSE			
104-2 Demonstrate and describe processes for investigating scientific questions and solving technological problems	2nd cycle: Circulation: Heart rate activity		
106-4 Describe instances in which scientific ideas and discoveries have led to new inventions and applications	2nd cycle: Canadian innovations		
107-5 Provide examples of how science and technology have been used to solve problems in their community and region	1st cycle: Canadian innovations 2nd cycle: Canadian innovations		
107-8 Describe examples of technologies that have been developed to improve their living conditions	1st cycle: Canadian innovations 2nd cycle: Canadian innovations		
107-12 Provide examples of Canadians who have contributed to science and technology	1st cycle: Canadian innovations 2nd cycle: Canadian innovations		
SKILLS			
204-1 Propose questions to investigate and practical problems to solve	1st Cycle: Think like a Scientist 2nd cycle: Circulatory: Heart rate activity		
204-2 Rephrase questions in a testable form	1st cycle: Think like a scientist 2nd cycle: Circulatory: Heart rate activity		
205-1 Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea by controlling major variables	2nd cycle: Circulatory: Heart rate activity		
205-2 Select and use tools to manipulate materials and build models	3rd cycle: Activity 2: Model respiratory system		
205-7 Record observations using a single word, notes in point form, sentences, simple diagrams and charts	1st cycle: Digestive system activity 2nd cycle: Circulatory: Heart rate activity 3rd cycle: Activity 1: Breathing		

206-2 Compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs	2nd cycle: Circulatory: Heart rate activity 3rd cycle: Activity 1: Breathing	
206-3 Identify and suggest explanations for patterns and discrepancies in data	2nd cycle: Circulatory: Heart rate activity; discussion 3rd cycle: Activity 1: Breathing; discussion	
207-5 Identify problems as they arise and work cooperatively with others to find solutions	2nd cycle: Circulatory: Heart rate activity 3rd cycle: Activity 1: Breathing	
KNOWLEDGE		
302-5a Describe the structure and function of the major organs (i.e. teeth, tongue, esophagus, stomach, small intestine, and large intestine) of the digestive system	1st cycle: Digestive system activity; discussion; Kinesthetic activity or simulation; journal	
302-5b Describe the structure and function of the major organs (i.e. kidneys, ureters and urethra, as well as skin and lungs) of the excretory system	3rd cycle: Discussion	
302-5c Describe the structure and function of the major organs (i.e. nose, trachea, lungs, diaphragm), of the respiratory system	3rd cycle: Activity 1: Breathing; Activity 2: Model respiratory system	
302-5d Describe the structure and function of the major organs (i.e. heart, blood vessels (arteries, veins, capillaries), and blood) of the circulatory system	2nd cycle: Discussion 3rd cycle: Model circulatory system	

Observation Checklist

names	104-2 Demonstrate and describe processes for investigating scientific questions and solving technological problems	106-4 Describe instances in which scientific ideas and discoveries have led to new inventions and applications	107-5 Provide examples of how science and technology have been used to solve problems in their community and region	107-8 Describe examples of technologies that have been developed to improve their living conditions	107-12 Provide examples of Canadians who have contributed to science and technology	204-1 Propose questions to investigate and practical problems to solve	204-2 Rephrase questions in a testable form	205-1 Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea by controlling major variables	205-2 Select and use tools to manipulate materials and build models	205-7 Record observations using a single word, notes in point form, sentences, simple diagrams and charts	206-2 Compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs	206-3 Identify and suggest explanations for patterns and discrepancies in data	207-5 Identify problems as they arise and work cooperatively with others to find solutions	302-5a Describe the structure and function of the major organs (i.e. teeth, tongue, esophagus, stomach, small intestine, and large intestine) of the digestive system	302-5b Describe the structure and function of the major organs (i.e. kidneys, ureters and urethra, as well as skin and lungs) of the excretory system	302-5c Describe the structure and function of the major organs (i.e. nose, trachea, lungs, diaphragm), of the respiratory system	302-5d Describe the structure and function of the major organs (i.e. heart, blood vessels (arteries, veins, capillaries), and blood) of the circulatory system

Student Record

Outcome goal	Evidence
I can demonstrate and describe how to carry out a scientific investigation. (104-2)	
I can describe scientific discoveries that have led to new inventions and applications. (106-4)	
I can provide examples of how science and technology has been used to solve problems in my community and region. (107-5)	
I can describe examples of technologies that have been developed to improve people's lives. (107-8)	
I can provide examples of Canadians who have contributed to science and technology. (107-12)	
I can propose questions to investigate and problems to solve. (204-1)	
I can rephrase questions into a testable form. (204-2)	
When exploring problems, I can carry out procedures and ensure a fair test by controlling major variables. (205-1)	

I can select and use tools to build models. (205-2)	
I can record observations using a single word, notes in point form, sentences, simple diagrams and charts. (205-7)	
I can compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs. (206-2)	
I can identify and suggest explanations for patterns and discrepancies in data. (206-3)	
I can identify problems as they arise and work with others to find solutions. (207-5)	
I can describe the structure and function of the major organs of the digestive system (i.e. teeth, tongue, esophagus, stomach, small intestine, and large intestine). (302-5a)	
I can describe the structure and function of the major organs of the excretory system (i.e. kidneys, ureters and urethra, as well as skin and lungs). (302-5b)	
I can describe the structure and function of the major organs of the respiratory system (i.e. nose, trachea, lungs, and diaphragm). (302-5c)	
I can describe the structure and function of the major organs of the circulatory system (i.e. heart, blood vessels (arteries, veins, capillaries), and blood). (302-5d)