

B.C. Honey: The Natural Sweetener

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This document is the result of the author's participation in the BC Agriculture in the Classroom Foundation's Summer Institute for Educators in 2008. This third year level course in curriculum design (CUST 396) is offered every other year through the University of British Columbia's Faculty of Education's Office of External Programs.

In the summer of 2008 the Foundation partnered with the Teachers of Home Economics Specialist Association – THESA – and the Office of External Programs to make the Summer Institute a part of the Home Economics Education Diploma Program. This program consisted of 10 three credit courses that closely examined the Home Economics Curriculum IRP's and explored creative ways to address the learning outcomes.

Participants (30 educators from a variety of secondary disciplines and from many regions of the province) were based at Clarence Fulton Secondary in Vernon BC. As a result of visits to local farms and through intensive classroom work they developed a number of teaching strategies drawn from the agricultural, environmental, economic and nutritional concepts featured in the IRP's.

Participants taking the course for credit created teaching modules such as this to share with other educators around the province.

The BC Agriculture in the Classroom Foundation is supported by the BC Ministry of Agriculture and Lands as well as the agricultural community. Participants were sponsored for their farm tours as well as their meals (prepared by our Summer Institute chef using fresh and delicious local products).

Visit the BC Agriculture in the Classroom website at www.atic.ca/bc for further information on this and our many other exciting programs or to order additional resources for your classroom.

Thank you for bringing agriculture to your classroom. We hope that you too will find it a great teaching tool to enhance your lessons.

www.atic.ca/bc

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Synopsis

This unit on Honey has been designed for use in a Grade 11 or 12 Foods and Nutrition class but could also be modified for junior grades. The teaching activities explore a range of topics including fun facts about honey, how honey is gathered and processed, the types of and uses for honey, cooking with honey, and finally, the problems currently faced by beekeepers across the world. Lessons also explore honey as a sustainable food source and encourage the student to compare and evaluate the product with sugar in terms of its health benefits and ecological impact. The topic of Colony Collapse Disorder is important especially as bees are so essential to fertilization of food crops, and it is necessary that they feel empowered to affect change. Each activity is self-contained and suggestions for extending the lesson are given at the end of each.

Rationale

There are numerous reasons to promote the consumption of honey; historically, there are few foods that have been so highly prized, so beneficial to one's health, and so environmentally beneficial. Widely known as "nectar of the gods", honey has been used for millenia in food and drink, and for cosmetic and medicinal purposes (The George Mateljan Foundation, 2008). In January 2008, the First International Symposium on Honey and Human Health was held in Sacramento, California. According to a press release issued by the organizers of the symposium, "An international gathering of scientists convened... to review emerging findings on the potential role of honey in human health, including studies suggesting honey may play a favourable role in protection against chronic conditions such as diabetes, overweight, and hypertension. New research explores the natural sweetener's potential to improve chemotherapy-induced neutropenia, wound healing, restorative sleep, cough suppression, and cognitive function." (The Committee for the Promotion of Honey and Health, Inc., 2008). The new research is exciting, particularly in an age where teenagers are consuming more sugar than ever before. With rates of obesity and type II diabetes continuing to climb, it is fitting that teachers look for every opportunity to educate students about the healthier food choices available to them. Unlike refined sugar, honey contains various antioxidants, B vitamins and minerals. As well, it may contribute to gastrointestinal health by promoting the growth of the "good bacteria" called bifidobacteria. (National Honey Board, 2008)

In addition to its health benefits, the production of honey is beneficial to the environment as the honeybee's task of pollination is vital to most plant life and thus, our food supply. According to B.C.'s Ministry of Agriculture, honeybees "...are used in pollination and play a critical role in the production of many crops, representing a value of over \$14 billion per year in North America" (BC Ministry of Agriculture and Lands, 2008). In B.C. alone, with its relatively "small" industry, the "...tree fruits in the Okanagan and berry crops in the Fraser Valley are very dependent on the abundance of bees when these crops are in bloom. Fruit growers rent large number of colonies from beekeepers. It has been estimated that honeybees are responsible for the production of \$160 million worth of crops in B.C. every year" (The British Columbia Agriculture in the Classroom Foundation, 2008, p. 126). Honey is also a more ecologically sound choice than other sweeteners because it is locally produced and travels fewer 'food miles' in order to get from farm to consumer, utilizing fewer resources like fossil fuels.

The beekeeping industry employs people from a variety of occupations including beekeepers and bee breeders, honey processors and graders, and entomologists (apiculturists). (The British Columbia Agriculture in the Classroom Foundation, 2008, p. 128). Not only does the consumption of honey support the local economy by employing local labour, it is arguably a more ethical choice of sweetener than

sugar. According to Andony Melathopoulos of Agriculture Agri-Food Canada, "The exploitation of cane workers is severe across most developing countries...The U.N. reports child labor is widely used in cane cultivation in Brazil, Central America, Africa, and the Phillipines" (Melathopoulos, 2006). While the role of beekeepers et al is unquestionably important, the production of honey relies primarily on the labour of honeybees and worldwide, their hives have been drastically impaired.

Despite their diminutive size and ability to strike panic in some people, honeybees are exquisitely complex creatures. In the past several years, scientists from around the world have begun to express alarm at the frequency with which hives are experiencing "Colony Collapse Disorder" (CCD), a term used to describe the mysterious disappearance of honeybees from their hives. Scientists have isolated a virus linked to CCD, but also express concern over the use of pesticides and the possibility that these have impacted the immune system of the honeybee. As well, there is concern that agribusiness which engage in single-crop farming may contribute to malnutrition in bees. In B.C., Ministry of Agriculture officials acknowledged that "...the 2007 beekeeping season was a dismal one for virtually all beekeepers of British Columbia [as]...colonies suffered from a terribly long and cold winter that caused a lot of stress on bees..." (B.C. Ministry of Agriculture and Lands, 2007), but they remain cautious about attributing B.C.'s rising colony losses to CCD. As they state, "The results of the annual production survey are based on the anonymous information submitted by B.C. beekeepers. For each region, all entries are pooled and it is assumed that they are representative of the beekeeping community...It is important to remember that producer involvement in the survey is the only effective means to measure the status of the beekeeping community in the province." (B.C. Ministry of Agriculture and Lands, 2007). Nevertheless, such losses underscore the often precarious state of agriculture as it "...carries inherent risks and uncertainty – from natural disasters, to disease, to labour shortages..." (Province of B.C., 2007, p. 2).

Learning about honey and its production is the ideal way to intertwine such topics as nutrition, sustainability and the impact of our choices as consumers, both on our health and on that of the environment and to meet many of the Prescribed Learning Outcomes set forth in B.C.'s Integrated Resource Package, for instance, providing opportunities for students to "demonstrate an awareness of environmental and health issues related to the production and consumption of food" and to "identify ways to improve the nutritional value of recipes " (Ministry of Education, Province of B.C., 2007, p. 53-54). Students can be helped to understand and appreciate nature's delicate balance and learn more about proactive ways to practice stewardship of the earth, protecting the food supply for future generations. Examining serious issues such as Colony Collapse Disorder provides the opportunity for students to question their assumptions about the safety and efficacy of using products like pesticides and the need to be sensitive to the impact their consumer choices have on the long-term health of their environment. This promotes the type of analytical thinking advocated by Dr. Janet Reynolds and Dr. Martin Caraher. They write, "Education about and for food...must go beyond skilling the consumer to be able to make healthy choices from a range of unhealthy ones. Students should use critical thinking skills as they come to understand, for example: what constitutes healthy choices going beyond nutritional values—consider...'food miles', [and] environmental impacts (how it was grown, packaged, etc.)" (Caraher & Reynolds, 2005, p.13).

It is hoped that this unit will be used to heighten student awareness of the many health benefits and uses of honey as well as to promote critical thinking in making informed consumer choices so that students can move from being "industrial eaters" to people who "...understand that eating takes place inescapably in the world, that it is inescapably an agricultural act, and how we eat determines, to a considerable extent, how the world is used" (Berry, 1990, p. 3).

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Curriculum Outcomes – Connections to the BC Home Economics IRP

These are the Prescribed Learning Outcomes from the Home Economics IRP that can be met by teaching this unit:

Food Preparation Foundations:

- demonstrate the ability to accurately evaluate and follow recipes using a variety of food preparation techniques and equipment
- demonstrate organization and co-operation in partner and group work, including integration of planning skills
- vary ingredients and methods in recipes to affect nutrition, flavour, texture, taste, and quality of the product

Food Preparation Techniques:

- select recipes and apply cooking principles to prepare healthy dishes and meals, incorporating presentation and budgetary considerations.
- use a variety of cooking methods to prepare foods

Nutrition and Healthy Eating:

- demonstrate an understanding of the importance of nutrients during various stages of the lifecycle, and the effects of deficiencies and excesses
- analyse personal eating practices as they relate to physical and mental well-being, food fads, and food myths

Social, Economic, and Cultural Influences:

- demonstrate an awareness of environmental and health issues related to the production and consumption of food.

Activity 1: Test your honey IQ – How Sweet are You?

Objective:

The student will explore facts about honey, describe a variety of products in which honey is used, the various forms in which honey is found and what contributes to a honey's unique flavour.

Materials/Resources:

- copies of Quiz: What's your honey I.Q.?
- copies of Where is the Honey? – Read the Label
- copies of How Sweet it is – Honey Sampling
- Various products containing honey (e.g. cosmetics or food products such as cereal, cosmetics, crackers, etc.). You can use just the packaging or labels. In advance of the lesson you could ask students to bring in a food label or package that has honey as an ingredient.
- Jars of different varieties of honey: liquid, creamed (e.g. fireweed, clover, lavender, blackberry)
- Photocopies of p. 126 -129 of Grow BC. You can order your own copy of Grow BC from BC Agriculture in the Classroom <http://www.aitc.ca/bc/resources/resource-order-form> [note: copies of this publication were sent to all school libraries in BC].

Directions:

1. Hand out Honey IQ test and have students complete. Afterwards, students can mark their own as the teacher discusses the answers with them. Have students name facts that surprised or interested them.
2. Hand out Where is the Honey? – Read the Label worksheet. Have a variety of products on display around the classroom. Afterwards, discuss how the products could be categorized (e.g. cereals, cookies, health foods, medicines, cosmetics, etc.). What is honey mainly used for in food products? Why might honey be used instead of another sweetener? Are there any non-edible products that contain honey? Why might honey be used in these?
3. (Honey has many health benefits. It is full of B vitamins and minerals, has anti-oxidant properties, is antibacterial and can be used as a wound dressing, and is believed to contribute to the production of "good bacteria" in the digestive tract. However, it should not be fed to infant under one year of age as it may cause infant botulism.)
4. Hand out How Sweet it is – Honey Sampling worksheet. Place different types of honey still in their containers around the room with a supply of toothpicks for dipping (emphasize food safe practices – no double dipping, take a new toothpick for each tasting). Encourage students to have a glass of water (for rinsing their mouths between tastings). Have students move from honey station to honey station filling in their sampling chart (alternatively the products could be passed from group to group). Once students have finished, discuss the differences in the taste and forms of the various honeys. Could they determine the nectar source from the honey's flavour? Is there a correlation between colour and taste? (generally, the lighter the honey, the milder the taste). Which one do they prefer? Why?

5. Have students number off 1 to 4 and get into number groups. Provide each group with information on Honey from Grow BC. Give each number a responsibility:
 - # 1 – Find the names of the 5 regions in BC that produce most of the honey.
 - # 2 – Find the most significant function of bees in agriculture.
 - # 3 – Find and describe other products that come from honeybees.
 - # 4 – Describe the most significant threat to bee colonies.

Then have students return to their home groups and “teach” the members of their group the information they gathered.

Extending the lesson:

- Students could design a “local honey” information poster. It could include botanical drawings and descriptions of various honeys including each one’s flavour and colour, as well as where in B.C. it is produced.
- Students could create a “honey map” showing various honey farms in B.C.

Teacher References:

For more comprehensive information on the health benefits of honey see the National Honey Board’s website at <http://www.honey.com/honeyindustry/> or The World’s Healthiest Foods website at <http://www.whfoods.com/genpage.php?pfriendly=foodspice&dbid=96>

NOTE: “Test your honey IQ” has been adapted from “Test your Sugar IQ” at The Canadian Sugar Institute website, <http://www.sugar.ca/sugariq/>

Some of this lesson is an adaptation of The Many Uses of Honey from the National Honey Board’s “The Honey Files Teacher’s Guide” available to download at <http://www.honey.com/consumers/kids/honey-files.aspName>

What's your "Honey IQ?"

1. What is honey?
 - a. A carbohydrate
 - b. Sucrose which has been converted to fructose, and glucose.
 - c. Nectar that has been regurgitated by bees
 - d. All of the above
2. Canada is the world's _____largest producer of honey.
 - a. First
 - b. Fourth
 - c. Sixth
 - d. Second
3. Canadian honey is mainly exported to:
 - a. Holland and Brazil
 - b. China and Australia
 - c. France and India
 - d. U.S. and Germany
4. Honey is has been used for thousands of years as a wound dressing because:
 - a. microbes cannot live in it
 - b. it produces hydrogen peroxide
 - c. it has antioxidant properties
 - d. all of the above
5. The most nutritious honey is:
 - a. found in the honeycomb
 - b. pasteurized
 - c. unfiltered and raw
 - d. filtered
6. Honey bees must gather nectar from _____ flowers to make one pound of honey.
 - a. 6, 000
 - b. 2, 000, 000
 - c. 500, 000
 - d. 75, 000

7. The flavour, colour, texture, and aroma of honey depends on:
 - a. The type of honeybee that collected the honey
 - b. The area in which the nectar was collected
 - c. The plants from which the nectar was collected
 - d. Whether or not the honey was processed after collection.

8. Honey is best stored:
 - a. In the refrigerator
 - b. In the freezer
 - c. At room temperature
 - d. In a very warm place

9. Crystallized honey:
 - a. Is spoiled and should be thrown out
 - b. Can be liquified by placing in hot water for 15 minutes
 - c. Should be microwaved on high for 30 seconds
 - d. None of the above

10. A single worker bee may fly up to 3 km. from home to gather nectar and will gather up to _____ of nectar in her lifetime.
 - a. 250 ml
 - b. 200 ml
 - c. 50 ml
 - d. 15 ml

What's your "Honey IQ?" — Answer Key

1. What is honey?
All of the above
2. Canada is the world's _____largest producer of honey.
Sixth
3. Canadian honey is mainly exported to:
U.S. and Germany
4. Honey is has been used for thousands of years as a wound dressing because:
all of the above
5. The most nutritious honey is:
found in the honeycomb
6. Honey bees must gather nectar from _____ flowers to make one pound of honey.
2, 000, 000
7. The flavour, colour, texture, and aroma of honey depends on:
The plants from which the nectar was collected
8. Honey is best stored:
At room temperature
9. Crystallized honey:
Can be liquified by placing in hot water for 15 minutes
10. A single worker bee may fly up to 3 km. from home to gather nectar and will gather up to _____
of nectar in her lifetime.
15 ml

Name _____

Where is the Honey? – Read the Label

Examine the products, the list of ingredients and record the following information:

Name of Product	Number of Ingredients	Probable Reason for Including Honey	Is honey mentioned anywhere on the label other than the list of ingredients? How?	Are there any claims made about the inclusion of honey in this product? Describe.

Name _____

How Sweet it is – Honey Sampling

Type/Name/ Brand of Honey	Where is it Produced	Nectar Source	Pas- teur- ized?	Colour	Consistency	Aroma	Taste

Activity 2: Why use honey?

Objective:

The students will compare the processing of honey and sugar in order to determine the most sustainable, natural choice of sweetener.

Materials/Resources:

- Copies of Sweetener Comparison Chart
- Samples of the Sweeteners named in the Chart (optional)
- Copies of "From Cane Sugar to Granulated Sugar" for each group or make into an overhead
- Copies of Honey as Canada's Sustainable and Ethical Sweetener

Directions:

1. Distribute the Sweetener Comparison Chart. Direct students in partners or small group to discuss what information might go in each column of the chart. When students are finished, have them share their ideas. Encourage students to write any new information on their charts.
2. Distribute copies of "From Cane Sugar to Granulated Sugar" or display as an overhead. Read the following description of honey processing from Grow BC:
 - Honey is extracted from the honey comb frames by removing the small wax caps covering each cell. The frames are then placed in a drum-like machine called an extractor, which works like a centrifuge. Extractors may hold anywhere from two frames at a time to more than 120. The frames are spun around rapidly causing the liquid honey to flow out of the cells. The honey is then collected and pumped through filters before being stored in a tank. Small honey containers are then filled for market. (p. 128 Grow BC)

Have students make a flow chart of Honey From Comb to Home either on the back of the comparison chart or a separate piece of paper. Ask them to explain the differences in processing. Is there information they could include on their chart?

3. Distribute the reading Honey as Canada's Sustainable and Ethical Sweetener. Direct students to determine the argument for each Did You Know? that the author uses to make the claim that honey is the most sustainable and ethical sweetener. Discuss whether they agree with the author or not and why? Is there information they could include on their chart?
4. Review the information that students have on their charts. Share information from the sample answer chart if it is apparent from student work that they have not considered those points. Have a summary discussion. Sample questions may include:
 - Which of these sweeteners comes from B.C.?
 - Does B.C. produce sugar? Some students may think "BC sugar" is made in B.C. It is not. Rogers Sugar has a refinery in Vancouver where imported cane sugar is refined.
 - Which sweetener provides the most benefits to consumers? In which ways?
 - Which sweetener do you think uses fewer resources to produce?

- What differences do you notice about the production and processing of the two sweeteners?
 - How do the packaging requirements differ for each product? Is one better than the other? In what ways?
 - What are the differences in shipping requirements in order to get the sweetener to the consumer?
 - Which one do you think is the most sustainable food choice? Why?
- How do you think price affects consumer choice? Are there other reasons why people opt for one over the other?

Extending the lesson:

Have students read p. 126-128 of Grow BC the honey industry in B.C. to find out more about jobs related to apiculture. You can order your own copy of Grow BC from BC Agriculture in the Classroom <http://www.aitc.ca/bc/resources/resource-order-form> [note: copies of this publication were sent to all school libraries in BC].

Teacher References:

- the National Honey Board's website at <http://www.honey.com/honeyindustry/>
- the Canadian Sugar Institute at www.sugar.ca/english/

Name _____

Sweetener comparison chart

Name of sweetener Type of sugar or ingredients	Source (plant, animal, or chemical)	Country or Countries of Origin	Pros	Cons
Cane Sugar				
Beet Sugar				
Corn Syrup				
Aspartame (NutraSweet)				
Sucralose (Splenda)				

Sample answers for comparison sheet:

Name of sweetener	Source (plant, animal, or chemical)	Country of Origin	Pros	Cons
Cane Sugar White Sugar Sucrose	Sugar cane	-Cane is grown in tropical countries such as India, Mexico, Australia, Thailand, S. Africa & Guatemala	- readily available -cheap -easy to use -fewer calories per 15 ml than honey -refined in Canada, provides jobs	-highly refined -less sweet than honey -greater environmental impact -little nutritive value -in tropical countries, cane harvesters are paid little and work in harsh conditions
Beet Sugar White Sugar Sucrose	Beets	Canada	-locally grown & processed so fewer food miles -readily available -cheap -easy to use -fewer calories per 15 ml than honey	-many resources used (land, fertilizers, pesticides, water) -soil erosion -highly processed - creates pollution
Honey Glucose	Honeybees	Produced in Canada, often in same community in which the consumer lives	-health benefits -ecologically friendly -requires minimal or no processing -bees are necessary for pollination, they serve a dual purpose. -sweeter than refined sugar - support local farmer/economy	-more expensive than white sugar -recipes may need to be adjusted for taste & texture. -not as easy store.
Aspartame (NutraSweet)	Combining 2 amino acids with methanol	Factories throughout the world – headquarters in the US	-low calorie - advantageous for sugar restricted diets	-artificial -no nutrient value - controversial
Sucralose (Splenda)	Chlorination of sucrose (white table sugar)	Factories in the US and Singapore	-low calorie - advantageous for sugar restricted diets - can be used in baking	-artificial -no nutrient value - controversial

Honey as Canada's Sustainable and Ethical Sweetener

Did You Know? Locally produced honey, takes far less energy to make and deliver a pound than any other sweetener. Cane, corn and beets are among the greediest cultivated plants on the planet, demanding more fertilizer, pesticides and irrigation than any other field crops.

Did You Know? Growing crops for sweeteners (cane, corn and beets) can be hard on the land. U.S. corn production, for example, erodes soil about 18 times faster than it can be reformed and uses more pesticides and herbicides than any other US crop. Cane sugar has similar impacts. Australian cane farmers, for example, use 40% of the total the irrigation water in Queensland. The resultant run-off has contributed to an annual discharge of 7,000 tonnes of nitrogen and 11,000 tonnes of phosphorous into the fragile Great Barrier Reef lagoon ecosystem. Beekeepers, by contrast, leave virtually no trace on farm ecosystems. Honey is either a byproduct of cultivated crops or comes from unmanaged wildflowers. The main floral sources are alfalfa and clover, both of which naturally fix nitrogen into the soil and reduce the reliance on fossil-fuel-based fertilizers. The only major input is the sugar used feed bee colonies for winter. This input, however is typically offset by the amount of honey made; typically beehives produce three to four times the calories of honey compared to calories of sugar needed for winter.

Did You Know? Honey also beats other sweeteners when it comes to the energy associated with refining. Honey is just spun out of the honeycomb frames, filtered and bottled. Honey extraction uses a miniscule amount of energy compared, for example, to the wet milling of corn for corn syrup. Wet milling is arguably the most energy intensive food-processing step in the world. Wet milling gobbles up 15% of the US food industry's total energy expenditure.

Did You Know? Honey travels the least distance to get to Canadian consumers. Travel is an important environmental issue because the energy costs of transporting food can rival that of costs of processing. Refined sugar takes an incredible journey to reach Canadians. Canada imports 90% of its sugar. Approximately 1 million tons of raw sugar comes into Canada, primarily from Australia and Cuba and is refined by one of four Canadian companies. Domestic sugar production from Canadian grown sugar beet accounts for only 10% of the amount of sugar consumed.

Did You Know? When Canadian's buy table sugar they not only buy an exported product, but also a sweetener produced by labourers toiling under the most terrible of working conditions. The exploitation of cane workers is severe in most developing countries but has also plagued immigrant workers in US cane fields. Conditions that verge on slavery have been reported among Haitian refugees working in the cane fields of the neighbouring Dominican Republic. The UN reports child labor is widely used in cane cultivation in Brazil, Central America, Africa and the Philippines. Cane cultivation in developing countries is largely manual, backbreaking and unsafe. Sugarcane workers labour in direct sunlight and use machetes and other sharp tools to harvest the crop, which results in high rates of injury to their arms, hands and legs. Canadians buying domestic honey support beekeepers who own their own business and who abides by numerous health and safety regulations. Canadian beekeepers enjoy a high standard of living compared to workers in developing countries. Buying local honey also supports our ailing rural communities.

This information was adapted from an article: "Honey as Canada's Sustainable and Ethical Sweetener" by Andony Melathopoulos, Agriculture Agri-Food Canada, Beaverlodge, AB. It can be found online: <http://www.honeycouncil.ca/users/folder.asp@FolderID=5507.htm> .

Activity 3: Cooking with Honey

Objective:

The student will convert a blueberry muffins recipe to be made with honey and then conduct a taste experiment lab where they make the original recipe and the one with honey and compare appearance, flavour and/or texture.

Materials/Resources:

- Overhead transparency or copies of “Cooking with honey: tips and hints”
 - Copies of Cooking with Honey: Converting Blueberry Muffins to Honey
- Ingredients for two Blueberry Muffin recipes

Directions:

1. Using either the overhead transparency or copies of “Cooking with honey: tips and hints” review the basic principles of converting recipes so they can be made with honey instead of sugar.
2. Handout Copies of Cooking with Honey: Converting Blueberry Muffins to Honey and direct students to make the conversion to the ingredient list and the method.
3. Mark the Cooking with Honey: Converting Blueberry Muffins orally so that all students have the correct conversions on their sheets.

Answers:

__same 250ml__ all purpose flour	Change 1. Preheat the oven to 375°F . Prepare muffin pans (line with paper liners or grease).
____30-45ml__honey	No Change 2. Combine dry ingredients in a medium mixing bowl. Make a well in the center. [no sugar]
__same 7 ml__baking powder	No Change 3. Combine liquid ingredients in a small mixing bowl and beat until smooth. [honey is considered a liquid]
____f.g.____ baking soda	No Change 4. Pour liquid ingredients into well and stir until must moistened. Batter will be lumpy
__same 1 ml__ salt	No Change 5. Toss blueberries with flour to coat. Fold into batter.
__same 60 ml __ vegetable oil	No Change 6. Fill muffin cups $\frac{3}{4}$ full and bake for approximately 20 minutes.

__same ½ ____ egg	
____ 110 ml ____ milk	
__same 2 ml ____ vanilla	
__same_ 125 ____ blueberries + __5ml_fLOUR	

1. Divide the class into two groups. Have half the students make the blueberry muffin recipe with sugar and the other half make the recipe with honey. After the muffins are done, have each 'honey' group pair up with a 'sugar' group in order to compare their baked products. Using the comparison sheet provided, have students rate the quality of each muffin and determine which they preferred.
2. Discuss their findings as a class. If students were unhappy with the quality of their products, ask them to think of what they could have done differently next time to improve the outcome. Collect comparison sheets for marking.

Extending the lesson:

- Have the students conduct the same experiment with a more sophisticated recipe.

Teacher References:

- <http://www.honey.com/consumers/recipes/recipes.asp>
- <http://www.honeyassociation.com/recepies2.htm>
- <http://homecooking.about.com/library/archive/blmisc56.htm>
- <http://www.honey.com/downloads/beefit.pdf>
- <http://homecooking.about.com/od/specificfood/a/honeytips.htm>

Cooking with honey: tips and hints

It's very easy to substitute honey for sugar in your recipes.

- Honey is up to twice as sweet as table sugar, so you will need to reduce the amount called for in the recipe by one-third to one-half honey for granulated or table sugar. (e.g., if the recipe calls for 250 ml of sugar, you would use 125-180 ml of honey)
- Since honey is composed of up to 18% water, you will need to reduce the liquid called for in baked goods by about one-fifth. (e.g. if the recipes calls for 250 ml of liquid, you would use 200 ml)

Unless the recipe calls for sour milk or cream, some cooks add the merest pinch of baking soda to the recipes of baked goods to counteract the slight acidity of the honey (2 ml baking soda for each 250 ml of honey)

You may need to adjust the method of the recipe when you use honey instead of sugar. (e.g., in the muffin or one bowl cake method the honey would become part of the wet ingredients; give longer time for beating and more vigorous beating compared to sugar recipes, and when baking with honey.)

- In most fruit pies, increase the thickening agent by 1/2 (e.g., if the recipe calls for 125 ml of flour, you need to add approximately 60 ml more flour)

When only small amounts of sweetener are used such as in yeast breads or salad dressings, you do not need to adjust the recipe just substitute equal amount of honey for the other sweetener.

- When baking sweets, you should also lower your oven temperature by 25 degrees F. (15 degrees C).
- If you are measuring honey by weight, 250 ml will weigh 336 grams.

To help that honey slide smoothly from your measuring utensils, simply lightly coat the utensil with a vegetable spray before measuring the honey.

Since it has the ability to absorb and retain moisture, honey is used in the industry to keep baked goods moist and fresh. Use honey in baked goods you plan to mail to keep them bakery-fresh.

Honey is also an excellent choice to use in salad dressings, since its emulsifying qualities make it a perfect stabilizer.

Name _____

Cooking with Honey: Converting Blueberry Muffins to Honey

Blueberry Muffins (with sugar)	Blueberry Muffins (converted to honey)
250 ml all purpose flour	_____ all purpose flour
60 ml sugar	_____ honey
7 ml baking powder	_____ baking powder
	_____ baking soda
1 ml salt	_____ salt
60 ml vegetable oil	_____ vegetable oil
½ egg	_____ egg
125 ml milk	_____ milk
2 ml vanilla	_____ vanilla
125 ml blueberries, fresh or frozen + 5 ml flour	_____ blueberries + _____ flour

Method:

	Change or no change? If change write in the change.
1. Preheat the oven to 400°F. Prepare muffin pans (line with paper liners or grease).	
2. Combine dry ingredients in a medium mixing bowl. Make a well in the center.	
3. Combine liquid ingredients in a small mixing bowl and beat until smooth.	
4. Pour liquid ingredients into well and stir until moistened. Batter will be lumpy	
5. Toss blueberries with flour to coat. Fold into batter.	
6. Fill muffin cups $\frac{3}{4}$ full and bake for approximately 20 minutes.	

Name _____

Cooking with Honey: Comparing Blueberry Muffin Recipes

Evaluation Chart

	Shape (describe or draw)	Outer Colour	Inner Colour (cut in half)	Texture	Flavour
Muffin made with honey					
Muffin made with sugar					

Summary: What do you think about using honey as a sweetener (explain your answers)

- in terms of the overall quality of the final product?
- in terms of convenience?
- in terms of sustainability and social responsibility?

Would you consider substituting honey in cooking as a general practice?

Why or Why not?

Activity 4: How can you use honey? Let me count the ways...

Objective:

The student will select and prepare a recipe using honey as an ingredient [Note: this requires at least one or two classes for research before the lab]

Materials/Resources:

- Computers with internet Access or Library Access
- A variety of cookbooks
- Ingredients for recipes selected for lab day

Directions:

1. This is a modified Iron Chef competition where students know that their ingredient is honey. The first part of the assignment is to have students develop a complete menu where honey is an ingredient in each of the dishes. Their menu must have an appetizer, a soup or salad, a bread, a main dish, accompanying vegetables, accompanying rice, pasta or potato dish, dessert and a beverage. They must find recipes for each and submit with their menu.
2. On Iron Chef day they will be required to prepare one of the recipes for a sampling lab. (Teacher will decide what recipe – based on criteria such as degree of difficulty appropriate to the grade, cost of ingredients, preparation time, etc.). Students will not know which recipe in advance so it is important to remind them to read the recipes they select carefully so they will be prepared to make the one that is selected by the teacher.
3. On Iron Chef day students will prepare the selected recipe and then sample one another's products. Discuss how honey contributes to the flavour and/or texture in each of the dishes.

Extending the lesson:

- Compile recipes into a small honey cookbook for students to take home.

Have students create their own "value-added" honey product such as a salad dressing, dip, or muffin. They could test their recipes at school or home, design a label and perhaps a print ad for it as well. The class could then have a "Honey Fair" to display their wares.

Have students follow the outline for this assignment but the research involves finding a recipe for an ethnic or cultural use of honey (e.g., Lekach Israeli Jewish honey cake, Greek Baklava, German Honey Cookies, etc.)

Teacher References:

www.ontariobee.com .

<http://www.honey.com/consumers/recipes/recipes.asp>

<http://www.honeyassociation.com/recepies2.htm>

<http://homecooking.about.com/library/archive/blmisc56.htm>

Activity 5: The Silence of the Bees

Objective:

After viewing the PBS program “The Silence of the Bees” the student will be able to describe Colony Collapse Disorder and identify ways in which they can help save the honeybee population.

Materials/Resources:

LCD projector and wireless internet connect to show “Silence of the Bees” available as a podcast by accessing: <http://www.pbs.org/wnet/nature/episodes/silence-of-the-bees/introduction/38/>

or the purchase the DVD in advance of the lesson for 19.99 (U.S.) by shopping at PBS online: <http://www.shoppbs.org/search/index.jsp?kwCatId=&kw=bees&origkw=bees&f=PAD%2FFormat%2FDVD&sr=1>

Directions:

1. Put the following menu on the overhead or blackboard,

Split Pea Soup Pear and Hazelnut Salad
Stuffed Baby Squash Garlic Mashed Potatoes
Roast Chicken with Almond and Corn Bread Stuffing
Pumpkin Pie Apple Pie

2. Explain that about one-third of the total human diet is derived directly or indirectly from insect-pollinated plants. An estimated 80 percent of insect crop pollination is accomplished by honey bees. Honey bees are needed to pollinate a variety of fruits, berries, vegetables, tree nuts, oil seeds and legumes. In small groups have students discuss and make then make a list of all the foods that would be eliminated if all animal pollinators were to become extinct. [in this menu that would include the peas, pears, squash, potatoes, hazelnuts, almonds, pumpkin and apples – corn and the wheat for the flour in the bread and pie pastry are wind pollinated]
3. Introduce the issue of Colony Collapse Disorder (CCD) by asking students if anyone has heard about the current plight of the honeybee. Explain that CCD occurs when bees mysteriously disappear from their hives causing the entire bee colony to collapse.
4. Introduce the Podcast or DVD “Silence of the Bees” and handout the Viewing Sheet and review the questions with students. As the Podcast or DVD progresses determine whether it is appropriate to stop at various sections to discuss the questions and give students time to record the answers.

Answer Key

- a) Israeli Acute Paralysis Virus (IAPV) has been found in nearly all the tested bees affected by CCD. This virus was brought to the U.S. via imported Australian bees. Bees were shown to have fungi in their digestive tracts that signalled a weakened immune system, much like what happens when humans are infected with the AIDS virus however, scientists are unsure whether stress to the immune system is caused by pesticides, malnutrition, or parasites or a combination of all three. Scientists in Spain believe that malnutrition in bees may be a result of their being forced to pollinate on large-scale mono-crop farms; their nutrition sources are not varied enough to provide a balanced diet.
 - b) Some have killed bees outright (as neo-nicotinoids in France) but the effects are all pesticides are lingering. A researcher at Pennsylvania State University believes that pesticides impair bees' ability to learn and that perhaps they are unable to find their way back to the hive. Studies of pollen collected from bees exposed to pesticides revealed over 40 different chemicals present in the pollen. It is suspected that their immune systems are negatively impacted by this.
 - c) Honey bees account for 1/3 of the food grown in the U.S. alone. In the U.S. this accounts for a \$15 billion food industry. All of this would be lost. One scientist said that "Unless we only want to eat corn, wheat, and rice (which are wind pollinators), we need bees". Worldwide, the situation is much the same
 - d) Agri-business now means that farming is extremely large scale therefore, more bees are needed to produce more fruit, nuts, and vegetables. Pollinators have lost much of their natural habitat through development, farming, etc. and are not as naturally abundant as they once were and this means that bees now need to be trucked in from other places.
 - e) Plant pollinator friendly gardens to attract pollinators, become a backyard beekeeper (learn how to keep honeybees or mason bees), write to politicians in support of honeybee research.
1. Debrief the class after the DVD by allowing time for discussion and questions. Students can hand in answers to questions for marking.

Extending the lesson:

- Students could research whether Colony Collapse Disorder is occurring in BC (or wherever they live) and what local apiarists have to say about it.
- As a class, write a letter to the Minister of Agriculture in support of honeybee research. Each student who wishes to could sign the letter.

Students could research how to make mason bee homes and build them for their own yards or school grounds. You could collaborate with the wood working teacher to drill holes in blocks of wood. More information can be found through the B.C. Ministry of Agriculture at http://www.agf.gov.bc.ca/apiculture/factsheets/506_osmia.htm

Students could research local plants that attract honeybees and plant some of them in the school garden.

Bring in apiarist (bee keeper) as a guest speaker.

Name _____

"Silence of the Bees" Viewing Sheet

a) What do scientists think are the main reasons for Colony Collapse Disorder?

b) How are bees affected by the use of pesticides?

c) What are the repercussions for humans if CCD is not halted?

d) Why are beekeepers essential for modern crop yields?

e) How can we help ensure the survival of our honeybee population?

f) Were you aware of the importance of pollinators in ensuring the food supply?

g) What is the key message of the video?

Additional Resources:

Videos and dvds

- **POLLEN NATION** From the website: "This film follows the journey of one commercial beekeeper – third generation beekeeper Jeff Anderson -- from the honey harvest on the High Plains to the warm winter-feeding grounds of California. It also explores the history of human interaction with bees, a story that reflects the development of agriculture. In ancient Egypt beekeepers floated their clay hives down the Nile to some of the first irrigated fields; in the 21st century, professional bee brokers help balance the rising costs of maintaining hives with increasing demand from big agriculture." <http://www.pollenationthemovie.com/>
- **CANADIAN BEES & HONEY** - V6639 Video - 20 min. This video is a general overview of beekeeping and honey production. Great Outdoorsman Show (1995) <http://www.ontariobee.com/index.php?action=display&cat=13>

Websites

- National Honey Board (U.S.) <http://www.honey.com/honeyindustry/>
An excellent source of honey-related resources including downloadable information about honey and wellness, the story of honey, tips for honey use, and a honey reference guide with detailed information on honey's nutritive qualities and chemical properties.
- Beemaid Honey www.beemaid.com
Offers information about honey including answers to FAQs.
- The Canadian Honey Council www.honeycouncil.ca for information on honey facts and health-related information.
- The Voice of the Hive <http://www.voiceofthehive.com/>
From the website: "This site is a collection of stories regarding Honeybees and beekeeping. In each one I present a bee's eye view of major events in the life of colony of honeybees. Life is one set of trials after another and honeybees are not exempt. Here you will find one man's view of his bees, one man's interpretations of the events that a colony goes through."
- Planet Bee (Vernon, B.C.) www.planetbee.com
Offers educational tours and honey tasting. Visitors can see honeybees working in glass hives and learn more about these incredible creatures.
- The Ontario Beekeepers Association <http://www.ontariobee.com/>
Offers a teacher's kit about honeybees and a honey website which includes recipes and additional information about honey.
- B.C. Honey Producers Association <http://www.bcbeekeepers.com/>
Limited information for teachers but does offer links to local honey producers.
- The Honeybee Centre (Surrey, B.C.)
Offers fieldtrips and numerous bee-related teaching resources online. <http://www.honeybeecentre.com/>
- The Honey Association (U.K.) <http://www.honeyassociation.com/index.htm>
Good sources of recipes, honey trivia and facts. U.K. celebrates National Honey Week; information on site.