

Anglophone School District - North



Grade 8 Science - Unit Lesson Guide

Cells, Tissues, Organs, and Systems

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The Aim of Science Education - Scientific Literacy

The aim of science education in the Atlantic Provinces is to develop scientific literacy.

Scientific Literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment.

The Three Processes of Scientific Literacy

An individual can be considered Scientifically Literate when he/she is familiar with, and able to engage in, three processes: Inquiry, problem solving, and decision making.

Inquiry

Scientific inquiry involves posing questions and developing explanation for phenomena. While there is a general agreement that there is no such thing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging science. These activities provide students with opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving

The process of problem solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are important to their own right, and they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Science Assessment Overview

Science is a hybrid term that houses different disciplines such as: Physics, Chemistry, Biology, Environmental Studies, Engineering, Math, etc. Given this broad spectrum, it is not realistic that we can paint science assessment with a single brush in terms of probes that work for every science activity. However, regardless of school subject, let alone science, the frequency of assessment should be unbalanced with formative assessment occupying 80% of practise and summative with the remaining 20%.

80% Formative - 20% Summative

Formative Assessment

Formative assessment is a range of formal and informal assessment procedures employed by teachers during their learning process in order to modify teaching and learning activities to improve student attainment. It typically involves qualitative feedback (rather than scores) for both students and teacher that focuses on the detail of content and performance. Feedback is the central function of formative assessment. It typically involves a focus on the detailed content of what is being learnt.

Science Formative Assessment falls into 2 distinct categories, and they are divided about how feedback is given. Please be aware that an activity could be informal or formal, it is the purpose of the task that determines purpose.

Informal Formative

Informal Formative Science Assessment acts as a monitoring probe and is distinct because it is not graded.

Formal Formative

Formal Formative Science Assessment provides specific feedback to students, the teachers corresponds via anecdotal feedback, rubrics, and written responses to offer progress to student attainment.

Summative Assessment

Summative assessment seeks to monitor educational outcomes, often for the purposes of external accountability. Usually occurring at the end of a learning unit and determines if the content being taught was retained.

Grade 8 - Cells, Tissues, Organs, and Systems

Focus and Context

The focus of this unit of study is on decision making. Using the context of healthy/non-healthy lifestyle choices, and how these choices impact on cells, tissues, organs, and systems, students should appreciate their interconnections use them to make informed choices when it comes to their health

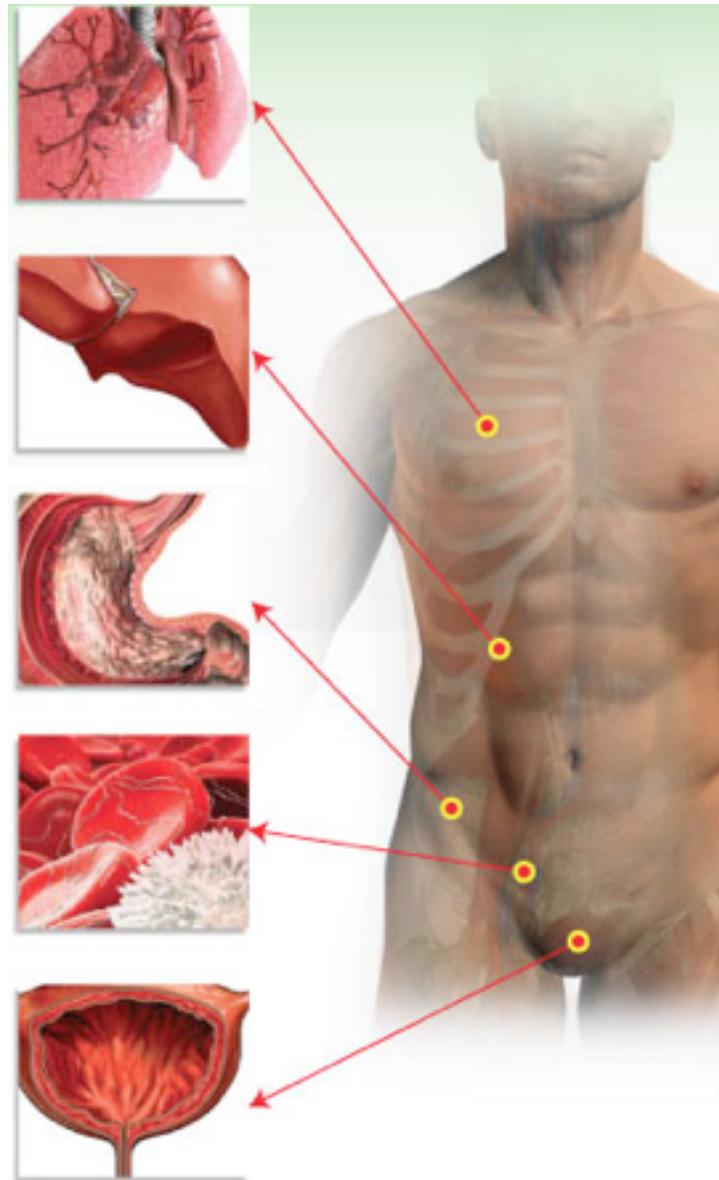


image source: www.look4thailand.com/

Unit Instructional Overview

Cells	Interdependence Among Cells, Tissues, Organs and Systems*	Healthy/Unhealthy Systems	Interdependence of Body Systems
Activity -Using A Microscope	Activity - Access Prior Knowledge	Activity - Understanding Body Systems	Activity - Fitness Testing Lab
Activity -Types of Cells	1st Cycle -Growing Yeast Activity	Activity - Understanding Science and the Media	Activity - STEM - Careers Exploration
Activity -Cells as Living Things	2nd Cycle -Factors That Affect Yeast Activity	Activity - Angioplasty and why you should Eat green Vegetables	Activity - Making Informed Decisions
Activity -Cell Reproduction - Mitosis	3rd Cycle - Activity – Similarities and differences between yeast cells and cells of the human body		

* - EECD Grade 8 Inquiry package - available at <https://portal.nbed.nb.ca/tr/lr/k-8Science/Pages/default.aspx>

Cells, Tissues, Organs, and Systems - Curriculum Outcomes

Cells	Interdependence Among Cells, Tissues, Organs and Systems*	Healthy/Unhealthy Systems	Interdependence of Body Systems
304-4 illustrate and explain that the cell is a living system that exhibits the following characteristics of life: growth; movement; stimulus/response; reproduction	304-8 relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole	304-9 describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous system	208-1 rephrase questions into testable form about the factors that affect physical fitness and health
304-6 explain that growth and reproduction depend on cell division	304-7 explain structural and functional relationships between and among cells, tissues, organs, and systems in the human body	110-5 illustrate examples of conflicting evidence related to how we should maintain and/or treat body systems	208-6, 209-1 design and carry out an experiment to compare and contrast heart rate and breathing rate in an individual during various levels of activity, and identify and control the major variables
304-5 distinguish between plant and animal cells	110-2 compare the early idea that living organisms were made of air, fire and water with the modern cell theory	111-5 describe the science underlying various technologies used to assist or replace unhealthy organs or systems	210-7 suggest explanations for variations in the heart rate and the breathing rate of an individual during various levels of activity when the experiment is repeated
209-3 use a light microscope or microviewer correctly to produce a clear image of cells	211-4 evaluate individual and group processes used in researching the roles of the main organ systems		304-10 describe three examples of the interdependence of various systems of the human body
211-3 work cooperatively with team members to develop and construct models of cells			112-10 provide examples of careers that are associated with the health of body systems
			113-8 make informed decisions about applications of science and technology that are associated with human body systems, taking into account personal social advantages and disadvantages

Cells, Tissues, Organs, and Systems

Strand - Cells

General Curriculum Outcomes	Specific Curriculum Outcomes
304-4 illustrate and explain that cell is living system that exhibits all the characteristics of life	304-4 illustrate and explain that the cell is a living system that exhibits the following characteristics of life: - growth - movement - stimulus/response - reproduction
304-6 explain that growth and reproduction depend on cell division	304-6 explain that growth and reproduction depend on cell division
304-5 distinguish between plant and animal cells	304-5 distinguish between plant and animal cells
209-3 use instruments effectively and accurately for collecting data	209-3 use a light microscope or microviewer correctly to produce a clear image of cells
211-3 work co-operatively with team members to develop and carry out a plan, and troubleshoot problems as they arise	211-3 work co-operatively with team members to develop and construct models of cells
109-13 explain the importance of choosing words that are scientifically or technologically appropriate	109-13 explain that it is important to use proper terms when comparing plant and animal cells

Using A Microscope

Outcomes:

209-3 use a light microscope or micro-viewer correctly to produce a clear image of cells

Lesson Activity Overview

This strand is focused around view different types and phases of cells. Since cells are microscopic, the best activity to begin this section is to introduce students to using the microscope. Every school has its individual challenges in terms of the science equipment available to them. Microscopes are no exception. Plan this lesson to include as many students as possible. meaning design the activity to have as many students using the equipment as possible. If you can go 1 to 1 with microscopes, that would be ideal, so try to keep that activity as inclusive so that students can perform that tasks.

1. Introduce students to the parts of the microscope. Not in terms of having them be able to label the parts, rather the focus should be on understanding how each part contributes to being able to correctly use the microscope. Simply, the focus should be on understanding the difference of the fine and coarse adjustment knobs, not being able to label them on a diagram.
2. Once students have been introduced to microscope, a great initial activity is to give students a pre-made slide with a letter on it (typically letter e is used). The purpose of this activity is to have student use a familiar object as their topic so they will understand what they are looking for. Students will realize that the image is inverted from the way they put it on the stage.
3. Next, if students are using a light microscope, then try using an American Penny. Students should try to find Abraham Lincoln sitting.
4. Finally, students should be giving a sample slide of either a plant or animal cell. Similar to the activity with letter e, students should be able to bring a slide of a cell into focus. -209-3

Assessment: Informal Formative

Ensure that students are able to identify the essential parts of the microscope

Ensure that students participate in lead up activities (letter e, American Penny) to practice using a microscope

Assessment: Formal Formative

Ensure that students are able to bring a sample slide of a cell into focus - 209-3

Types of Cells

Outcomes:

304-5 distinguish between plant and animal cells

109-13 explain that it is important to use proper terms when comparing plant and animal cells

209-3 use a light microscope or micro-viewer correctly to produce a clear image of cells

211-3 work co-operatively with team members to develop and construct models of cells

Lesson Activity Overview

Students have been given the opportunity use a microscope to view a cell. This lesson has the specific purpose of having students differentiate between plant and animal cells.

1. A discussion should take place to assess the students prior knowledge of the difference between a plant and an animal cell.
2. Based on the results of the discussion, lead students to understand that plants have two major differences: the need for a cell wall and chloroplasts. 109-13
3. Depending on the teachers assessment of what students know about cells, teachers will have to present the organelles that differentiate the cells (Cell Wall and Chloroplasts) and the organelles in common (cell membrane, nucleus, vacuoles, cytoplasm). 304-5
4. Have students view a collection of pre-made plant and animal cells. The purpose of this activity is to have students identify if the slide is a plant or an animal and add their justification/illustration of what they are seeing. Students should be encouraged to label the parts they can identify (use the attached work sheet) - 209-3
 - a. Set up the room in stations so that each student/group of students, depending on numbers, views the same cells, therefore there can be some consistency to what the students view.
 - b. Students should be identifying cell walls, cell membrane, vacuoles, nucleus, cytoplasm, and chloroplasts as justification for plant cells.
5. Have students create a journal entry where they compare and contrast the differences between plant and animal cells (organelles). - 304-5
6. Have students create a three-dimensional model of an animal and/or plant cell illustrating the cell wall, cell membrane, nucleus, cytoplasm, vacuoles, and chloroplasts. To avoid redundancy, divid the class into larger groups to assemble their models 211-3

Assessment: Informal Formative

Ensure that students have used a light microscope to correctly produce a clear image of a cell - 209-3

Ensure that students completed the work sheet where students identify plant and animal cells and add their justification/illustrations -304-5, 109-13

Ensure that students work co-operatively with team members to develop and construct models of cells - 211-3

Assessment: Formal Formative

Ensure that students have created a journal entry that compares and contrasts the differences between plant (cell wall and chloroplasts) and animal cells - 304-5

Ensure that 3-D models of cells are appropriately created and labeled - 211-3

Cell Station - 1

Plant Cell _____ Animal Cell _____

Justification/Illustration:

Cell Station - 2

Plant Cell _____ Animal Cell _____

Justification/Illustration:

Cell Station - 3

Plant Cell _____ Animal Cell _____

Justification/Illustration:

Cell Station - 4

Plant Cell _____ Animal Cell _____

Justification/Illustration:

Cells as Living Things

Outcomes:

304-4 illustrate and explain that the cell is a living system that exhibits the following characteristics of life:

growth

movement

stimulus/response

reproduction

Lesson Activity Overview

Students should be given opportunities to investigate and observe examples of cells that are or have demonstrated the basic characteristics of life: growth, locomotion, stimulus/response, and reproduction. 304-4

There are many different virtual examples of these features that can be used.

As a UDL design, students should be given the opportunity to express what they know about cells as living things. It should be noted that regardless of type of selection they make, students must make evidence of growth, movement, stimulus/response, and reproduction

Write a poem about cells and how they exhibit characteristics of life - 304-4

or

Create a cartoon or a series of cartoons/sketches that illustrate the basic characteristics of life - 304-4

Assessment: Formal Formative

Ensure that students are able to identify growth, movement, stimulus/response, and reproduction from the activity they chose.

Cell Reproduction - Mitosis

Outcomes:

304-6 explain that growth and reproduction depend on cell division

209-3 use a light microscope or micro-viewer correctly to produce a clear image of cells

Lesson Activity Overview

Students can investigate cellular growth and reproduction by germinating corn or similar seeds and watch the growth of root tips. Commercial slides are available in which some cells are identified in the process of mitosis

Thin onion layers or lettuce can also be prepared to observe cell structures and evidence of reproduction.

Students should also view:

<http://www.cellsalive.com/mitosis.htm>

And using Discovery Education

<http://app.discoveryeducation.ca/search?Ntt=mitosis&N=18342>

After, students should be able to differentiate:

Interphase	Mitosis	Cytokinesis
Growth part of the of Cell -	Prophase	Cell Division - 2 distinct cells
	Metaphase	
	Anaphase	
	Telophase	

Journal How would you explain the growth of an organism? - 304-6

Assessment: Informal Formative

Ensure that students have viewed examples of cellular growth and reproduction from a microscope 209-3

Assessment: Formal Formative

Ensure that students are able to differentiate the stages of cellular growth and reproduction from their journal entry - 304-6

I. ORGANIZATION OF THE BODY

CELL DIVISION / MITOSIS

DN: Use the colors you used on Plate 3 for cell membrane, nuclear membrane, nucleolus, and centriole for those titles on this plate, even though the previous letter labels may be different. Use contrasting colors for E-E² and F-F², and gray for D-D¹ to distinguish the latter from those with the contrasting colors. (1) Begin with the cell in interphase, reading the related text and completing each cell before

going on to the next. (2) Color gray the name of each stage and its appropriate arrow of progression. Note that in interphase, the chromatin material within the nuclear membrane is in a thread-like state; color over the entire area with the appropriate color. Note that the starting chromatin (D* in interphase) is colored differently in the daughter cells (E², F²); it is the same chromatin.

- CELL MEMBRANE^A
- NUCLEAR MEMBRANE^B
- NUCLEOLUS^C
- CHROMATIN^{D*}/CHROMOSOME^{D¹*}
- CHROMATID^E/CHROMOSOME^{E¹}
- CHROMATIN^{E²}
- CHROMATID^F/CHROMOSOME^{F¹}
- CHROMATIN^{F²}
- CENTROMERE^G
- CENTRIOLE^H
- ASTER^I
- SPINDLE^J

The ability to reproduce its kind is a characteristic of living things. Cells reproduce in a process of duplication and division called mitosis. Epithelial and connective cells reproduce frequently; mature muscle cells not so frequently; mature nerve cells rarely if at all. Overactive mitoses may result in the formation of an encapsulated tumor; uncontrolled mitoses, associated with invasiveness and metastases, is called cancer.

As the main cellular changes during mitosis occur in the nucleus and surrounding area, only these parts of the cell are illustrated here. We are showing here how the nuclear chromatin (diffuse network of DNA and related protein), once duplicated, transforms into 46 chromosomes which divide into paired subunits (92 chromatids), and how those chromatids separate and move into opposite ends of the dividing cell, forming the 46 chromosomes of each of the newly formed daughter cells. For clarity, we show only 4 pairs of chromatids and chromosomes. The phases of the observed nuclear changes during mitosis are:

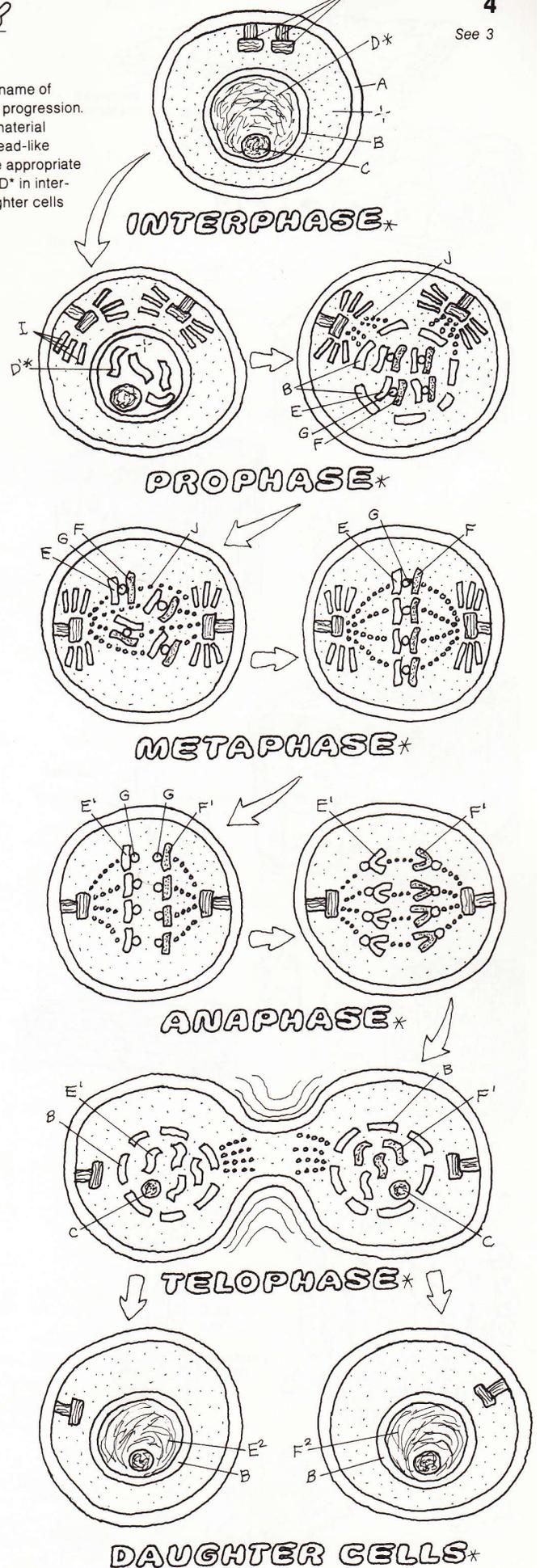
Interphase: the longest period of the reproductive cycle; the phase between successive divisions. Duplication of DNA (in chromatin) occurs during this phase. The dispersed chromatin (D*) here is a network of fine fibrils, not visible as discrete entities in the nucleoplasm. The cell membrane, nucleus, and nucleolus are intact. The centrioles are paired and adjacent to one another at one pole of the cell.

Prophase: the dispersed chromatin (D*) thickens, shortens, and coils to form condensed chromatin or chromosomes (D¹*). Each chromosome consists of 2 chromatids (E and F) connected by a centromere (G). Each chromatid has the equivalent amount of DNA of a chromosome. In the latter part of this phase, the nuclear membrane breaks up and dissolves, as does the nucleolus. The centrioles, having duplicated during interphase, separate, each pair going to opposite poles of the cell. They project microtubules called asters.

Metaphase: strands of spindle fibers project across the cell center from paired centrioles. The chromatids attach to the spindle fibers at the centromere, and line up in the center, half (46) on one side, half (46) on the other.

Anaphase: the centromeres divide, each daughter centromere attached to one chromatid. Each centromere is drawn to the ipsilateral pole of the cell, along the track of the spindle fiber, and taking its chromatid with it. The separated chromatids now constitute chromosomes. Anaphase ends when the daughter chromosomes arrive at their respective poles (46 on each side).

Telophase: here the cell pinches off in the center, forming 2 daughter cells, each identical to the mother cell. The cytoplasm and organelles had duplicated earlier and are segregated each into their respective newly-forming cells. As the nucleus is reconstituted, and the nuclear membrane and nucleolus reappear in each new cell, the chromosomes fade into dispersed chromatin and the centromere disappears. Complete cleavage of the parent cell into daughter cells terminates the mitotic process. Each daughter cell enters interphase to start the process anew. The process of cell division serves to increase cell numbers, not change cellular content.



Cells, Tissues, Organs and Systems

Strand - Interdependence Among Cells, Tissues, Organs and Systems

General Curriculum Outcomes	Specific Curriculum Outcomes
304-8 relate the needs and functions of various cells and organs to the needs and function of the human organism as a whole	304-8 relate the needs and functions of various cells and organs to the needs and function of the human organism as a whole
304-7 explain structural and functional relationships between and among cells, tissues, organs and systems in the human body	304-7 explain structural and functional relationships between and among cells, tissues, organs, and systems in the human body
110-2 distinguish between ideas used in the past and theories used today to explain natural phenomena	110-2 compare the early idea that living organisms were made of air, fire and water with the modern cell theory
211-4 evaluate individual and group processes used in planning, problem solving, decision making, and completing a task	211-4 evaluate individual and group processes used in researching the roles of the main organ systems

Science Resource Package: Grade 8

**Cells, Tissues, Organs
and Systems:
Interdependence Among
Cells, Tissues, Organs
and Systems**

New Brunswick Department of Education

September 2009

Instructional Plan

Access Prior Knowledge

Ask students if anyone has made bread from scratch. An important step of making bread is letting the dough “rise”. What ingredient makes the dough “rise”? (Yeast) (Students may think of baking soda or powder – a good example of a chemical reaction.) *What is yeast? Is yeast alive?*

“Yeast is alive. What do you know about yeast?”

Tell students to do a place mat activity. A sheet of paper is folded into four sections diagonally. In groups of four, each student has a separate section in which to write what they know about yeast.



mat activity. A sheet of paper is folded diagonally. In groups of four, each section in which to write what they

After a few minutes, the teacher indicates it is time to share at the group level. The group stars or highlights all their facts about yeast to share with the class. Groups could be given index cards or large sticky notes to print their facts on.

As groups share, create a class chart of what is known about yeast. Accept all ideas and record in a way that these ideas can be revisited in later lessons. Do not indicate whether the suggestions are correct or incorrect at this time. If students disagree with each other, allow them to express their thinking and reasons to each other. The tips on supporting class discussion on pages 15-16 may be helpful.

Students should realize that yeast exhibits characteristics of life.

✓ **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 18). 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

- 210-7 Identify and suggest explanations for discrepancies in data.
- 211-3 Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise.
- 304-4 Illustrate and explain that the cell is a living system that exhibits all the characteristics of life.

Growing Yeast Activity

In this activity, the students will grow yeast. A balloon can be used to capture the resulting gas or the reaction can be done in a Ziploc bag.

The procedure given to the students should be slightly vague. After the experiment, this will provide the opportunity to discuss the importance of controlling variables and the variability between experiments.

Materials:

- Yeast
- Sugar
- Water
- 2 containers per group
- Balloons or Ziploc
- Masking tape
- Marker
- Timing device
- Spoons of various sizes



(plastic water bottle)
baggies

Have students use 2 water place a spoonful of yeast, a water. A balloon is placed over

Have students make how to measure and record their if their two bottles have similar their results to those of other



bottles. In each bottle they should spoonful of sugar and a scoop of the mouth of each bottle.

observations. They can decide observations. They should notice results. Students should compare groups.

A sheet with directions for students can be found on page 19. Fill in the time required for observation before using the sheet with students.

 **Teacher note:** If you would like the students to have results quickly, use warmer water and/or provide a larger spoon for measuring sugar. When providing materials to groups, you could provide some groups with warm and others with cooler water to see

what the difference is in terms of the reaction. If you would like to have the students leave their experiments overnight, provide students with cold water and smaller spoons for the yeast and sugar.

✓ **Assessment:**

During 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 (on pages 22-24) on a clipboard may be helpful to you. Develop your own code for quick notes.

A suggested code:

✓ for observed and appropriate,

WD - with difficulty,

RTT - refused to try,

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: In small groups**

- Have students discuss in their groups: *What did you notice?* Have them rotate around room to look at other results. Or put containers on a table at the front to compare. Photos may be taken if discussion needs to happen next day.
- Ask students to find the group with results most unlike theirs and talk with that group to figure out what they did differently.

 **Reflection: Class Discussion**

- Have a class discussion to determine what factors may have contributed to the variety of results (amount of yeast, sugar, water, temperature of the water, temperature of the room – especially if they were left overnight, how fast the balloon was put on or the baggie sealed, if there was a tight seal between the neck of the bottle and the balloon or the baggie)
- Ask students: What is happening to the sugar? Why does the balloon or bag inflate?
- Revisit the created list of facts about yeast (see page 4). Ask: *Are there any items that should be added to or revised? Is there other information we could add?* Remind your class about respectful discussion. See the tips on pages 15-16.

Reflection: Journaling

In their journals, have students describe the variability in experimental results observed in their classroom. Have them suggest reasons for the variability.

✓ **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 are getting the idea of experimental variables and the importance of controlling variables (being fair and consistent).

Growing Yeast

Using the 2 water bottles provided, in each bottle:

Place 1 spoonful of yeast

Add 1 spoonful of sugar

Pour 1 scoop of water

Place the balloon over the mouth of each bottle and observe for _____

What do you notice?

Are both of your bottles the same?

Look at results from other groups. Which group has completely different results from what you found? Talk to them to see what they did differently.

2nd Cycle

Curriculum Outcomes

- | 208-1 Rephrase questions in a testable form and clearly define practical problems.
- | 208-6 Design an experiment and identify major variables.
- | 209-1 Carry out procedures controlling the major variables.
- | 211-3 Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise.

Factors That Affect Yeast Activity

From the last activity students learned that yeast needs food (sugar) and water. Based on the similarities and differences between the experiments done earlier, the students will design and carry out some experiments to see what has an effect on yeast growth. Students who have made bread may refer to their experience. What do you do with bread dough when you want it to rise? (Cover it and place the container in warm water or a warm place.)

Try to keep this activity as open as possible, allowing students to design their own experiments. Students can check with you before starting to make sure they are only changing one variable at a time.

If the rubric is to be used for assessing student work, it should be given to students and discussed **before** the investigation. Examples of previous experimental write ups should be displayed. If this is new to students, the process should be modeled by the teacher several times before expecting students to complete one independently.

Materials:

Ziploc bags or balloons

Liquids such as water, Salt, sugar

Ice, hot water Teaspoons,

spoons, measuring cups

Yeast



containers (water bottles) and juice, and/or pop

tablespoons, measuring

Have students in small groups write a question concerning the growth of yeast that they could test. They should outline their procedure with projected amounts, how they will make measurements and record them, and/or time and make a prediction that reinforces their choice of variable.

Students then try it out. To get a variety, have a class chart where students record their choice before starting and record their observations and results. Seeing what other groups are testing may also help groups struggling to design an experiment. (Digital photos of results may be helpful for sharing results with the whole class or referring to results on subsequent days.) If time remains they can try another variable or combination not already tried.

See what students come up with on their own to speed up or slow down the production of gas. If they are stumped, show them a box of materials they could choose from without explaining how they would use the materials. Possible experiments may include altering the amount of sugar such as doubling or halving; adding salt; using different liquids such as juice, Five Alive, vinegar; adding carbon dioxide by blowing into the container with a straw; using hot water; or ice water; adding food colouring.

✓ **Assessment:**

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

Students should write up their question, materials and procedure to hand in.

Have students self-assess their write up before handing it in to you. Give students the guidelines (see “got it” column) and ask them to comment on how well their work meets each criteria. The third column will be for you to give feedback (see sheet on page 21).

✓ **Assessment:**

Note if students are able to write up a lab report or if mini-lessons on specific parts of the report are needed. The following rubric may be helpful.

Got it	Nearly there	Not yet
Question is stated clearly and in a testable form	Question is clear but not in a testable form.	Question is unclear .
Materials list includes all necessary and appropriate items.	Materials list incomplete .	Materials list incomplete and contains unnecessary items.
Written steps are detailed and in sequential order . Steps are detailed enough that variables are controlled . Procedure could be replicated .	Some steps are unclear or missing and/or steps are out of order . Missing some details that would control one or more variables during the replication.	Steps are not accurate or there is not enough detail to replicate procedure.
Spelling and grammar errors are absent or rare .	Some spelling and grammar errors .	Spelling and grammar errors common .

Reflection: Class Discussion

- Have students share their results with the class and what that tells us about yeast.
- Revisit the created list of facts about yeast (see page 4). Ask: *Are there any items that should be added to or revised? Is there other information we could add?* Remind your class about respectful discussion. See the tips on pages 15-16.

Reflection: Journaling

What factors seemed to make the yeast produce the most gas? The least?
Explain why these factors affect yeast the way they do.

✓ **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.

Were students able to identify factors that positively and negatively affected the yeast?
Could they provide explanations for why the factors had an effect on the yeast?

3rd Cycle

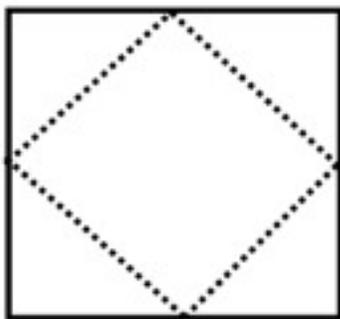
Curriculum Outcomes

- 211-4 Evaluating individual and group processes used in researching the roles of the main organ systems.
- 304-7 Explain structural and functional relationships between and among cells, tissues, organs and systems in the human body.
- 304-8 Relate the needs and functions of various cells and organs to the needs and functions of the human organism as a whole.

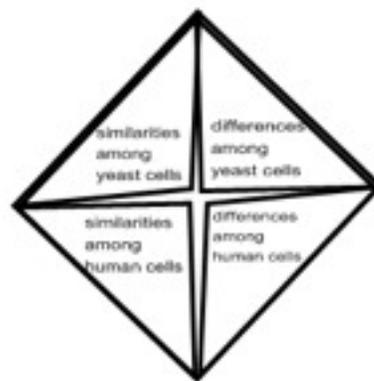
Activity – Similarities and differences between yeast cells and cells of the human body

- Ask students to think about a giant vat of yeast cells and the similarities and differences among the cells in that vat.
- Then ask students to imagine that a human was liquidized and the resultant mixture of cells was placed in a vat. What are the similarities and differences between the human cells?

This thinking/discussion can happen whole class or in small groups or a combination of those. When you determine they are ready, have individual students make a foldable from a square piece of paper. First they fold each corner of the paper to the center. They should label each flap as shown. Under each flap they list the characteristics of that category.



fold to center on dotted lines



 **Teacher note:** The cells from the two different organisms have the same needs such as oxygen, temperature, food and so on. In the yeast all of the cells look identical and have the same abilities and functions. With human cells, the different kinds of cells look different from one another and have different functions depending on which part of the body they come from. In most multi-cellular organisms, cell function is specialized.

✓ **Assessment:**

The comparison foldable can be collected. Note whether students have the idea that while cells all have the same needs, those in a multi-cellular organism are not all the same; instead they are specialized.

Storage options for foldables:

- Insert into a large zippered plastic bag. The bag can be hole-punched and put inside a duotang or binder. A strip of wide tape folded over the left edge of the bag before punching the holes will keep the bag from ripping
- Glue into notebooks or duotangs
- Display them on bulletin boards

Focus on Cell Function in Humans

- Create a class list on the blackboard/overhead/SMART board of the different types of cells found in a human, along with their function. Based on the created list of cell function, ask students:
Can you identify where within the human body system each function (and its specialized cells) will be found?

This will introduce the idea of different organs, each with their own function. Cells doing the same function are often located in the same area, creating organs.



Cell Employment Advertisement Activity

Students will work in pairs for this activity. Ask students to imagine they are a human organ looking for additional cells to join it. Research from book or online resources is necessary.

List of suitable organs:

Salivary glands, Stomach, Liver, Pancreas, Gall bladder, Small intestine, Large intestine, Lungs, Heart, Skin, Kidney, Brain, Eyes, Thyroid gland, Spleen, Appendix, Pituitary gland, Pineal gland, Adrenal gland.

Instructions (also given on a sheet for students on page 20):

Are You the Right Cell for the Job?!

For this project you will be creating an employment advertisement for a cell to work in a specific organ. Your advertisement must meet the following requirements:

- “Help Wanted” heading
- Position Open (Which organ will the cell be working in?)
- Picture of Organ (can be taken from a print or electronic resource that is properly cited)
- Job description – must describe ALL duties of the organ
- Qualifications/Education – knowledge and skills needed to perform the job duties
- Compensation/benefits – how will the cell will be paid? (Cells do not use money – be creative)
- No grammatical or spelling errors
- Neat and colourful
- Advertisement should fill an entire 8 1/2 x 11 inch unlined paper
- A bibliography of sources used (other than textbook) should be included on the back of the paper. Note: You are required to use an additional source.

After all students have completed their ads, display them on the wall.

✓ **Assessment:**

The advertisement can be assessed using the components which the assignment states should be included. The job description and qualifications will indicate the understanding students have about cell structure and function.

 **Reflection: Journaling**

- Have students write about the individual and group dynamics while working together. Questions such as the following may help students focus:

How did I contribute to the group?

My group worked well by . . .

Our working together could be improved by . . .

Group members showed cooperation by . . .

✓ **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 the individual and group strengths and weaknesses.

Possible Extension Activities:

- Ask each pair of students to pick out one advertisement to respond to as a cell looking for work. They should write a letter of application stating why they are suited for the job, their job experience, and so on. A sample letter of application for a job can be found at:

http://resource.educationcanada.com/coverletter_sample1.html

- Students can interview applicants for the position of working in their organ. Students should compile a list of questions to ask applicants.

Are You the Right Cell for the Job?!

For this project you will be creating an employment advertisement for an organ. Your advertisement must meet the following requirements:

- “Help Wanted” heading
- Position Open (organ name)
- Picture of Organ (can be taken from a print or electronic resource that is properly cited)
- Job description – must describe ALL duties of the organ
- Qualifications/Education – knowledge and skills needed to perform the job duties
- Compensation/benefits – how the organ will be paid (Organs do not use money – be creative)
- No grammatical or spelling errors
- Neat and colourful
- Create Ad using MS Publisher OR Fill an entire 8 1/2 x 11 inch unlined paper
- A bibliography of sources used (other than textbook) should be included on the back of the paper. Note: You are required to use an additional source.

You will present your advertisement to the class. You must speak loudly and clearly and can not read directly from your paper. You should know the function of the organ without looking at your paper. Your presentation should be three to five minutes long. Please refer to the rubric for a breakdown of how each requirement will be graded. Originality and The WOW Factor will be rewarded!!

Cells, Tissues, Organs, and Systems

Strand - Healthy/Unhealthy Systems

General Curriculum Outcomes	Specific Curriculum Outcomes
304-9 describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous systems	304-9 describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous systems
110-5 illustrate examples of conflicting evidence for similar scientific questions	110-5 illustrate examples of conflicting evidence related to how we should maintain and/or treat body systems
111-5 describe the science underlying particular technologies designed to explore natural phenomena, extend human capabilities, or solve practical problems	111-5 describe the science underlying various technologies used to assist or replace unhealthy organs or systems

Understanding Body Systems

Outcomes:

304-9 describe the basic factors that affect the functions and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous systems

*Due to the compacted curriculum in the intensive french at grade 5, most students would not have studied/been exposed to the Meeting Basic Needs and Maintaining a Healthy Body unit. In order for students to be successful at grade 8, specifically with outcome 304-9, it is suggested to teachers give an overview of the following outcomes from Grade 5:

- 302-5a describe the structure and function of the major organs (i.e., teeth, tongue, oesophagus, stomach, small intestine, and large intestine) of the **digestive** system
- 302-5b describe the structure and function of the major organs (i.e., kidneys, bladder, ureters and urethra) 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., arteries, veins, capillaries, and blood) or the **circulatory** system
- 302-5e describe the structure and function of the major organs (i.e., brain, spinal cord, and nerves) or the **nervous** system

Lesson Activity Overview

The goal is this lesson, which will be lengthy due to the need to overview each of the grade 5 outcomes, is to merge the overview of the organs of the system with understanding the basic factors that affect the function and efficiency of each system. Do not expect to overview each of the 5 systems in one class. Rather, overview each system individually and move one to the next once you feel the class is ready.

System 1 - Digestive system

Students should investigate the role of the digestive system in providing energy for the body's functions. The major organs of the digestive system include teeth, tongue, esophagus, stomach, small intestine, and large intestine.

Label or draw a diagram (teeth, tongue, esophagus, stomach, small intestine, and large intestine) and use it to illustrate your answer. (302-5a)

Journal - Why do we need to eat? (302-5a)

System 2 - Excretory system

Students should investigate the role of the excretory system in ridding the body of harmful wastes and body products. Major organs of the excretory system include kidneys, bladder, ureters and urethra, as well as the skin and lungs. The excretory system deals with getting rid of harmful or useless materials from the body. Waste materials from the blood are collected in the kidneys, and are then sent to the bladder through the ureters, and expelled through the urethra. The lungs can also be considered part of the excretory system, since gases not needed by the body are expelled through them. The skin also plays a role, as many chemicals are eliminated through sweat. Students can relate increased activity to sweat using their experiences in gym classes.

Label or draw a diagram (kidneys, bladder, ureters and urethra, as well as the skin and lungs) and use it to illustrate your answer. (302-5b)

Journal - My kidneys are important to me because ... (302-5b)

System 3 - Respiratory system

Students should investigate the structures and functions of the major parts of the respiratory system. The major organs include nose, trachea, lungs, and diaphragm. Students can use a variety of sources (e.g., print, electronic, computer software) to learn about the major organs of the respiratory system.

Label or draw a diagram (nose, trachea, lungs, and diaphragm) and use it to illustrate your answer. (302-5c)

Journal - Could we breathe without a diaphragm? Explain. (302-5c)

System 4 - Circulatory System

Students should investigate the structures and functions of the major parts of the circulatory system. The major organs include heart, blood vessels, (arteries, veins, capillaries) and blood. Students can use a variety of sources (e.g., print, electronic, computer software) to learn about the major organs of the circulatory system.

Label or draw a diagram (arteries, veins, capillaries) and use it to illustrate your answer. (302-5d)

Journal - Imagine you are in a capsule in the circulatory system. Describe the parts through which you would move during your voyage. (302-5d)

System 5 - Nervous System

Students should investigate the structure and function of the major organs of the nervous system. The major organs include the brain, spinal cord, and nerves. Students can use a variety of sources (e.g., print, electronic, computer software) to learn about the major organs of the nervous system.

Label or draw a diagram (brain, spinal cord, and nerves) and use it to illustrate your answer. (302-5e)

Journal - Why do people sometimes become paralysed due to an injury? (302-5e)

Students should be given the chance to explore positive and negative factors, such as nutrition, exercise, and other lifestyles, that affect the functions and efficiency of the human respiratory, circulatory, digestive, excretory, and nervous systems. Students should be encouraged to explore and learn about what practices or lifestyles contribute to healthy and unhealthy systems. Students may work in pairs or small groups to investigate and explore how certain lifestyles positively or negatively affect body systems. For example, students can investigate how certain foods and/or diets affect the function and performance of several body systems such as the circulatory and digestive systems. 304-9

(Teachers may want to co-ordinate many of the topics in this section with a health teacher or health nurse. A presentation by a health nurse can be done. Also, the reproductive systems can be covered as part of the health program.)

Students can communicate their findings in the form of a presentation, a multimedia report or a written report. Using the UDL model, Students should be given the opportunity to choose a report that allows them to express themselves best.

Option 1 - Research and debate the availability and use of soft drinks in a school setting.

Option 2 - In a report, describe how factors such as proper nutrition, exercise, and other healthy lifestyles affect the various systems of the body.

Option 3 - Write an essay that explains how does lack of exercise affect several of the main body systems?

Assessment: Informal Formative

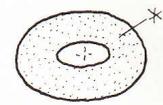
- Ensure that students have labeled or drawn a diagram (teeth, tongue, esophagus, stomach, small intestine, and large intestine) and use it to illustrate your answer. (302-5a)
- Ensure that students have labeled or drawn a diagram (kidneys, bladder, ureters and urethra, as well as the skin and lungs) and use it to illustrate your answer. (302-5b)
- Ensure that students have labeled or drawn a diagram (nose, trachea, lungs, and diaphragm) and use it to illustrate your answer. (302-5c)
- Ensure that students have labeled or drawn a diagram (arteries, veins, capillaries) and use it to illustrate your answer. (302-5d)
- Ensure that students have labeled or drawn a diagram (brain, spinal cord, and nerves) and use it to illustrate your answer. (302-5e)

Assessment: Formal Formative

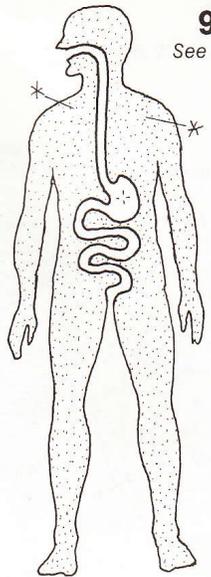
- Ensure that students have created a journal entry that is appropriate - Why do we need to eat? (302-5a)
- Ensure that students have created a journal entry that is appropriate - My kidneys are important to me because ... (302-5b)
- Ensure that students have created a journal entry that is appropriate - Could we breathe without a diaphragm? Explain. (302-5c)
- Ensure that students have created a journal entry that is appropriate - Imagine you are in a capsule in the circulatory system. Describe the parts through which you would move during your voyage. (302-5d)
- Ensure that students have created a journal entry that is appropriate - Why do people sometimes become paralysed due to an injury? (302-5e)
- Ensure that students have chosen one of the three options for the UDL design assessing the 304-9 outcome. A rubric for each should be created before students choose, the assessment should be based off of each rubric

K. DIGESTIVE SYSTEM OVERVIEW OF THE SYSTEM

Color: When coloring the organs that overlap each other, use your lightest colors for D, E, T, V, and W. Each overlapping portion receives the color of both structures. (1) After coloring the alimentary canal, review the structures before completing the accessory organs. The central section of the transverse colon (J) has been removed to show deeper structures.



Alimentary canal is like the hole in a doughnut

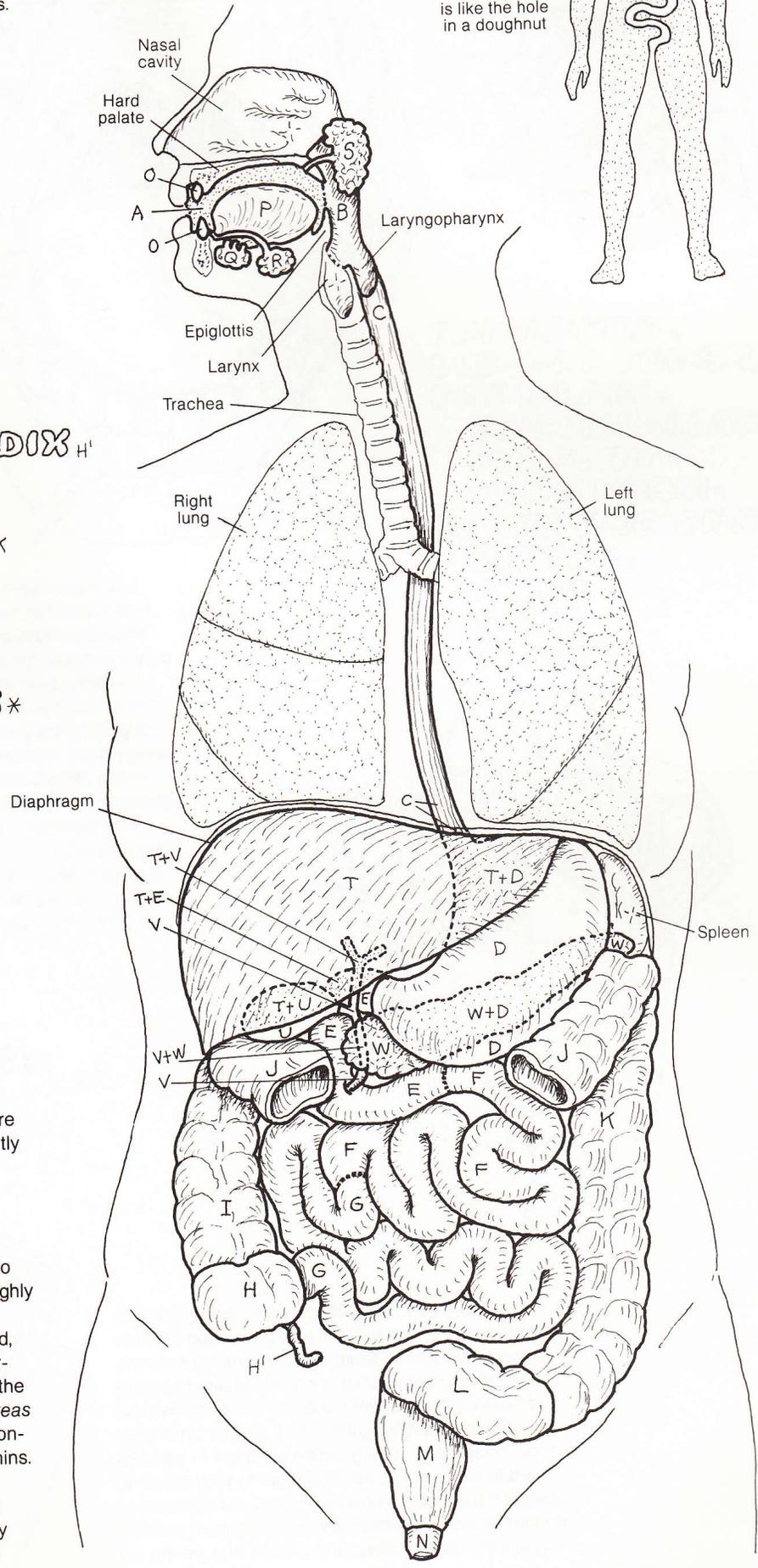


ALIMENTARY CANAL: *

- ORAL CAVITY **A**
- PHARYNX **B**
- ESOPHAGUS **C**
- STOMACH **D**
- SMALL INTESTINE: *
- DUODENUM **E**
- JEJUNUM **F**
- ILEUM **G**
- LARGE INTESTINE: †
- CECUM **H**
- VERMIFORM APPENDIX **H'**
- ASCENDING COLON **I**
- TRANSVERSE COLON **J**
- DESCENDING COLON **K**
- SIGMOID COLON **L**
- RECTUM **M**
- ANAL CANAL **N**

ACCESSORY ORGANS: *

- TEETH **O**
- TONGUE **P**
- SALIVARY GLANDS: *
- SUBLINGUAL **Q**
- SUBMANDIBULAR **R**
- PAROTID **S**
- LIVER **T**
- GALL BLADDER **U**
- BILE DUCTS **V**
- PANCREAS **W**



The digestive system consists of an alimentary canal with accessory organs. The canal begins with the oral cavity. Here the teeth pulverize ingested food while it is softened and partly moistened by salivary gland secretions. The tongue aids in the mechanical manipulation of the food, and literally flips the bolus into the fibromuscular pharynx during swallowing.

The esophagus moves the bolus along to the stomach by peristaltic muscular contractions. Here the bolus is treated to mechanical and chemical digestion, then passed into the highly coiled small intestine for more enzymatic and mechanical digestive processes. Small molecular nutrients are extracted, absorbed by lining cells, and transferred to capillaries. Liver-produced bile, stored in the gall bladder, is discharged into the duodenum by bile ducts. Digestive enzymes from the pancreas enter the duodenum as well. The large intestine is mainly concerned with absorption of water, minerals, and certain vitamins. The non-nutritive residue of the ingested bolus is moved through the rectum and anal canal to the outside. Nutrients absorbed throughout the tract are transported to the liver by the hepatic portal system for processing and distribution to

XI. URINARY SYSTEM

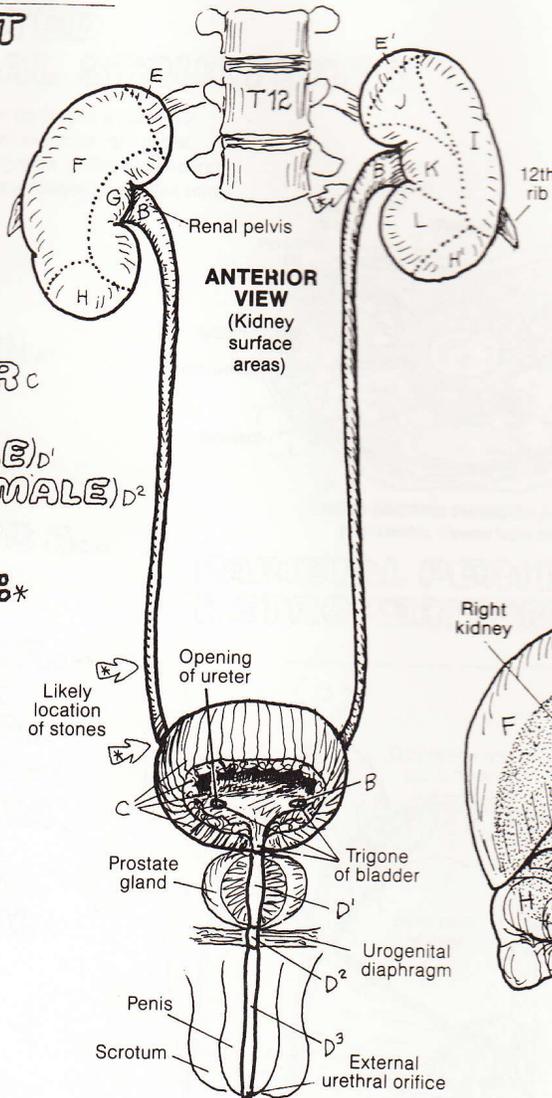
URINARY TRACT

URINARY TRACT: *

- KIDNEY ^A
- URETER ^B
- URINARY BLADDER ^C
- URETHRA ^D
- PROSTATIC U. (MALE) ^{D¹}
- MEMBRANOUS U. (MALE) ^{D²}
- SPONGY U. (MALE) ^{D³}

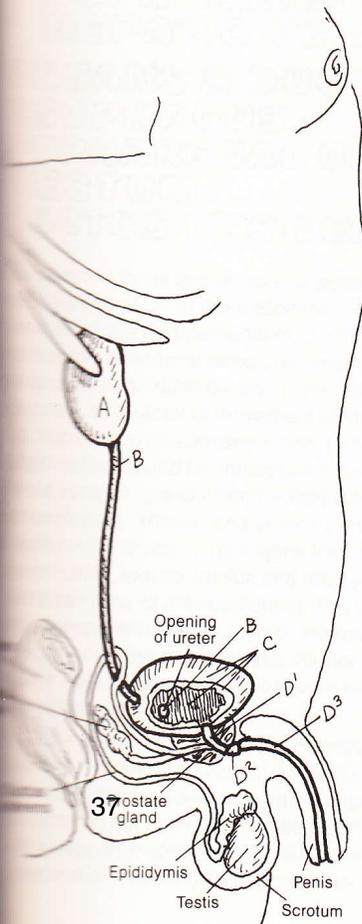
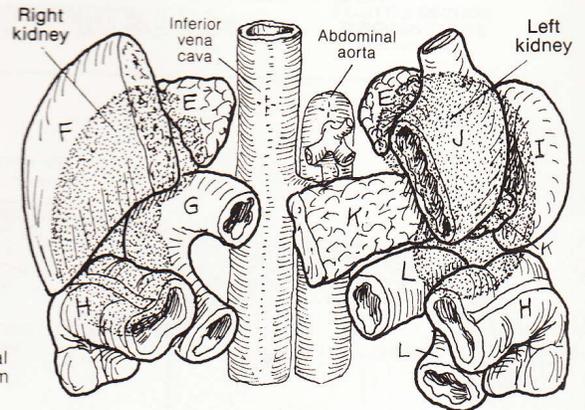
KIDNEY RELATIONS: *

- SUPRARENAL GLAND ^E
- LIVER ^F
- DUODENUM ^G
- TRANSVERSE COLON ^H
- SPLEEN ^I
- STOMACH ^J
- PANCREAS ^K
- JEJUNUM ^L



CN: Use very light colors for C and E-L.
 (1) Color the three views of the urinary tract simultaneously. Note that the kidneys at the top of the plate are to be colored according to areas which are in contact with other organs. Also note that the ureters penetrate the posterior wall of the urinary bladder, and that these openings receive a color. (2) Color the anterior relations of the kidneys which are shown as shaded silhouettes. Color gray the arrows marking sites of potential obstruction by "stones."

ANTERIOR RELATIONS OF THE KIDNEYS



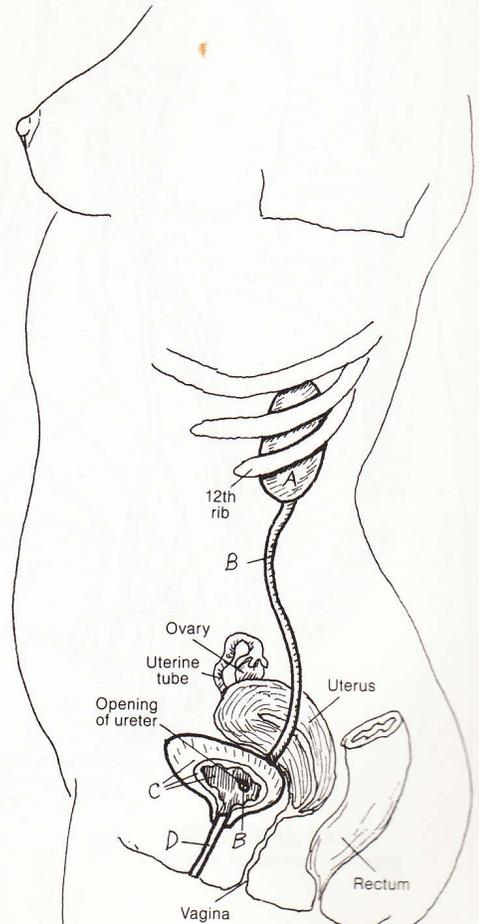
The urinary tract consists of paired *kidneys* and *ureters* in the retroperitoneum, a single *urinary bladder*, and a *urethra*. The urinary tract represents a pathway for the elimination of metabolic by-products and toxic and other non-essential molecules all dissolved in a small volume of water (urine). The *kidneys* are not simply instruments of excretion; they function in the conservation of water and maintenance of acid-base balance in the blood. The process is a dynamic one, and what is excreted as waste in one second may be retained as precious in the next.

The *ureters* are fibromuscular tubes, lined by transitional epithelium. Three areas of the ureters are relatively narrow and are prone to being obstructed by mineralized concretions ("stones") from the kidney (see arrows).

The fibromuscular *urinary bladder* lies in the true pelvis, its superior surface covered with peritoneum. The mucosa is lined with transitional epithelium. The bladder can contain as little as 50 ml of urine and can hold as much as 700-1000 ml without injury; as it distends, it rises into the abdominal cavity and bulges posteriorly. The mucosal area between the two ureteral orifices and the urethral orifice is called the trigone.

The fibromuscular, glandular *urethra*, lined with transitional epithelium except near the skin, is larger in males (20 cm) than females (4 cm). Hence, urethritis is more common in men, cystitis is more common in women.

The urethra is described in three parts in the male (*prostatic, membranous and spongy*). The membranous urethra is vulnerable to rupture in the urogenital diaphragm with trauma to the low anterior pelvis.



IX. RESPIRATORY SYSTEM OVERVIEW

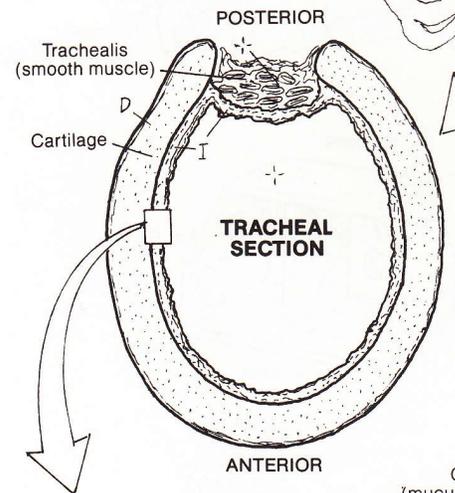
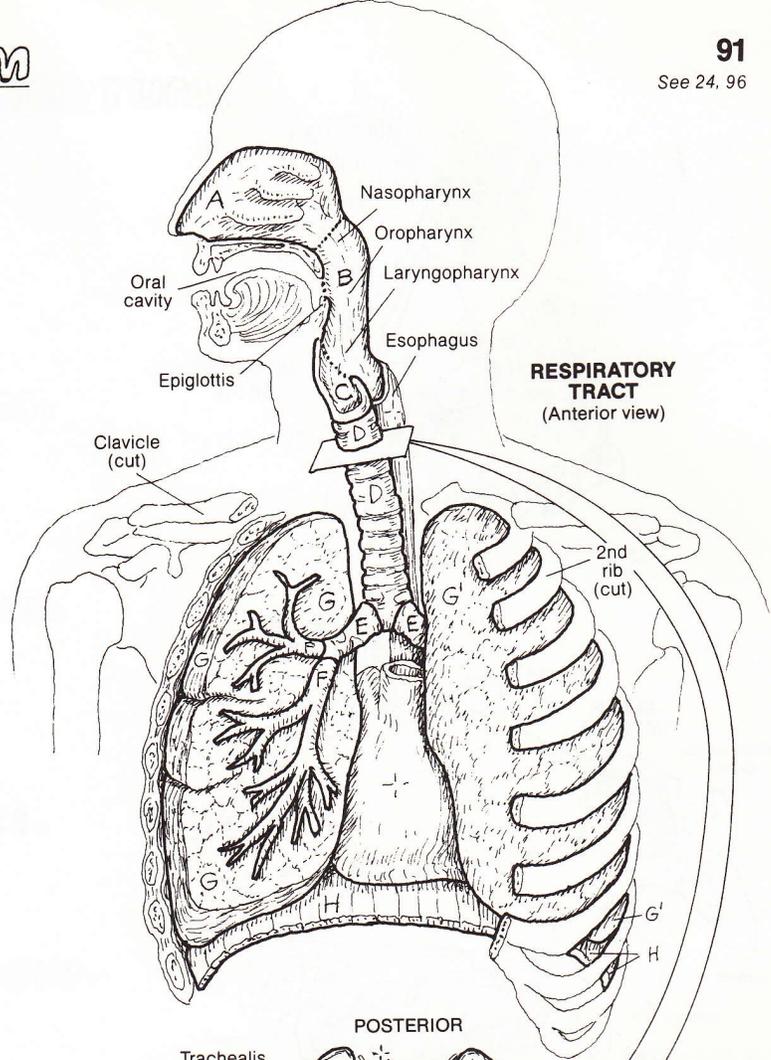
ON Use red for L and light colors throughout. (1) Begin with the structures of the respiratory system. (2) Color the cross section of the trachea (D), including the respiratory mucosa (I). (3) Color the enlargement of the mucosa in the lowest view.

- NASAL CAVITY^A
- PHARYNX^B
- LARYNX^C
- TRACHEA^D
- PRIMARY BRONCHI^E
- BRONCHIAL TREE^F
- R. LUNG^G, L. LUNG^{G'}
- DIAPHRAGM^H

The respiratory tract conducts air to the respiratory units of the lungs where it can readily be absorbed by the blood, and it removes carbon dioxide-laden air from the air cells and exhausts it to the external atmosphere. It develops and refines sounds into potentially intelligible vocalization, and helps maintain acid-base balance of the blood by blowing off excess acid in the form of carbon dioxide. Nowhere in the body does the outside world, with all its creatures of microscopic dimension, have such easy access to the protected interior cavities of the body as it does at the air/blood interfaces of the lung. The respiratory tract has both air-conducting and respiratory (gas exchange) parts.

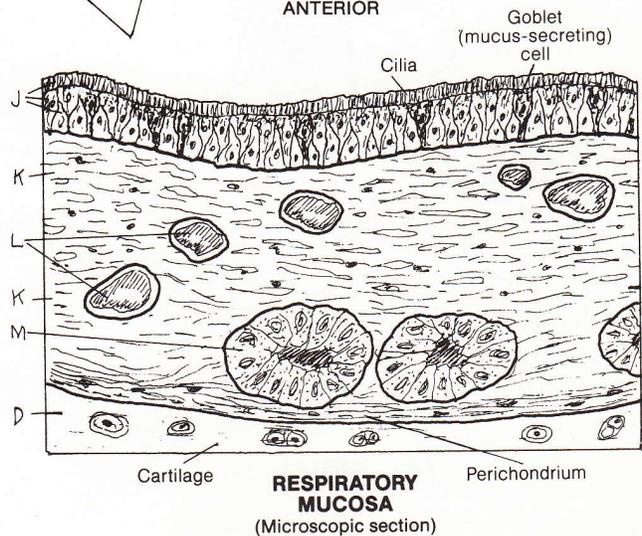
The air conduction tract includes an upper (nasal cavity, oral cavity, pharynx, larynx) and lower tract (trachea, primary bronchi and bronchial tree). The upper tract is lined with respiratory mucosa except in the lower pharynx where it has a stratified squamous epithelial surface. Except for the nose and pharynx, the skeleton of the respiratory tract is cartilaginous down to the smallest airways (bronchioles) where the cartilage is replaced by smooth muscle. Those parts associated with gaseous exchange are the smallest bronchioles and alveoli (respiratory units) and take up much of the lung's volume.

The muscular diaphragm provides much of the force necessary for inspiration and expiration of air. One quarter of that force is generated by the intercostal muscles moving the ribs.



- RESPIRATORY MUCOSA: I
- PSEUDOSTRATIFIED COLUMNAR EPITHELIUM J
- LAMINA PROPRIA K
- BLOOD VESSEL L
- GLAND M

The mucosa of the respiratory tract is largely pseudostratified columnar and (in the bronchioles) cuboidal epithelia with mucus-secreting goblet (unicellular gland) cells and cilia. Here secreted mucus traps foreign particulate matter, inhaled air is hydrated (mixed with water) putting oxygen in solution, and the air is heated from underlying vessels. These epithelial cells are supported by a loose fibrous, glandular, vascular lamina propria, complete with fibroblasts and cells of the lymphoid system. Deep to this connective tissue layer is the supporting tissue (bone in nasal cavity, muscle in the pharynx, hyaline cartilage in the trachea, larynx, and bronchi, smooth muscle in the bronchioles, and thin fibers supporting the air cells).



IX. RESPIRATORY SYSTEM

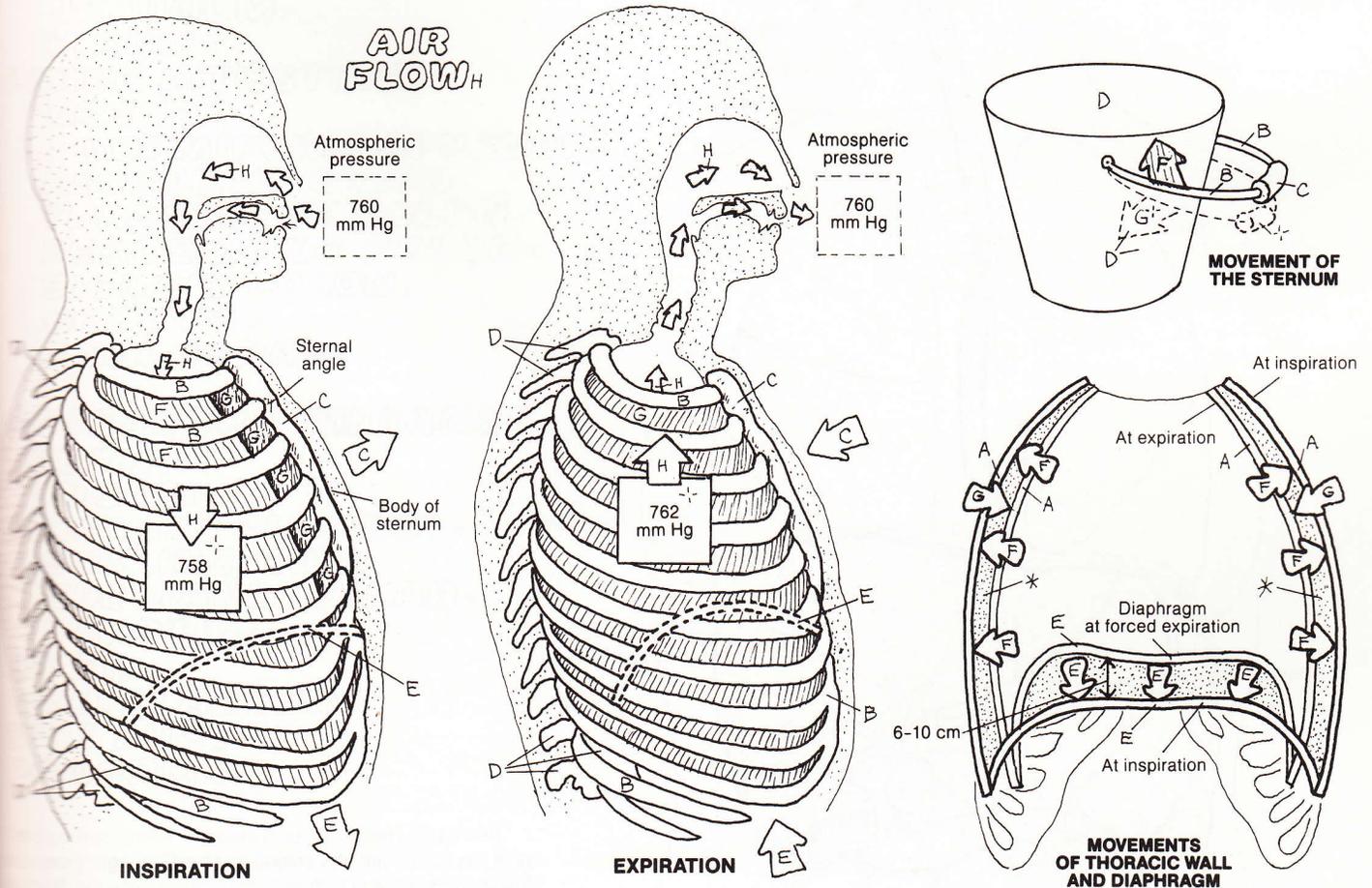
MECHANICS OF RESPIRATION

Use light colors throughout, except for a bright or dark color for E. (1) Begin with the illustration at far left (inspiration); note that the thoracic wall (A) is shown only in the far right diagram. Color the diaphragm, its location represented by broken lines. Color the expiration illustration and the bucket handle analogy. (2) Color the expiration illustration and the bucket handle analogy. (3) Finish with the illustration at far right.

THORACIC WALL: A
RIB & COSTAL CARTILAGE: B
STERNUM: C
THORACIC VERTEBRAE: D

MUSCLES OF INSPIRATION: *
DIAPHRAGM: E
EXTERNAL INTERCOSTAL: F

MUSCLE OF EXPIRATION: *
INTERNAL INTERCOSTAL: G



The mechanism of respiration makes possible breathing which consists of inhalation (inspiration) and exhalation (expiration) phases. The physical principle underlying air movement in/out of the thorax is the inverse relationship of pressure and volume (as one goes up, the other goes down). Volume changes within the thorax alter the intrathoracic pressure 1-2 mm Hg above/below atmospheric pressure (outside the body) in quiet breathing, enough of a change to move about 500 ml of air with each breath. The thoracic diaphragm accomplishes about 75% of the inspiratory effort, the external intercostals 25%. Expiration is largely diaphragm and external intercostal relaxation/stretch, and lung elasticity, with some help from the internal intercostals. 39piration, contraction of the diaphragm flattens the muscle and lowers the floor of the thorax, increasing the vertical dimension of the thoracic cavity. Contraction of the external intercostals

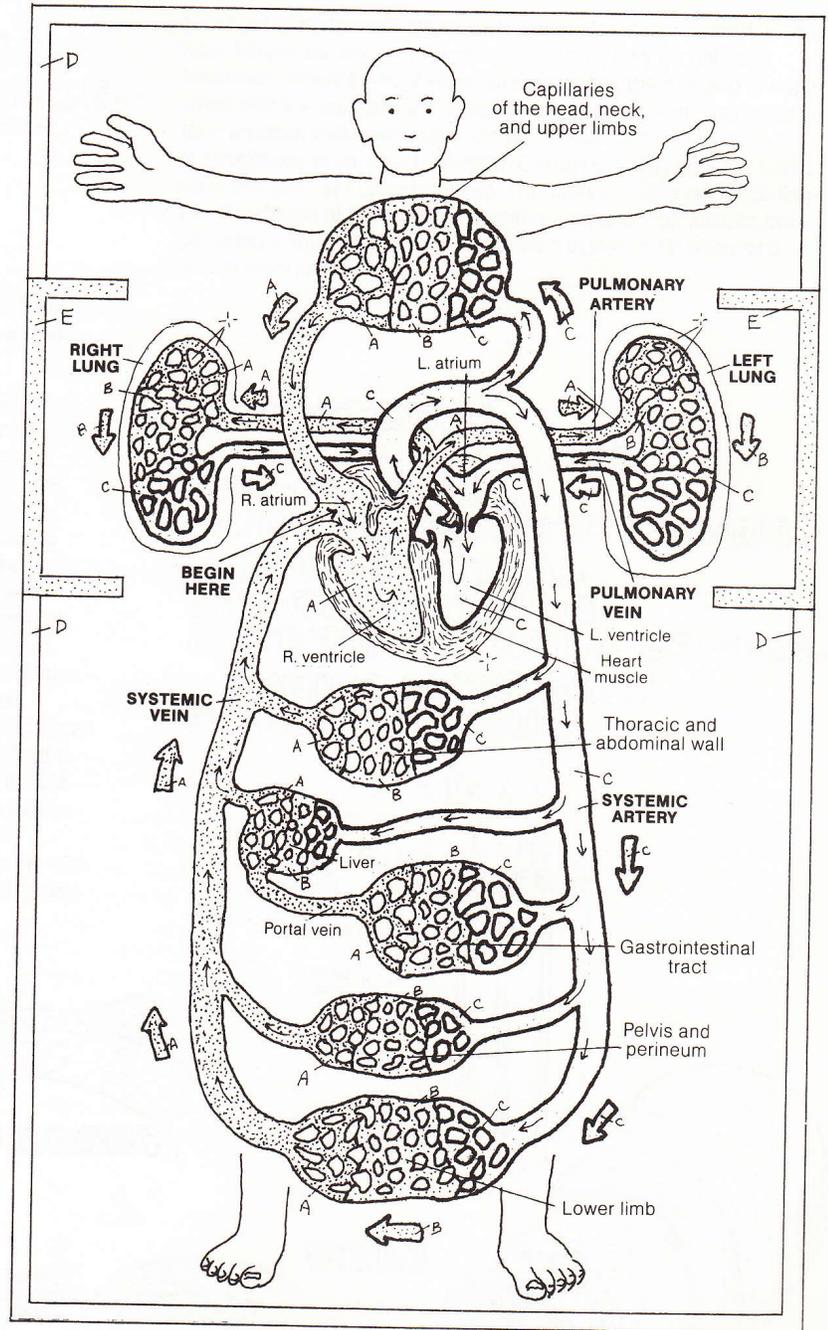
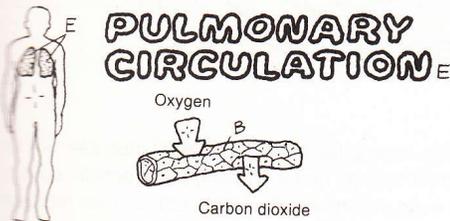
elevates the ribs, swinging the sternal body slightly outward at the sternal angle. This increases the transverse and anteroposterior dimensions of the thoracic cavity. These actions collectively increase the intrathoracic volume, momentarily lowering the pressure within. Given the relatively higher atmospheric pressure outside the head, air is induced to enter the respiratory tract to find lower pressure. The action of the bucket handle demonstrates the hinge action at the sternal angle and related rib elevation. In expiration, the relaxed diaphragm forms "domes" over the underlying liver and stomach, decreasing the vertical dimension of the thorax. Recoil/descent of the ribs decreases the transverse and anteroposterior dimensions. The thoracic volume is thus decreased, momentarily increasing the intrathoracic pressure above atmospheric. Air escapes to the outside, aided by the natural elastic recoil of the lungs.

VI. CARDIOVASCULAR SYSTEM

SCHEME OF BLOOD CIRCULATION

DN: Use blue for A, purple for B, red for C, and very light colors for D and E. (1) Color the titles for systemic and pulmonary circulation; the two figures; and the borders bracketing the large illustration. Also color purple (representing the transitional state between oxygenation and deoxygenation) the two capillaries, demonstrating the difference between capillary function in the lungs versus the body. (2) Begin in the right atrium of the heart and color the flow of deoxygenated blood (A) into the lungs. After coloring the pulmonary capillary network (B), color the oxygenated blood (C) that re-enters the heart and is pumped into and through the systemic circuit.

DEOXYGENATED BLOOD A
 CAPILLARY BLOOD B
 OXYGENATED BLOOD C



Circulation of blood begins with the heart which pumps blood into arteries and receives blood from veins. *Arteries* conduct blood away from the heart regardless of the amount of oxygen (oxygenation) in that blood. *Veins* conduct blood toward the heart, regardless of the degree of oxygenation of the blood. *Capillaries* are networks of extremely thin-walled vessels throughout the body tissues that permit the exchange of gases and nutrients between the vessel interior (vascular space) and the area external to the vessel (extracellular space). Capillaries receive blood from small arteries and conduct blood to small veins.

There are two circuits of blood flow: (1) the pulmonary circuit, which conveys *deoxygenated blood* from the right side of the heart to the lungs and freshly *oxygenated blood* back to the left side of the heart, and (2) the systemic circuit, which conveys *oxygenated blood* from the left heart to the body tissues and returns *deoxygenated blood* to the right heart. The color red is used universally for *oxygenated blood*; the color blue is used for *deoxygenated blood*.

Clearly, not all arterial blood is oxygenated (in the pulmonary circulation, arteries conduct *deoxygenated blood* to the lungs), and not all venous blood is *deoxygenated* (pulmonary veins conduct *oxygenated blood* to the heart).

Capillary blood is mixed; it is largely oxygenated on the arterial side of the capillary bed, and it is largely *deoxygenated* on the venous side, as a consequence of delivering oxygen to and picking up carbon dioxide from the tissues it supplies.

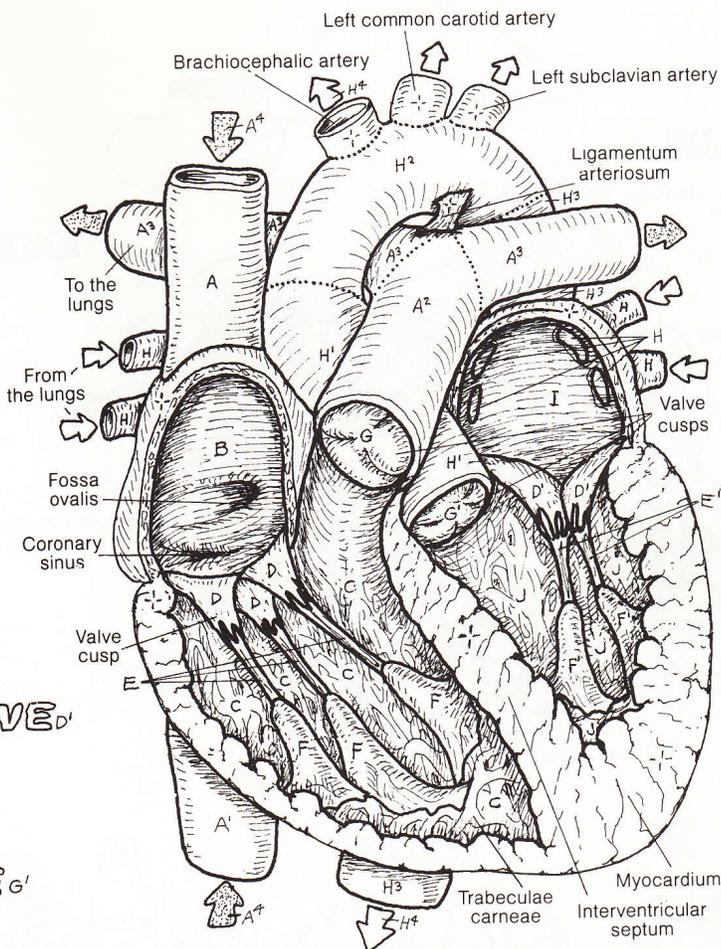
The capillary network generally exists between an artery and a vein; an exception is the portal circulation characterized by two capillary sets between artery and vein. The vein between the two networks is the portal vein. Such can be seen between the gastrointestinal tract and the liver.

VI. CARDIOVASCULAR SYSTEM

CHAMBERS OF THE HEART

Use blue for A, red for H, and your lightest colors for B, C, I, and J.
Begin with the four chambers of the heart, and follow the direction of blood flow as you color your way down the list of titles. Also color the directional arrows blue (dotted) and red; their titles are at lower right. (2) Color the circulation chart below, beginning with numeral one (1) in the right atrium. Color the arrows accordingly, along with the four numerals. Do not color the chambers or the vessels.

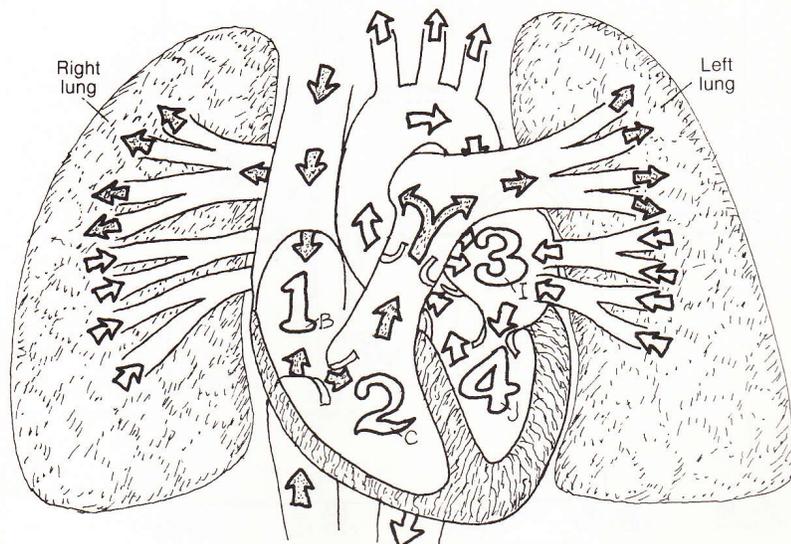
- SUPERIOR VENA CAVA^A
- INFERIOR VENA CAVA^{A'}
- RIGHT ATRIUM^B
- RIGHT VENTRICLE^C
- A-V TRICUSPID VALVE^D
- CHORDAE TENDINEAE^E
- PAPILLARY MUSCLE^F
- PULMONARY TRUNK^{A²}
- PUL. SEMILUNAR VALVE^G
- PUL. ARTERY^{A³}
- PULMONARY VEIN^H
- LEFT ATRIUM^I
- LEFT VENTRICLE^J
- A-V BICUSPID (MITRAL) VALVE^{D'}
- CHORDAE TENDINEAE^{E'}
- PAPILLARY MUSCLE^{F'}
- ASCENDING AORTA^{H'}
- AORTIC SEMILUNAR VALVE^{G'}
- AORTIC ARCH^{H²}
- THORACIC AORTA^{H³}



ANTERIOR VIEW OF HEART CAVITIES

CIRCULATION THROUGH THE HEART*

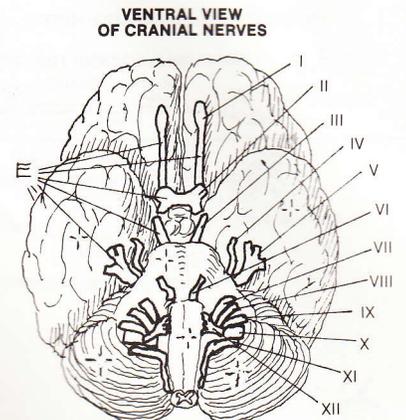
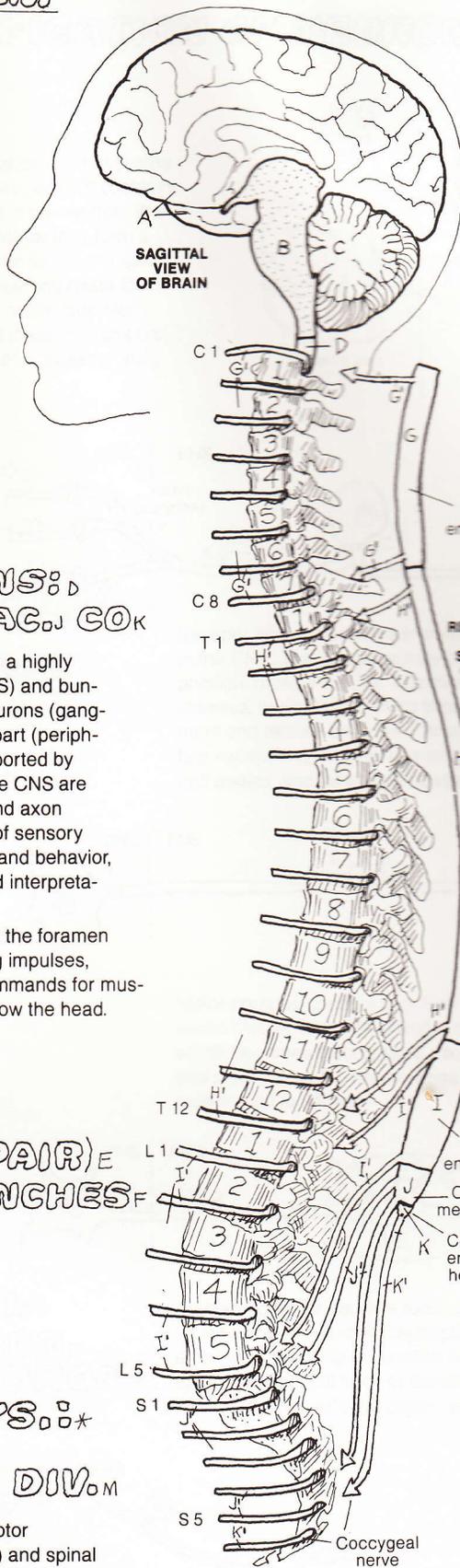
OXYGENATED BLOOD → H⁴
DEOXYGENATED BLOOD → A⁴



The heart is the muscular pump of the blood vascular system. It contains four cavities (chambers): two on the right side (pulmonary heart), two on the left (systemic heart). The pulmonary "heart" includes the right atrium and right ventricle. The thin-walled *right atrium* receives *deoxygenated blood* from the *superior* and the *inferior vena cava*, and from the coronary sinus (draining the heart vessels). The thin-walled *left atrium* receives *oxygenated blood* from pulmonary veins. Atrial blood is pumped at a pressure of about 5 mm Hg into the *right and left ventricles* simultaneously through the atrioventricular orifices, guarded by the 3-cusp *tricuspid valve* on the right and the 2-cusp *bicuspid valve* on the left. The cusps are like panels of a parachute, secured to the *papillary muscles* in the ventricles by tendinous *chordae tendineae*. These muscles contract with the ventricular muscles, tensing the cords, and resisting cusp over-flap as ventricular blood bulges into them during ventricular contraction (systole). The ventricles, significantly more muscular than their fellow atria, pump deoxygenated blood to the lungs via the *pulmonary trunk* at a pressure of about 25 mm Hg (right ventricle), and into the *ascending aorta* at a pressure of about 120 mm Hg (left ventricle) simultaneously. This pressure difference is reflected in the thicker walls of the left ventricle compared to the right. The pocket-like *pulmonary and aortic semilunar valves* guard the trunk and aorta, respectively. As blood falls back toward the ventricle from the trunk/aorta during the resting phase (diastole), these pockets fill, closing off their respective orifices, and preventing reflux into the ventricles.

XIV. NERVOUS SYSTEM ORGANIZATION

CN: Use very light colors for A and C. (1) The spinal cord has been placed behind the vertebral column in the main illustration to show the length of the cord and corresponding spinal cord regions in relation to the length and regions of the vertebral column. Note the descending spinal nerve roots (arrows coming off the cord) in the lumbar regions and below. (2) In coloring the spinal nerves and their peripheral branches at lower right, color over the lines representing them. (3) Color the motor ganglia of the autonomic nervous system (L and M) in the lower right drawing.



CENTRAL (CNS) NERVOUS SYSTEM: *

BRAIN: :-

- CEREBRUM^A
- BRAINSTEM^B
- CEREBELLUM^C

SPINAL CORD^D / REGIONS: ^D

- CERV^D, THOR^{DH}, LUM^{DI}, SAC^{DJ}, CO^{DK}

The nervous system consists of neurons arranged into a highly integrated central part (central nervous system, or CNS) and bundles of neuronal processes (nerves) and islands of neurons (ganglia) largely outside the CNS making up the peripheral part (peripheral nervous system, or PNS). These neurons are supported by neuroglial cells, and a rich blood supply. Neurons of the CNS are interconnected to form centers (nuclei; gray matter) and axon bundles (tracts; white matter). The brain is the center of sensory awareness and movement, emotions, rational thought and behavior, foresight and planning, memory, speech, language and interpretation of language.

The *spinal cord*, an extension of the brain beginning at the foramen magnum of the skull, traffics in ascending/descending impulses, and is a center for spinal reflexes, source of motor commands for muscles below the head, and receiver of sensory input below the head.

PERIPHERAL (PNS) NERVOUS SYSTEM: *

CRANIAL NERVES (12 PAIR)^E

SPINAL NERVES / BRANCHES^F

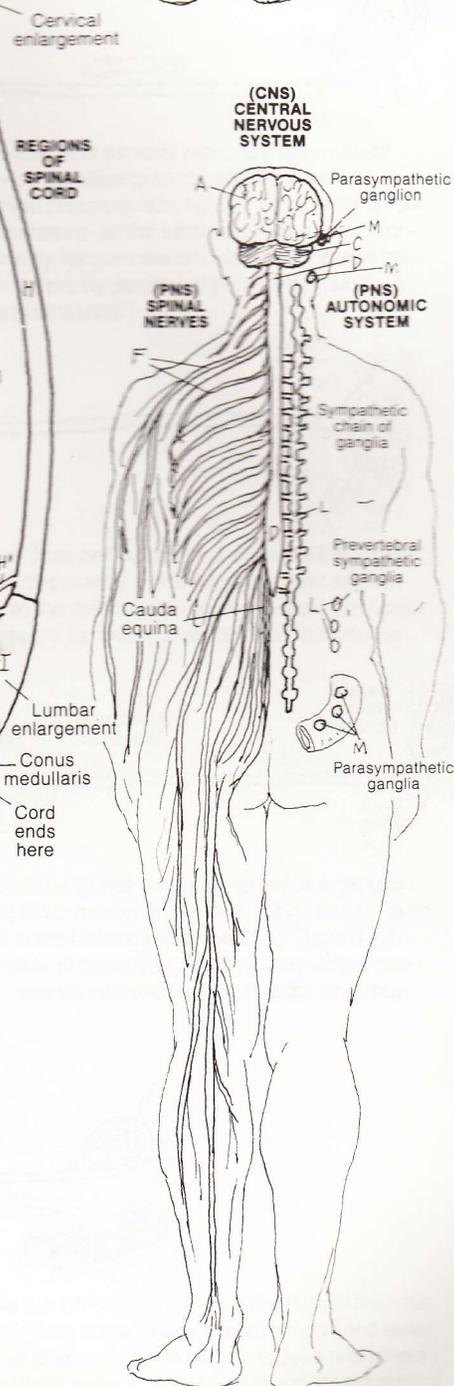
- CERVICAL (8)^G
- THORACIC (12)^{H'}
- LUMBAR (5)^I
- SACRAL (5)^{J'}
- COCCYGEAL (1)^{K'}

AUTONOMIC NERV. SYS.^{D, P} *

SYMPATHETIC DIV.^L

PARASYMPATHETIC DIV.^M

The PNS consists largely of bundles of sensory and motor neurons (nerves) radiating from the brain (*cranial nerves*) and spinal cord (*spinal nerves*) segmentally and bilaterally and reaching to all parts of the body (visceral and somatic) through a classic pattern of distribution. *Branches* of spinal nerves are often called peripheral nerves. Nerves conduct all sensations from the body to the brain and spinal cord, and conduct motor commands to all the skeletal muscles of the body. The *autonomic nervous system* (ANS) is a subset of ganglia and nerves in the PNS dedicated to visceral movement and glandular secretion, and the conduction of visceral sensations to the spinal cord and brain.



VERTEBRAL COLUMN AND SPINAL NERVES

Understanding Science and the Media

Outcomes:

110-5 illustrate examples of conflicting evidence related to how we should maintain and/or treat body systems

Lesson Activity Overview

A major scientific skill that we promote is interpreting data in-order to draw your own conclusions of what has been learned. A significant gap in societies understanding of these skills comes when you have two distinguished scientists that offer conflicting views, Whom are we expected to believe? How do we choose a side?

At the middle school level, students are not ready to tackle scientific research and choose a side. However, they are ready to understand elements of popular cultures that relate to science and use their scientific reasoning to select which is appropriate. For example, students have been told for several years that potato chips are unhealthy. Recently, chip manufacturers have began a campaign with a green check mark that signifies a healthy choice, if you choose a baked option. Similarly, soft drinks have been removed from schools and replaced with juice, sports drinks and water.

The issue is not is eating a baked chip better then eating a traditionally fried chip, the answer is yes it is “healthier”. Sports drinks have their specific need, after a cardiovascular event, but they are not necessarily healthy mid day. The STSE Outcome in this lesson is asking students to determine if eating a baked chip or drinking a sports drink at noon is in fact a healthy choice.

Create a debate. Select a current topic related to these issues and have an in class debate.

As a follow-up to the debate, provide students with options for follow-up. Organize students into one of the following groups:

Group 1 - Survey students in the school on nutrition, exercise, and incidence of illness.

Compile and analyse the results and draw conclusions. (110-5, 304-9)

Group 2 - Using current/popular newspapers and magazines, make a collection of advertisements that promote healthy development of various body systems. (110-5, 304-9)

Design the parameters of expectations with each group before they begin, using a rubric

Assessment: Informal Formative

- Ensure that students participate in the debate and are appropriate in their responses based on the topic
- Ensure that students participate in their group and contribute to the overall task

Angioplasty and why you should Eat green Vegetables

Outcomes:

111-5 describe the science underlying various technologies used to assist or replace unhealthy organs or systems

Lesson Activity Overview

Do not let the lesson title lead you to believe that this lesson has to be about Angioplasty. Rather, the lesson should continue to connect how being unhealthy can lead to replacement of unhealthy organs or systems. Students should relate to the science behind the technologies investigated

Students should note the technologies that have been designed to assist damaged organs and/or systems.

- The dialysis machine which filters the blood and artificial hearts which pump blood throughout the body are examples that may be investigated.
- Hearing aids,
- Artificial limbs controlled by electrical impulses from nerves,
- Artificial heart valves,
- Respirators, and pacemakers are other examples that may be explored and discussed.

Students should be encouraged to do a small presentation:

Option 1 - Produce a poster with pictures of technologies used to aid or replace organs or body parts/systems. Briefly describe their function with regard to what they do and how they aid or replace particular organs, systems or body parts (for example pacemaker, insulin pump, dialysis machine). (111-5)

Option 2 - Interview an audiologist to find out what technologies are available to people who have limited hearing ability. Prepare an audiovisual presentation for the class. (111-5)

Option 3 - Interview another health care professional in your community to find out what technologies are available to people who have issues in their respective medical field. Prepare an audiovisual presentation for the class. (111-5)

Design the parameters of expectations with each option before they begin, using a rubric

Assessment: Formal Formative

Ensure that students have completed a small presentations based on their choice that is appropriate.

Cells, Tissues, Organs, and Systems

Strand - Interdependence of Body Systems

General Curriculum Outcomes	Specific Curriculum Outcomes
208-1 rephrase questions in a testable form and clearly define practical problems	208-1 rephrase questions into testable form about the factors that affect physical fitness and health
208-6 design an experiment and identify major variables	208-6, 209-1 design and carry out an experiment to compare and contrast heart rate and breathing rate in an individual during various levels of activity, and identify and control the major variables
209-1 carry out procedures controlling the major variables	
210-7 identify and suggest explanations for discrepancies in data	210-7 suggest explanations for variation in the heart rate and breathing rate of an individual during various levels of activity when the experiment is repeated
304-10 describe three examples of the interdependence of various system of the human body	304-10 describe three examples of the interdependence of various system of the human body
112-10 provide examples of science and technology based careers in their province or territory	112-10 provide examples of careers that are associated with the health of body systems
113-8 make informed decisions about applications of science and technology, taking into account personal and social advantages and disadvantages	113-8 make informed decisions about applications of science and technology that are associated with human body system, taking into account personal and social advantages and disadvantages

Fitness Testing Lab

Outcomes:

208-1 rephrase questions into testable form about the factors that affect physical fitness and health

208-6, 209-1 design and carry out an experiment to compare and contrast heart rate and breathing rate in an individual during various levels of activity, and identify and control the major variables

210-7 suggest explanations for variation in the heart rate and breathing rate of an individual during various levels of activity when the experiment is repeated

304-10 describe three examples of the interdependence of various system of the human body

Lesson Activity Overview

This lesson is designed to be an investigation about factors that affect physical fitness and health. Specifically, students are asked to design an investigation to compare and contrast heart rate and breathing rate during various levels of activity. There are several scientific skills outcomes that are expected in the activity. Below is an overview of the expectations of the prescribed outcomes. Also, a work sheet has been created for students to follow to ensure they have completed all required skill outcomes.

Begin by introducing the concept of factors that affect physical fitness. A volleyball discussion should follow so that students can work through any prior knowledge and misconceptions. There should be no intent that students make a prediction at this point, the discussion should only raise awareness of the subject.

Students will take the initial purpose of factors that affect physical fitness and health and rephrase the concept into a testable form and clearly define the practical problem that they will be solving - 208-1

Next, students will design their own procedures related to their testable questions and they must ensure that they control the major variables. Make sure the design is set to investigate heart rate and breathing rate in an individual during various levels of activity - 208-6

Although it is not a specified outcome in this section, a major science skill is for students to create a hypothesis of what they expect to happen based on their prior knowledge. This would be an excellent time for students to work on this skill.

Once they have created their hypothesis, students should gather any materials needed based on their experimental design in 208-6, this may include Pasco probes for heart rate. Now they can carry out their procedures making sure that they control the major variables. 209-1

Its now time to make sense of our raw data (breathing and heart rates) by analyzing and interpreting our data. Two things will happen. First, students will plot their data into a graph. Next, students should suggest explanations for variation in the heart rate and breathing rate of an individual during various levels of activity when the experiment is repeated. 210-7

Based on their analysis, students should be able then to write a brief conclusion that describes three examples of the interdependence of various system of the human body
- 304-10

Assessment: Formal Formative

Ensure that students have completed the investigation worksheet. Evaluate each outcome that is listed individually.

Task 3

Outcome - 208-5	State a prediction and a hypothesis based on background information or an observed pattern of events

Task 4

Outcome - 209-1	Carry out their procedures making sure that they control the major variables - <i>Record observations and rough data</i>

Task 5

Outcome - 210-7	Identify and suggest explanations for discrepancies in data after carrying out procedures designed to study the factors that affect physical fitness and health

Task 6

Outcome - 304-10	Students should be able then to write a brief conclusion that describes three examples of the interdependence of various system of the human body

STEM - Careers Exploration

Outcomes:

112-10 provide examples of careers that are associated with the health of body systems

Lesson Activity Overview

Students should be invited to provide examples of careers that deal directly or indirectly with the health of body systems such as lab and X- ray technicians, physiotherapists, nutritionists, doctors, and public- health nurses. People with these careers may be invited to class to share what they do and how it involves the body systems investigated in this unit of study. The expression of interest in science- and technology- related careers is an indication of a positive attitudinal outcome.

UDL Activity - Students will choose one of the two options

Option 1 - Create a mural of careers that deal with the health of body systems. (112-10)

Option 2 - Interview someone working in a STEM career that is associated with the health of body system, report your results to the class.

Design the parameters of expectations with each option before they begin, using a rubric

Assessment: Formal Formative

Ensure students have appropriately completed one of the options

Making Informed Decisions

Outcomes:

113-8 make informed decisions about applications of science and technology that are associated with human body system, taking into account personal and social advantages and disadvantages

Lesson Activity Overview

This outcome may be addressed by using a decision-making model in the science or health program. Developments in science and technology related to our health and the health of various body systems can be addressed by asking students to imagine life without sports and fitness equipment, for example. “Which body systems would be affected?” and “What would be the consequences?” are questions that can lead to discussions concerning developments related to health issues.

Discussion and reflection regarding what we know about various lifestyles and their effects on body systems (such as deciding to exercise or stop smoking on the basis of scientific research) provide a worthwhile opportunity for students to make informed personal decisions about their own health. Students can investigate risk-analysis models used by insurance companies and advertisements for various fitness machines. Other possibilities for research and discussion are the use of sunscreen, food additives, and steroids, as well as health-related issues that arise in newspapers and magazines.

UDL Activity - Students will choose one of the two options

Interview a nurse or health-care worker about the interdependence of several body systems. (113-8)

Prepare a report regarding the advantages and disadvantages of using food additives. (113-8)

Prepare an advertisement for newspaper or radio regarding participation in a particular activity and its effects on a body system. (113-8)

Design the parameters of expectations with each option before they begin, using a rubric

Assessment: Formal Formative

Ensure students have appropriately completed one of the options