

# “Fingerprinting” different plants in the Heath family\*

## Purpose

This study looked at 14 healing plants in the Heath family. For each species of plant, it aimed to do three things:

1. Identify the different ingredients in the plant (the chemical compounds).
2. Measure how *much* of each ingredient is in the plant.
3. Produce a “fingerprint” for each plant extract, based on how much of each ingredient it has. This fingerprint should allow us to tell the plants apart even when they look very similar.

In short, the study looked for a way to tell the plants apart based on their major and minor ingredients. It aimed to produce “fingerprints” that describe the unique combination of ingredients in each plant.

## About the Heath family

The Heath family is a family of plants that like acidic soil. In Canada, the family has 18 members, including

- Blueberry
- Cranberry
- Labrador tea
- Bearberry
- Sheep laurel

The scientists chose to look at plants in the Heath family because many Aboriginal peoples use them for healing. In Iiyiyiu Aschii, the elders named five plants in the Heath family among the ones they use for symptoms of diabetes. For instance, they use Labrador tea a lot. Table 1 shows what the elders in Mistissini and Whapmagoostui told us about these plants. It also shows how other Aboriginal groups in North America use these plants.

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\* This is a plain-language version of an article by Ammar Saleem, Cory Harris, Pierre Haddad, Louis Martineau, Alain Cuerrier, Jason Coonishish, and John Arnason, titled “Metabolomic Methods for the Identity and Quality Assurance of Northern Medicinal Ericaceae” (version of July 2008). Once the article is in final form, the authors plan to submit it to the *Journal of Agriculture and Food Chemistry*.

Another reason to look at the plants in this family is that we know some of them are good for health. Studies show that both blueberries and Labrador tea help our bodies to produce insulin and absorb sugar. And we know that many of the plants in this family contain “anti-oxidants.” These could help prevent some of the long-term problems that go with diabetes.

### **Why “fingerprint” the plants?**

Why would we use chemistry to tell the difference between plants when we could sort them on the basis of their appearance?

First, some of these plants—like the different kinds of cranberry—look and taste very similar. But the “fingerprinting” method can detect even tiny differences, and make sure the wrong plant isn’t used by mistake.

Second, the ingredients in plants can vary a bit from year to year and in plants collected from different locations. The weather, pollution, and the type of soil the plant is growing in all have an effect. A plant that is stressed in some way might actually produce toxic (harmful) ingredients. In future, if the healing plants are to be used in clinics in Iiyiyiu Aschii, we will need to quickly test each batch of plants to be sure they contain the usual good ingredients and don’t contain toxic ones. To do this, we will need an accurate test. The point of this study was to develop such a test.

### **How the “fingerprinting” process worked**

The scientists developed fingerprints for 14 plants in the Heath family. Some of these plants had been mentioned by elders in Mistissini and Whapmagoostui. A few came from other parts of Canada. Past studies of plants in this family have tended to look at how the fruit are used. But this study looked at the leaves, because that is the part the healers tend to use. The scientists came up with a process that had several steps:

First, they used a machine to separate out the different ingredients in each plant. This was actually complex; they tried several different ways to separate the ingredients. Eventually, they came up with one that worked best.

Then they needed to identify each separate ingredient (chemical). Imagine that you have caught a kind of bird you don’t recognize: how would you identify it? You might compare it to the

pictures in a bird book, to see if your bird has the same colours, the same kind of beak, etc as the bird in the picture. The scientists used a similar process: they compared the chemicals they found against those in a library of 131 chemicals. But instead of describing colour and beak shape, the “pictures” in their library describe how different chemicals absorb ultraviolet light. And instead of comparing by eye, the scientists used a computer. If the computer found that a chemical in the plant was 99% similar to one in the library, they concluded it was the same chemical.

They did this kind of comparison for 24 “marker or representative” chemicals in the plants. Many of these “markers or representatives” are ingredients that we already know are found in Heath family plants. We also know that these ingredients are safe to use, but that, taken alone, they don’t have any healing effect. Yet if the plants work, it means that some *combinations* of these ingredients could have an effect. This is why it is interesting to build up a picture of what combinations are in the plant. It turned out that 16 of the 24 “markers” in the plants could be identified from the library.

Sometimes the computer could not find a match between a plant chemical and one in the library. This happened for some ingredients that were only present in tiny amounts. In these cases, the scientists used a second method to identify the chemical. The second method looks at a chemical’s weight. It is a more sensitive method than the ultraviolet-light one.

In the end, the scientists were able to produce “fingerprints” for all 14 plants. These fingerprints show what combinations of the 24 marker chemicals each plant contains. (A table in the original article names the exact chemicals that they found in each plant).

### **What we learned from the study**

This study perfected a “fingerprinting” method that can be used to test future batches of plants. It also showed that, for most ingredients, a computer can do the fingerprinting. And it showed that the method can tell apart even species that are a lot alike. This “fingerprinting” process will interest plant scientists across Canada, who may use it on other plants.

The study also found that plants in the Heath family contain a lot of ingredients that are good for health. In particular, they have a lot of “anti-oxidants” — ingredients that might help prevent the complications of diabetes. Knowing this helps western scientists understand why Aboriginal peoples, including the Iiyiyiu, use so many of these plants for healing. The Anti-diabetic Plant

Project is making it clear to people that traditional medicines work, and that the knowledge that healers have built up through observation and traditional ways is valuable.

**Table 1: How Iiyiyiu healers and other Aboriginal peoples in North America use plants in the Heath family**

English and Latin names of plant	Cree name of plant	Part of plant used	Healers in Iiyiyiu Aschii use this plant to treat these symptoms of diabetes: <sup>†</sup>	Published reports say that healers in other parts of North America use this plant to treat these health problems:
Bog rosemary  ( <i>Andromeda polifolia</i> ssp. <i>Glaucophylla</i> )	Kakupukw	Whole	<ul style="list-style-type: none"> <li>• General weakness (1 W) [Fainting also mentioned]</li> </ul>	<ul style="list-style-type: none"> <li>• Stomach ache (Métis)</li> </ul>
Bearberry  ( <i>Arctostaphylos uva-ursi</i> )		Leaf		<ul style="list-style-type: none"> <li>• Rheumatism (Ojibway)</li> <li>• Blood medicine (Ojibway)</li> <li>• Headache (Ojibway)</li> <li>• All ailments (Ojibway)</li> <li>• Reduce menstrual bleeding, prevent miscarriage, help after childbirth (Cree)</li> <li>• Fight diarrhea (Cree)</li> <li>• Cough (Dene)</li> <li>• Kidney problems (Métis)</li> </ul>
Creeping snowberry  ( <i>Gaultheria hispidula</i> )	Piyemanaan	Fruit	<ul style="list-style-type: none"> <li>• Heart/chest pain (2 M)</li> </ul>	<ul style="list-style-type: none"> <li>• Digestive problems (Algonquin)</li> <li>• Cough (Cree)</li> </ul>
Northern cranberry  ( <i>Vaccinium oxycoccos</i> )		Leaf		<ul style="list-style-type: none"> <li>• Nausea (Ojibway)</li> </ul>

<sup>†</sup> The numbers in brackets ( ) show how many healers mentioned the plant and whether they were from Whapmagoostui (W) or Mistissini (M). Note that some of the plants in this table are in the Heath family, but were not mentioned by healers in Iiyiyiu Aschii.

English and Latin names of plant	Cree name of plant	Part of plant used	Healers in Iiyiyiu Aschii use this plant to treat these symptoms of diabetes: <sup>†</sup>	Published reports say that healers in other parts of North America use this plant to treat these health problems:
Crowberry  (Empetrum nigrum )	Iischiiminh	Whole	<ul style="list-style-type: none"> <li>• Back/kidney pain (1 W)</li> </ul>	<ul style="list-style-type: none"> <li>• Diarrhea (Inuit)</li> <li>• Hypothermia (exposure) (Inuit)</li> <li>• Inflammation (Inuit)</li> <li>• Cold (Gwich'in)</li> <li>• Stomach ache (Gwich'in)</li> </ul>
		Fruit	<ul style="list-style-type: none"> <li>• Increased urination</li> </ul>	<ul style="list-style-type: none"> <li>• Increase urination (Cree)</li> <li>• Kidney problems (Tanana)</li> <li>• Diarrhea (Tanana)</li> <li>• Bring disease to a head (Bella Coola)</li> <li>• Colds (Tanana)</li> <li>• Sore eyes (Tanana)</li> </ul>
Northern Labrador tea  (Rhododendron tomentosum ssp subarticum)	Wiisichipukw	Leaf	<ul style="list-style-type: none"> <li>• Diarrhea (13 W)</li> <li>• Heart/chest pain (12 W)</li> <li>• Abscesses/boils (10 W)</li> <li>• Back/kidney pain (8 W)</li> <li>• Increased thirst (7 W)</li> <li>• Slow-healing infections (7 W)</li> <li>• Foot sores/numbness (7 W)</li> <li>• Sore/swollen limbs (6 W)</li> <li>• Headaches (5 W)</li> <li>• Swelling/inflammation (4 W)</li> <li>• Blurred vision (2 W)</li> <li>• Increased urination (2 W)</li> <li>• General weakness (1 W)</li> <li>• Increased appetite (1 W)</li> <li>• Arthritis/rheumatism (1 W)</li> <li>• Diabetes (1 W)</li> </ul> <p>[Sore throat, cold, cough, lung problems (asthma), stomach ache, knee pain, neck pain, toothache also mentioned].</p>	<ul style="list-style-type: none"> <li>• Cough, sore throat, cold, flu (Inuit)</li> <li>• Respiratory problems (Inuit)</li> <li>• Toothache (Inuit)</li> <li>• Stomach ache (Inuit)</li> </ul>

English and Latin names of plant	Cree name of plant	Part of plant used	Healers in Iiyiyu Aschii use this plant to treat these symptoms of diabetes: <sup>†</sup>	Published reports say that healers in other parts of North America use this plant to treat these health problems:
Wintergreen (Gaultheria procumbens)		Leaf		<ul style="list-style-type: none"> <li>• Colds (Chippewa, Algonquin, Atikamekw, Malecite, Iroquois)</li> <li>• Headaches (Algonquin)</li> <li>• Flu (Atikamekw)</li> <li>• Stomach ache, upset stomach (Atikamekw, Malecite)</li> <li>• Kidney or urinary problems (Malecite, Iroquois)</li> <li>• Rheumatism (Iroquois, Ojibway)</li> <li>• Parasites</li> <li>• Purifying blood</li> </ul>
Sheep laurel (Kalmia angustifolia)	Uischichipukw	Leaf	<ul style="list-style-type: none"> <li>• Inflammation/swelling (2 M, 3 W)</li> <li>• Sore/swollen limbs (6 W)</li> <li>• Back/kidney pain (1 M, 8 W)</li> <li>• Arthritis/rheumatism (3 W)</li> <li>• Diarrhea (2 W)</li> <li>• Headaches (4 W)</li> <li>• Heart/chest pain (8 W)</li> <li>• Numb or sore feet (4 W)</li> <li>• Slow-healing infections (3 W)</li> <li>• Abscess or boils (3 W)</li> <li>• Increased urination (2 W)</li> <li>• Increased thirst (1 W)</li> </ul> [Toothache, stomach ache also mentioned]	<ul style="list-style-type: none"> <li>• Pain and swelling (Mi'qmaq, Malecites)</li> <li>• Colds (Algonquin, Innu, Abenaki)</li> <li>• Back ache (Innu)</li> <li>• Rheumatism (Innu)</li> <li>• Diarrhea (Cree)</li> <li>• Headaches (Mi'qmaq, Atikamekw)</li> <li>• Stomach ache (Innu, Cree)</li> <li>• Tonic (Cree)</li> <li>• Broad range of ailments (Mi'qmaq)</li> </ul>

English and Latin names of plant	Cree name of plant	Part of plant used	Healers in Iiyiyiu Aschii use this plant to treat these symptoms of diabetes: <sup>†</sup>	Published reports say that healers in other parts of North America use this plant to treat these health problems:
Labrador tea  (Rhododendron groenlandicum)	Kaachepukw	Leaf	<ul style="list-style-type: none"> <li>• Heart, chest pain (3 M, 21 W)</li> <li>• Back, kidney pain (5 M, 18 W)</li> <li>• Sore swollen limbs (2 M, 15 W)</li> <li>• Diarrhea (1 M, 15 W)</li> <li>• Headaches (1 M, 13 W)</li> <li>• Slow-healing infections (1 M, 7 W)</li> <li>• Arthritis or rheumatism (1 M, 5 W)</li> <li>• Blurred vision (3 W)</li> <li>• Increased urination (3 W)</li> <li>• Increased appetite (2 W)</li> <li>• Diabetes (1 W)</li> <li>• Abscesses or boils (20 W)</li> <li>• Foot sores (1 M, 12 W)</li> <li>• Inflammation or swelling (2 M, 8 W)</li> <li>• General weakness (2 M, 6 W)</li> <li>• Increased thirst (8 W)</li> </ul> <p>[Other uses mentioned: toothache, vomiting blood, asthma, sore throat, sickness, stomach ache, cough]</p>	<ul style="list-style-type: none"> <li>• Heart or chest pain (Cree)</li> <li>• Back ache, kidney pain, kidney problems (Cree, Malecite)</li> <li>• Sore hands (Cree)</li> <li>• Flu, diarrhea (Cree, Dene)</li> <li>• Headache (Algonquin)</li> <li>• Cuts and wounds, infected wounds (Cree)</li> <li>• Rheumatism, arthritis (Malecite, Cree)</li> <li>• Eye problems (dry or infected eyes) (Cree)</li> <li>• Increase urination, urinary infections (Cree, Mi'qmaq)</li> <li>• Colds, inflamed nose (Abenaki, Algonquin, Mi'qmaq)</li> <li>• Childbirth (Algonquin)</li> <li>• To kill pain (Bella Coola)</li> <li>• Teething pain (Cree)</li> <li>• Stomach ache (Bella Coola)</li> <li>• Burns (Cree, Mi'qmaq)</li> <li>• To cause vomiting (Cree)</li> <li>• Skin problems (Cree, Ojibway); umbilical scab (Cree); wet eczema (Mi'qmaq)</li> <li>• Pneumonia (Cree)</li> <li>• Cough and whooping cough (Cree)</li> <li>• Headaches (Cree)</li> <li>• Chills, fever (Cree, Innu)</li> <li>• Bad breath (Cree)</li> <li>• Tonic, clean out body or stomach, purify blood (Algonquin, Mi'qmaq, Cree, Innu)</li> <li>• Hair loss (Cree)</li> <li>• Diabetes (Cree)</li> <li>• Jaundice (Innu)</li> <li>• Scurvy (Mi'qmaq)</li> <li>• Asthma (Mi'qmaq)</li> <li>• Nervousness, tension (Mi'qmaq)</li> </ul>



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Lowbush and velvetleaf blueberries  ( <i>Vaccinium angustifolium</i> & <i>V. myrtilloides</i> )	Miinshe	Fruit	<ul style="list-style-type: none"> <li>• Increased appetite (2 M)</li> <li>• General weakness (1 M)</li> </ul>	<ul style="list-style-type: none"> <li>• Colic (Algonquin)</li> <li>• Stop urination (Algonquin)</li> <li>• Prevent pregnancy and miscarriage (Cree)</li> <li>• After miscarriage (Algonquin)</li> <li>• Induce labour (Algonquin, Cree)</li> <li>• Bring on menstruation and bleeding after childbirth (Cree)</li> <li>• Purify blood (Ojibway)</li> <li>• Cause sweating (Cree)</li> </ul>
		Whole plant	<ul style="list-style-type: none"> <li>• Back/kidney pain (1 W)</li> </ul>	<ul style="list-style-type: none"> <li>• Fight cancer (Métis)</li> <li>• Prevent pregnancy or miscarriage (Métis)</li> <li>• Bring blood after childbirth (Métis)</li> <li>• Bring on/regulate menstruation (Métis)</li> <li>• Cause sweating (Cree)</li> <li>• Cough (Gwich'in)</li> </ul>
		Root	<ul style="list-style-type: none"> <li>• Diabetes (2 M)</li> </ul>	<ul style="list-style-type: none"> <li>• Diarrhea (Chippewa)</li> <li>• Headaches (Dene)</li> <li>• Induce childbirth, after childbirth (Cree)</li> <li>• Urinary problems (Algonquin)</li> </ul>
Bog cranberry  ( <i>Vaccinium vitis-idaea</i> )	Wiishichimanaan	Fruit	<ul style="list-style-type: none"> <li>• Increased urination (1 M, 1 W)</li> <li>• Blurred vision (10 W)</li> <li>• Abscesses or boils (2 W)</li> </ul> <p>[Toothache, skin problems, snow blindness also mentioned]</p>	<ul style="list-style-type: none"> <li>• Kidney problems (Gwich'in)</li> <li>• Clean out stomach (Cree)</li> <li>• Fever (Dene)</li> <li>• Acne (Métis)</li> <li>• Vomiting (Métis)</li> <li>• Colds (Gwich'in)</li> <li>• Digestion (Gwich'in)</li> <li>• Improve appetite (Gwich'in)</li> </ul>
		Whole plant		<ul style="list-style-type: none"> <li>• Kidney problems (Malecite)</li> <li>• Bladder problems (Inuit, Cree)</li> <li>• Tonic tea (Inuit)</li> <li>• Application after birth (Cree)</li> </ul>