

**Integrative Science / Toqwa'tu'kl Kijitaqnn:**  
*the story of our journey*  
*in bringing together Indigenous and Western*  
*scientific knowledges*



**Cheryl Bartlett, PhD**

Canada Research Chair in Integrative Science  
Professor of Biology, Dept of Biology

Ta'n Wetapeksi'k (Understanding From Where We Come);  
Workshop for the Mi'kmawey Debert Cultural Project,  
Debert, NS, 19-21 October 2005

**Integrative Science / Toqwa'tu'kl Kijitaqnn:**  
*the story of our journey*  
*in bringing together Indigenous and Western*  
*scientific knowledges*



**Spirit**  
**of the East**

**Integrative Science / Toqwa'tu'kl Kijitaqnn:**  
*the story of our journey*  
*in bringing together Indigenous and Western*  
*scientific knowledges*



Presentation Outline

- what, why, how
- structure
- growth

**Integrative Science / Toqwa'tu'kl Kijitaqnn:**  
*the story of our journey*  
*in bringing together Indigenous and Western*  
*scientific knowledges*



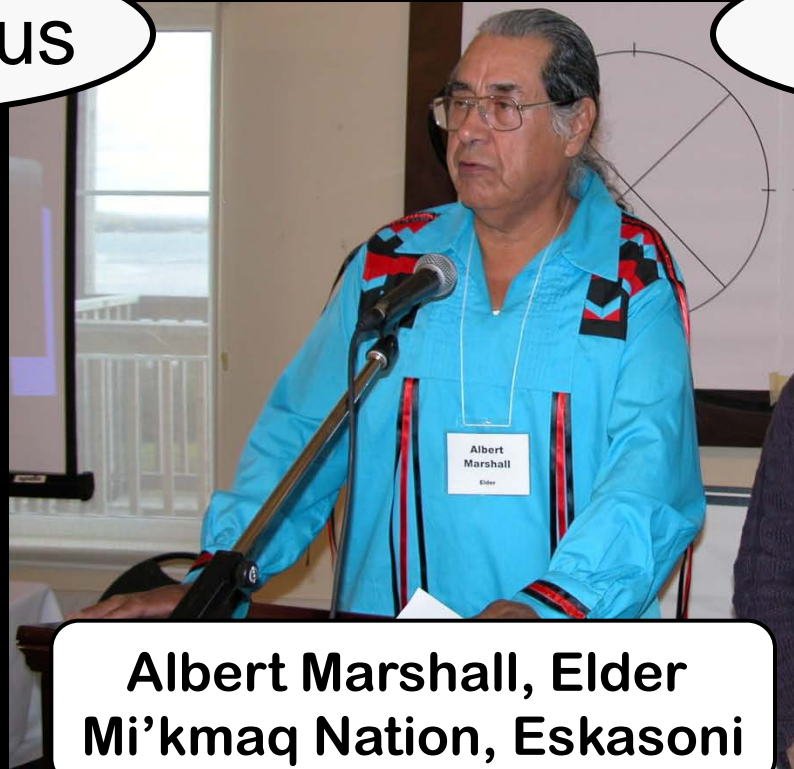
**“science”**  
**= stories about our**  
**interactions with nature**

# “two-eyed seeing”



Indigenous

Western



**Albert Marshall, Elder  
Mi'kmaq Nation, Eskasoni**



**Science: stories about our interactions with nature**

A sunset over a body of water, with the sun low on the horizon and its reflection visible. A large dotted white circle is superimposed over the scene, centered on the sun. Two white ovals with black outlines are positioned horizontally across the middle of the circle. The oval on the left contains the word 'Indigenous' and the oval on the right contains the word 'Western'.

Indigenous

Western



Artist Basma Kavanagh



# Toqwa'tu'kl Kijitaqnn Integrative Science

Indigenous our world views Western  
our knowledges

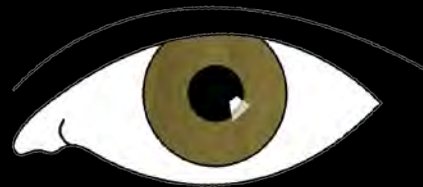
“bringing our stories together”



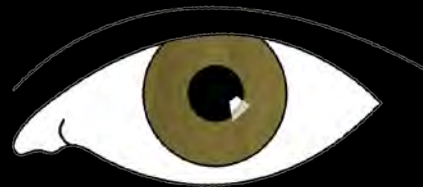
Indigenous

Western

example



example



# Why?



Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

# Why?

universities in  
traditional territory of Mi'kma'ki

... almost  
no Mi'kmaq students in science

---

same picture  
other Aboriginal students  
and universities across Canada

Native Council of Nova Scotia  
Mi'kmaq Language Program  
Artist: Michael J. Martin

# Why?



... and many youth



# Why?

Indigenous



Western



**The central dilemma of science education today is the teaching of science from only one cultural perspective, and in an incomplete and non-connected manner.**

Gregory Cajete, PhD, Univ. of New Mexico

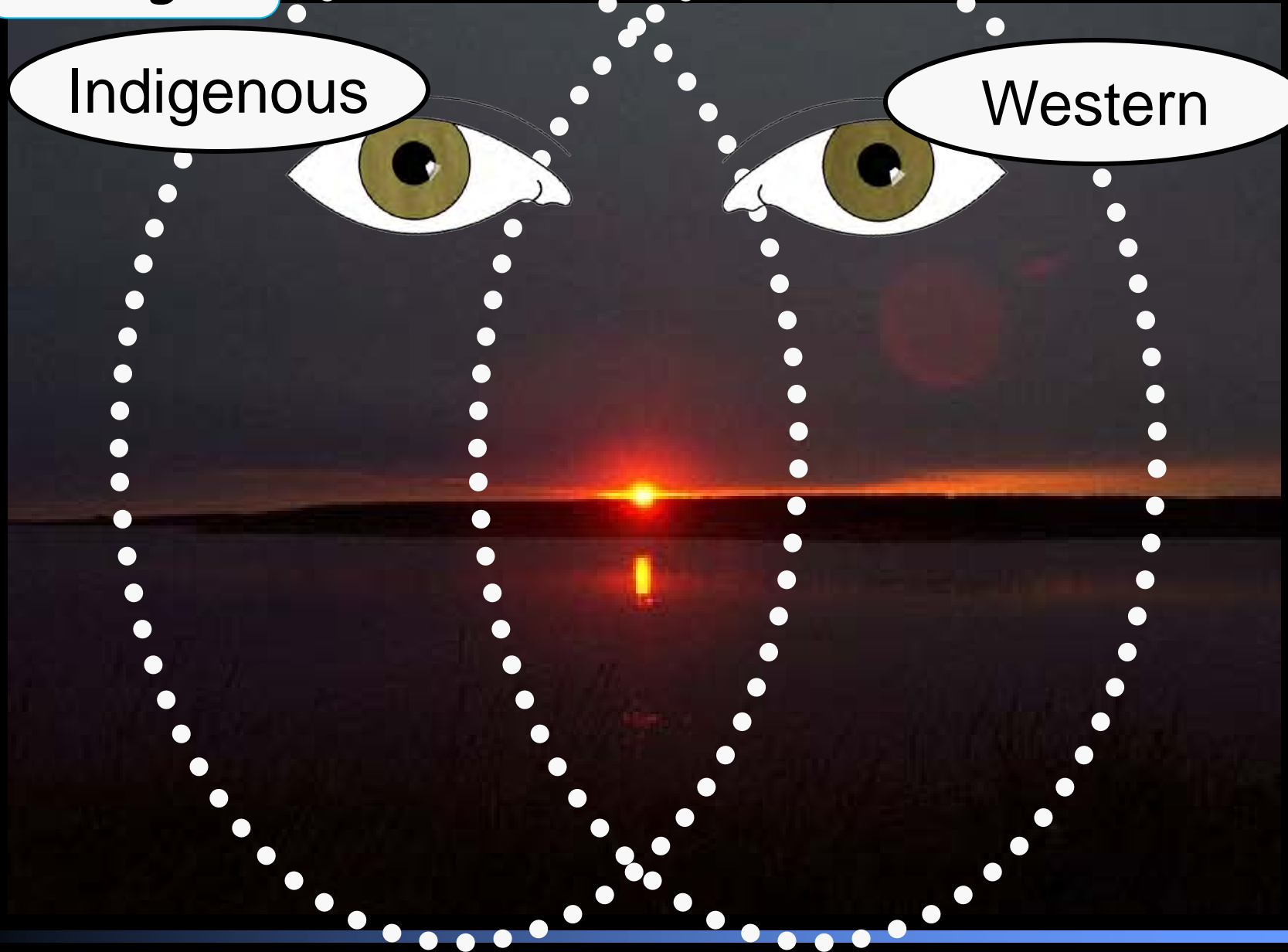


# Why?

Indigenous



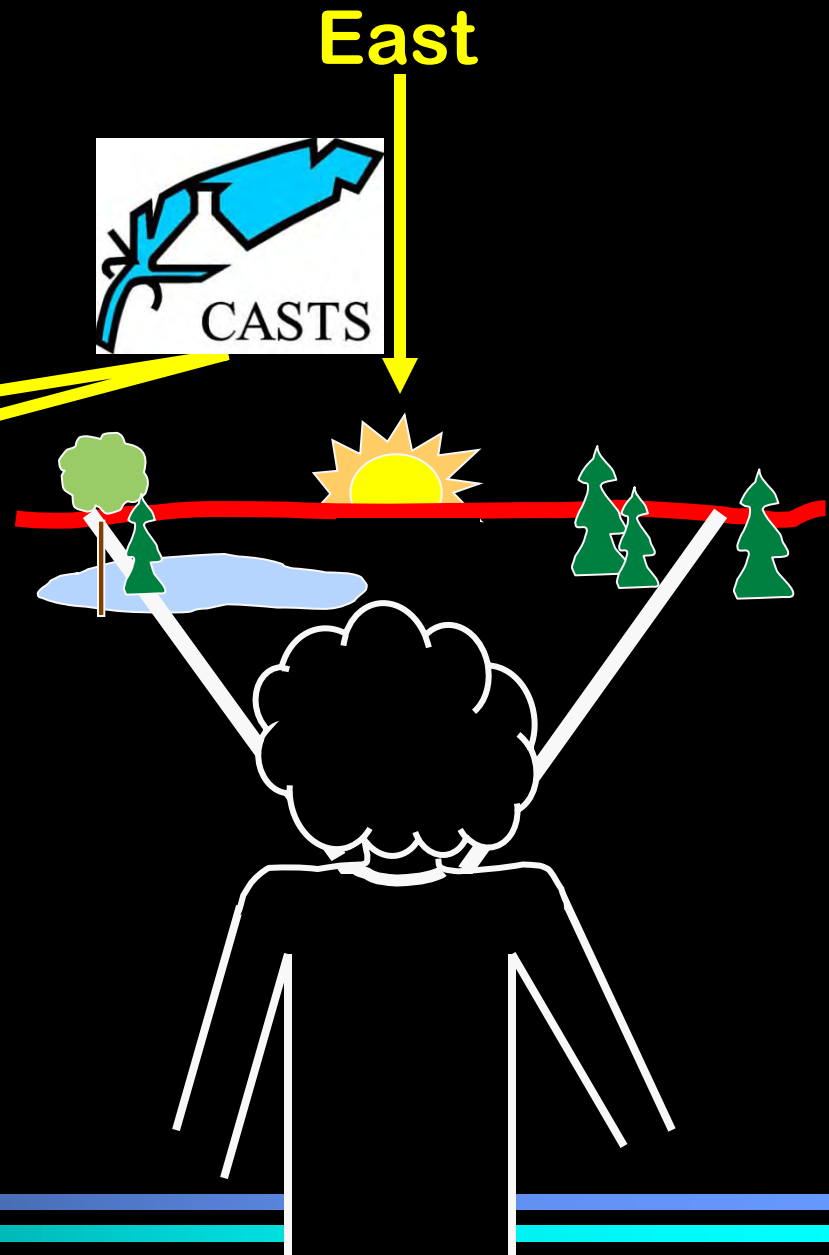
Western



“**Due East**” is where the sun rises on two special days each year:

- **Fall Equinox**  
(22 Sept 2005)
- **Spring Equinox.**

On these two days there are equal periods of light and dark.

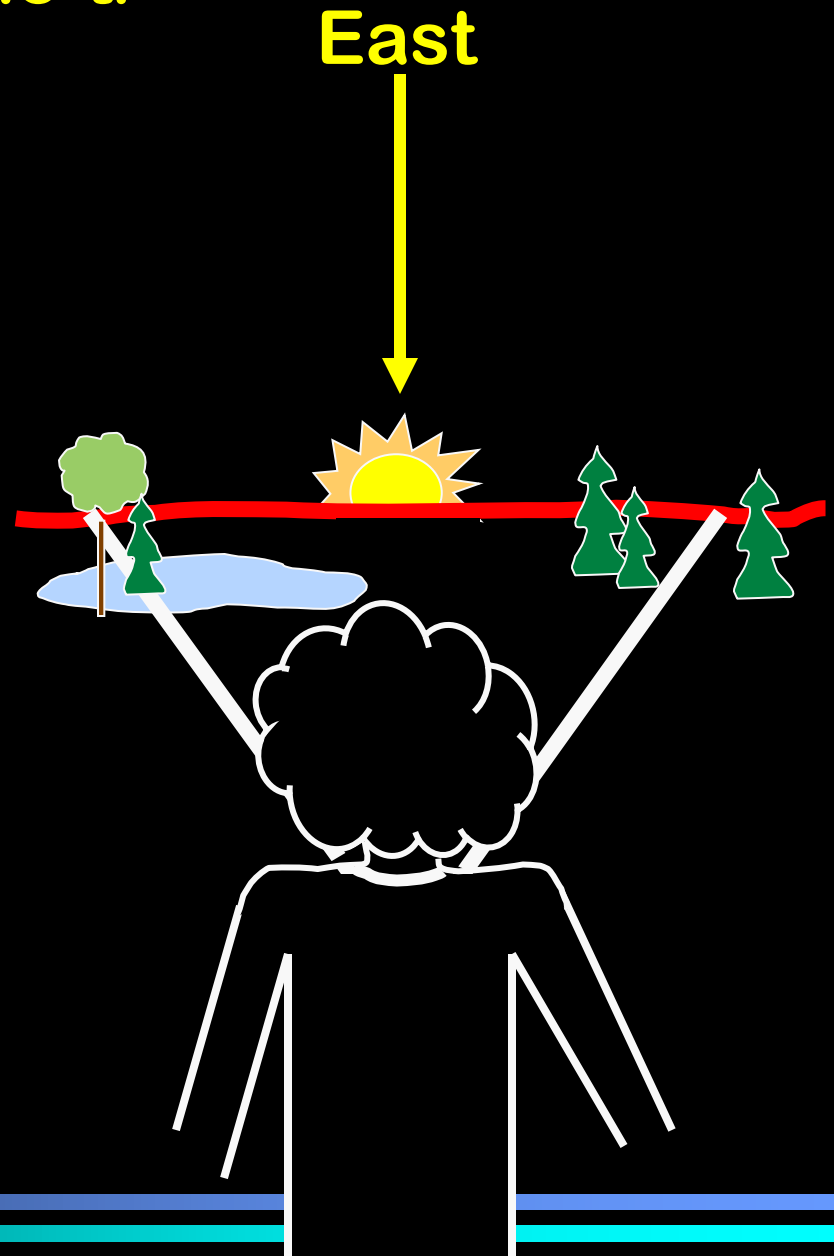


# Wjipenuk Etek Lnuimlkikno'ti

## Spirit of the East



Artist Basma Kavanagh



# Wjipenuk Etek Lnuimlkikno'ti

## Spirit of the East



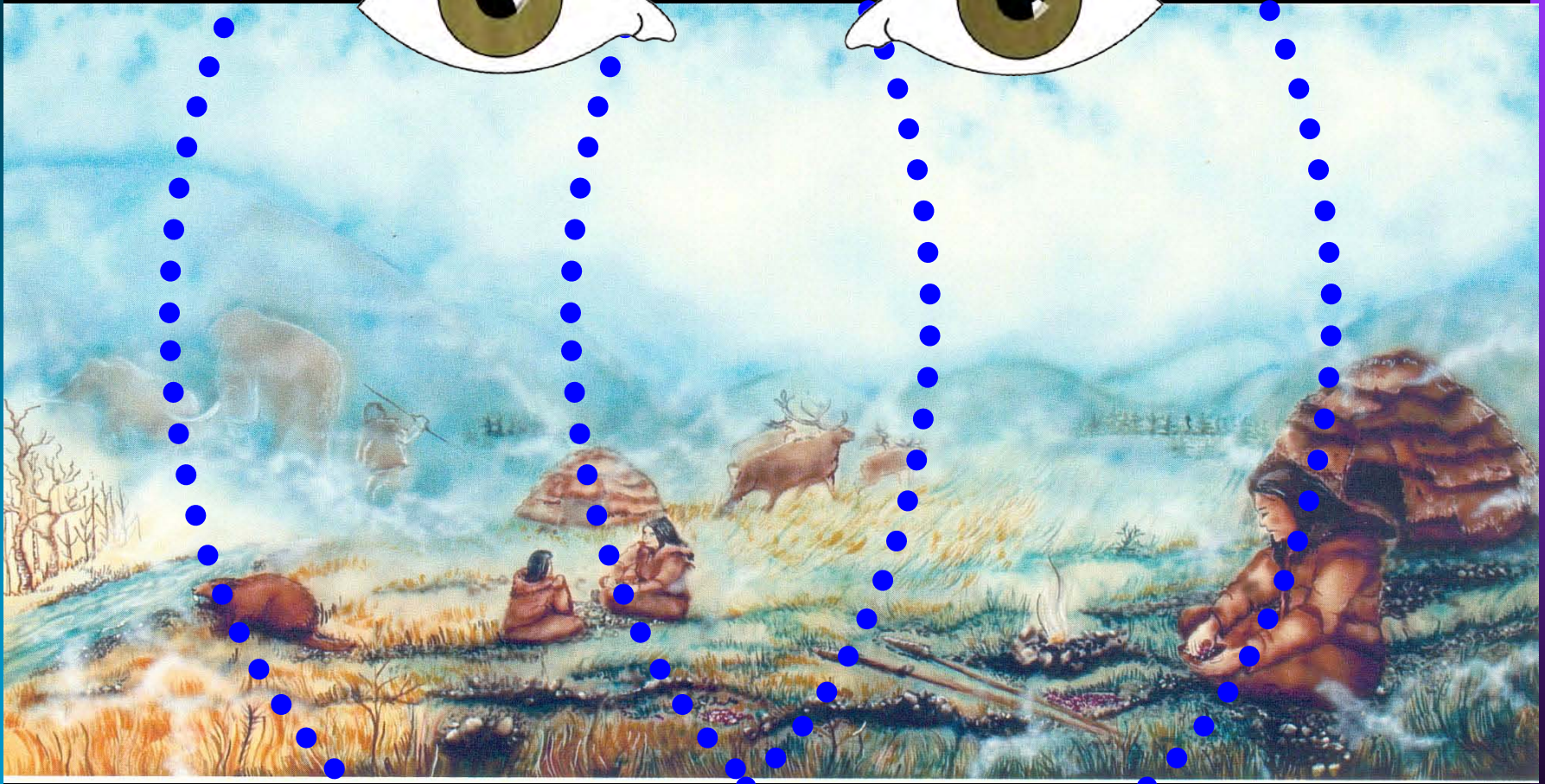
The East is, through its association with the sunrise, a place of beginnings and enlightenment, and a place where new knowledge can be created or received to bring about harmony or right relations.



Mi'kmawey Debert

Indigenous

Western



Artist Dozay Christmas



Mi'kmawey Debert

**As a scientist, I want my imagination rekindled. I want to be shown how to look at things in new ways; I believe my capacity for innovation and creativity in my own discipline will grow as a result.**

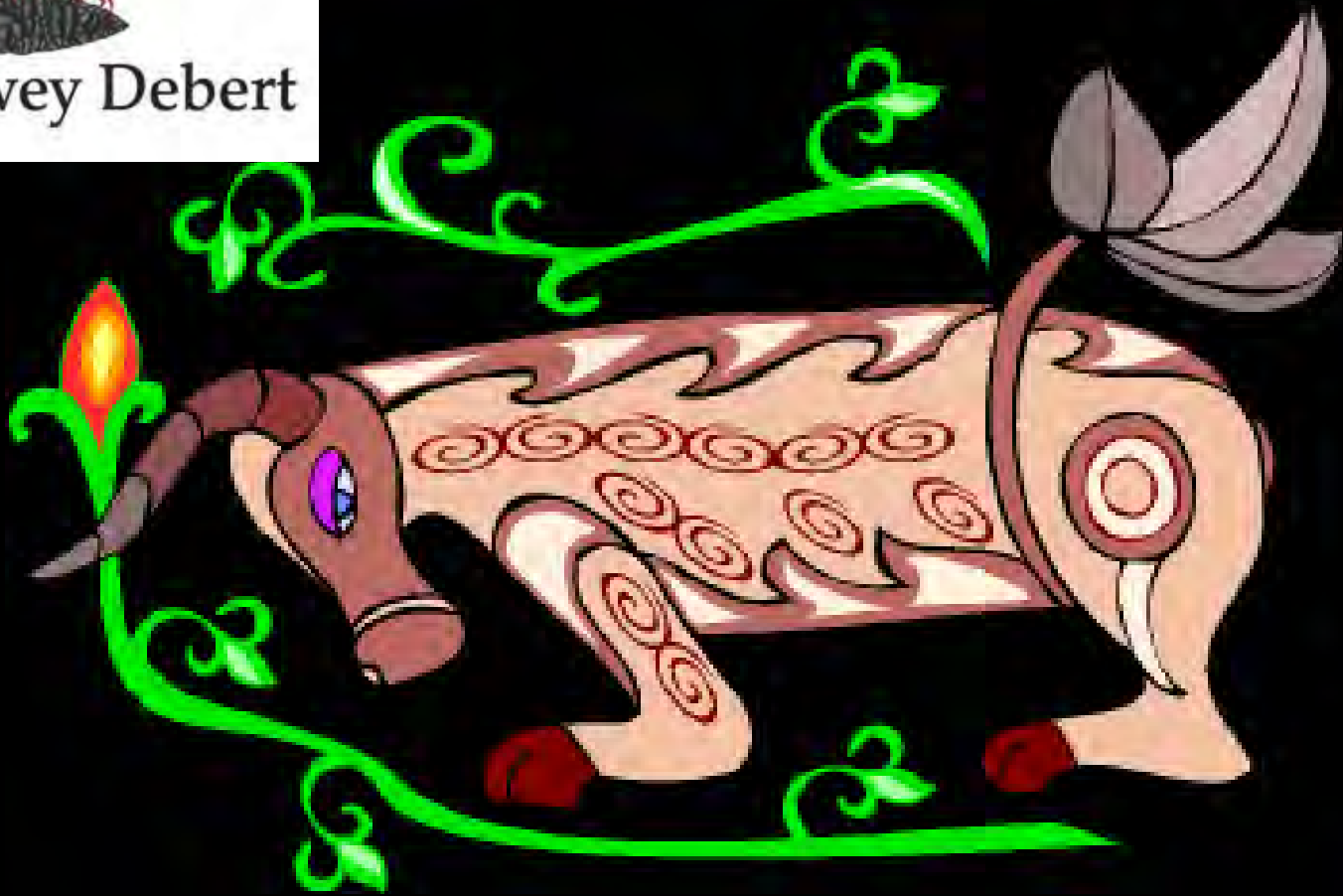
*(Arthur J. Carty, National Science Advisor to PM)*

**(2000 Conference on Creativity in the Arts and Sciences)**

**We (scientists) can learn transformational consciousness towards thinking in new ways.**



Mi'kmawey Debert



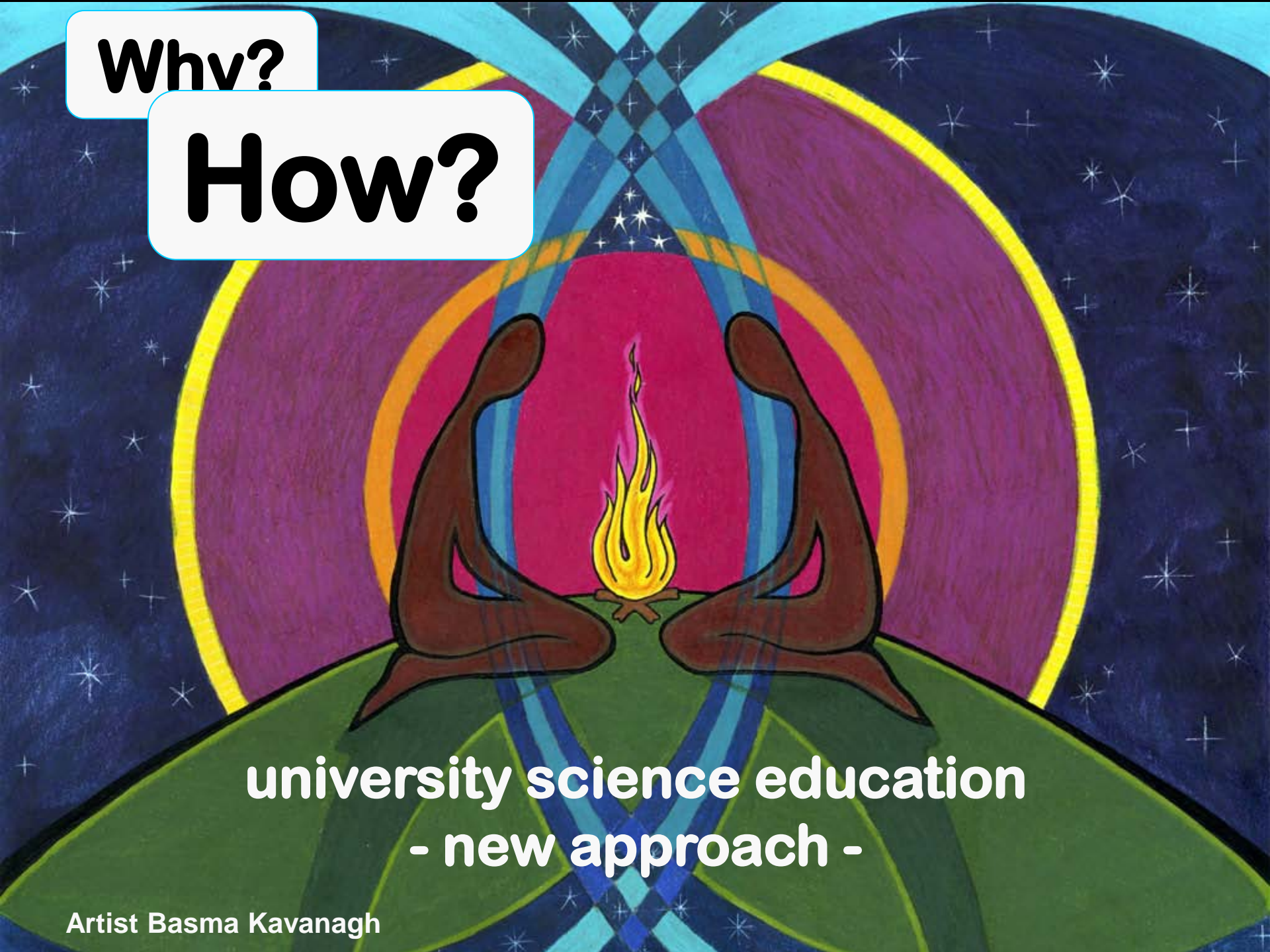
**We (scientists) can learn  
transformational consciousness  
towards thinking in new ways.**

**Why?**

**How?**

**university science education  
- new approach -**

Artist Basma Kavanagh





# 4 yr Science Degree Program

## Bachelor of Science Community Studies

Degree Profile for:  
**Toqwa'tu'kl Kjjitaqnn /  
Integrative Science**

*Bringing Knowledges Together*  
... from Western scientific and Aboriginal world views



### Degree Core (48 credits)

- 1) \_\_\_\_\_ PCS 100: Analysis and Decision Making (6 credits)
- 2) \_\_\_\_\_ PCS 200: Applied Research (6 credits)
- 3) \_\_\_\_\_ PCS 300: Community Intervention (6 credits)
- 4) \_\_\_\_\_ science and technology perspectives (6 credits): Phil 222, or equivalent
- 5) \_\_\_\_\_ world views and values (3 credits): Phil 251, Phil 253, or equivalent
- 6) \_\_\_\_\_ Aboriginal perspectives (3 credits): Mikm at 100 or 200 level, or 361, or equivalent
- 7) \_\_\_\_\_ business perspectives (3 credits): Buss 111, Buss 231, or equivalent
- 8) \_\_\_\_\_ public communication (3 credits): Comm 103, Comm 105, or equivalent
- 9) \_\_\_\_\_ effective writing (6 credits): Engl 100, Engl 205 + Engl 207, or equivalent
- 10) \_\_\_\_\_ computer literacy (3 credits): Phil 115, Comp 102 or 111, Buss 181, or equivalent
- 11) \_\_\_\_\_ statistics (3 credits): Math 135, Math 335, Buss 182, Psych 201, or equivalent

### Science Area of Concentration (42 credits)

#### a) University (8 courses)

- 1) 3 credits: MSIT 101
- 2) 3 credits: MSIT 103
- 3) 3 credits: MSIT 201
- 4) 3 credits: MSIT 203
- 5) 3 credits: MSIT 301
- 6) 3 credits: MSIT 303
- 7) 3 credits: MSIT 401
- 8) 3 credits: MSIT 401

#### b) Technology (6 courses)

- 1 + 2) 6 credits: Chem 121 + 122
- 3 + 4) 6 credits: Math 131 + 132, or  
Phys 100, or Phys 111 + 112
- 5 + 6) 6 credits (at least 3 credits must be at 300 level):
  - Geol 111
  - any PubH at 200 level or higher
  - any Envi at 200 level or higher

### Student's Electives (30 credits)

- |                     |                      |
|---------------------|----------------------|
| 1) 3 credits: _____ | 6) 3 credits: _____  |
| 2) 3 credits: _____ | 7) 3 credits: _____  |
| 3) 3 credits: _____ | 8) 3 credits: _____  |
| 4) 3 credits: _____ | 9) 3 credits: _____  |
| 5) 3 credits: _____ | 10) 3 credits: _____ |

### Work Placements (paid or voluntary, each at least 120 hours)

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_

**An overall average of 60% (in courses over your four years) is required for graduation.**



**MSIT  
science  
courses**

# 4 yr Science Degree Program

## Bachelor of Science Community Studies

Degree Profile for:  
**Toqwa'tu'kl Kijjitaqnn /  
Integrative Science**



1) core

### Degree Core (48 credits)

- 1) \_\_\_\_\_ PCS 100: Analysis and Decision Making (6 credits)
- 2) \_\_\_\_\_ PCS 200: Applied Research (6 credits)
- 3) \_\_\_\_\_ PCS 300: Community Intervention (6 credits)
- 4) \_\_\_\_\_ science and technology perspectives (6 credits): Phil 222, or equivalent
- 5) \_\_\_\_\_ world views and values (3 credits): Phil 251, Phil 253, or equivalent
- 6) \_\_\_\_\_ Aboriginal perspectives (3 credits): Mikm at 100 or 200 level, or 361, or equivalent

2) concentration

### Science Area Concentration (42 credits)

- a) University (8 courses)
- 1) 3 credits: MSIT 101
  - 2) 3 credits: MSIT 103
  - 3) 3 credits: MSIT 201
  - 4) 2 credits: MSIT 202
- b) Technology (6 courses)
- 1 + 2) 6 credits: Chem 121 + 122
  - 3 + 4) 6 credits: Math 131 + 132, or Phys 100, or Phys 111 + 112
  - 5) 6 credits (at least 3 credits must be at 300 level):
    - Geol 111
    - any PubH at 200 level or higher
    - any PubH at 200 level or higher

3) electives

### Student's Electives (30 credits)

- 1) 3 credits: \_\_\_\_\_
- 6) 3 credits: \_\_\_\_\_

4) work placements

### Work Placements (paid or voluntary, each at least 120 hours)

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_

An overall average of 60% (in courses over your four years) is required for graduation.

**MSIT  
science  
courses**

# 4 yr Science Degree Program

## Bachelor of Science Community Studies

Degree Profile for:  
**Toqwa'tu'kl Kjjitaqnn /  
Integrative Science**

*Bringing Knowledges Together*  
... from Western scientific and Aboriginal world views



### Degree Core (48 credits)

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- 6) \_\_\_\_\_ Aboriginal perspectives (3 credits): Mikm at 100 or 200 level, or 361, or equivalent  
or equivalent  
05, or equivalent  
207, or equivalent  
11, Buss 181, or equivalent  
1001, or equivalent

## 2) concentration

### Science Area of Concentration (42 credits)

- a) **University** (8 courses)
  - 1) 3 credits: MSIT 101
  - 2) 3 credits: MSIT 103
  - 3) 3 credits: MSIT 201
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  - 5 + 6) 6 credits (at least 3 credits must be at 300 level):
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### Student Electives (30 credits)

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- 1) \_\_\_\_\_
- 2) \_\_\_\_\_

**An overall average of 60% (in courses  
over your four years) is required for  
graduation.**



**MSIT  
science  
courses**

# How?

education  
-----  
lived • book-based

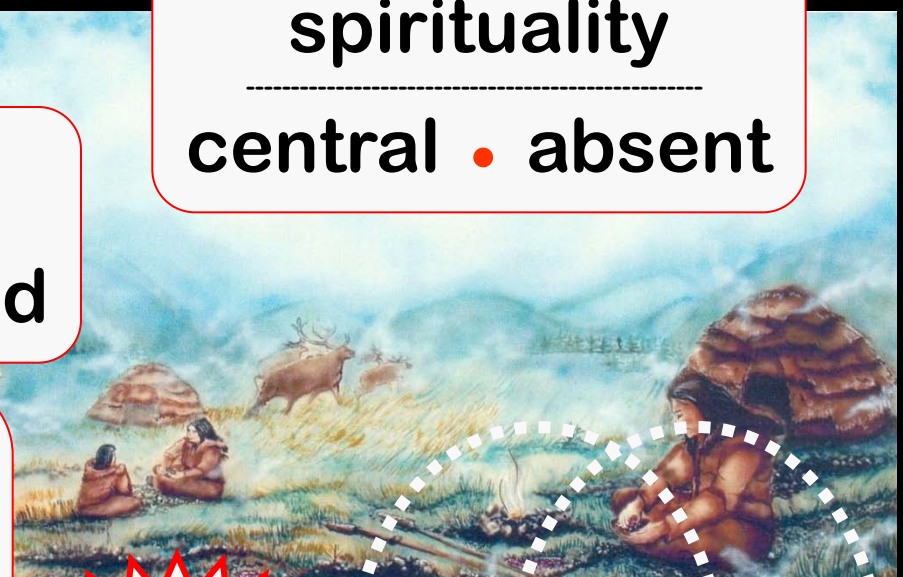
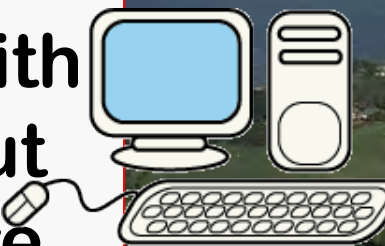
emphasis  
-----  
change  
wholeness • parts  
balance

today's students  
very familiar with  
computers, but  
not with nature

spirituality  
-----  
central • absent

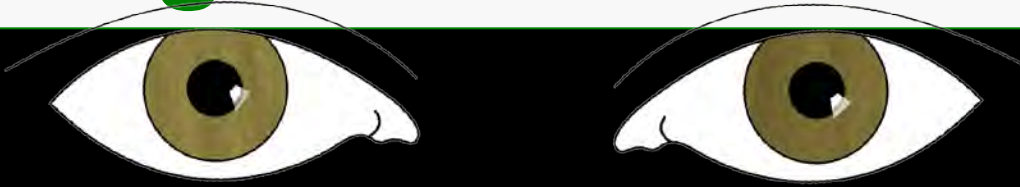
1<sup>st</sup>  
(unique)

challenges!



# How?

## integrative framework



"integrative" ... both, plus

- role of me and you in "the knowing"
- our common ground
- our differences
- our journey forward, together

---

**NOT** ... simply Western, plus  
bits and pieces of Indigenous

# How?

1



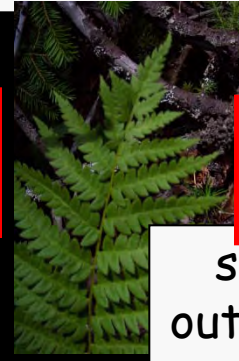
Mi'kmaq community Elders,  
resource people & organizations,  
TK events in community

2



TK literature

3



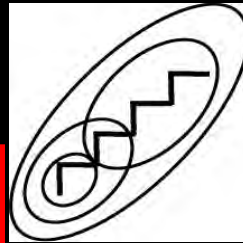
students  
out-of-doors

4

Aboriginal concepts  
& pedagogy

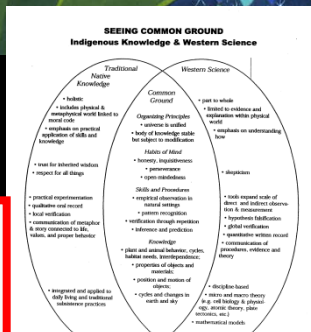


5



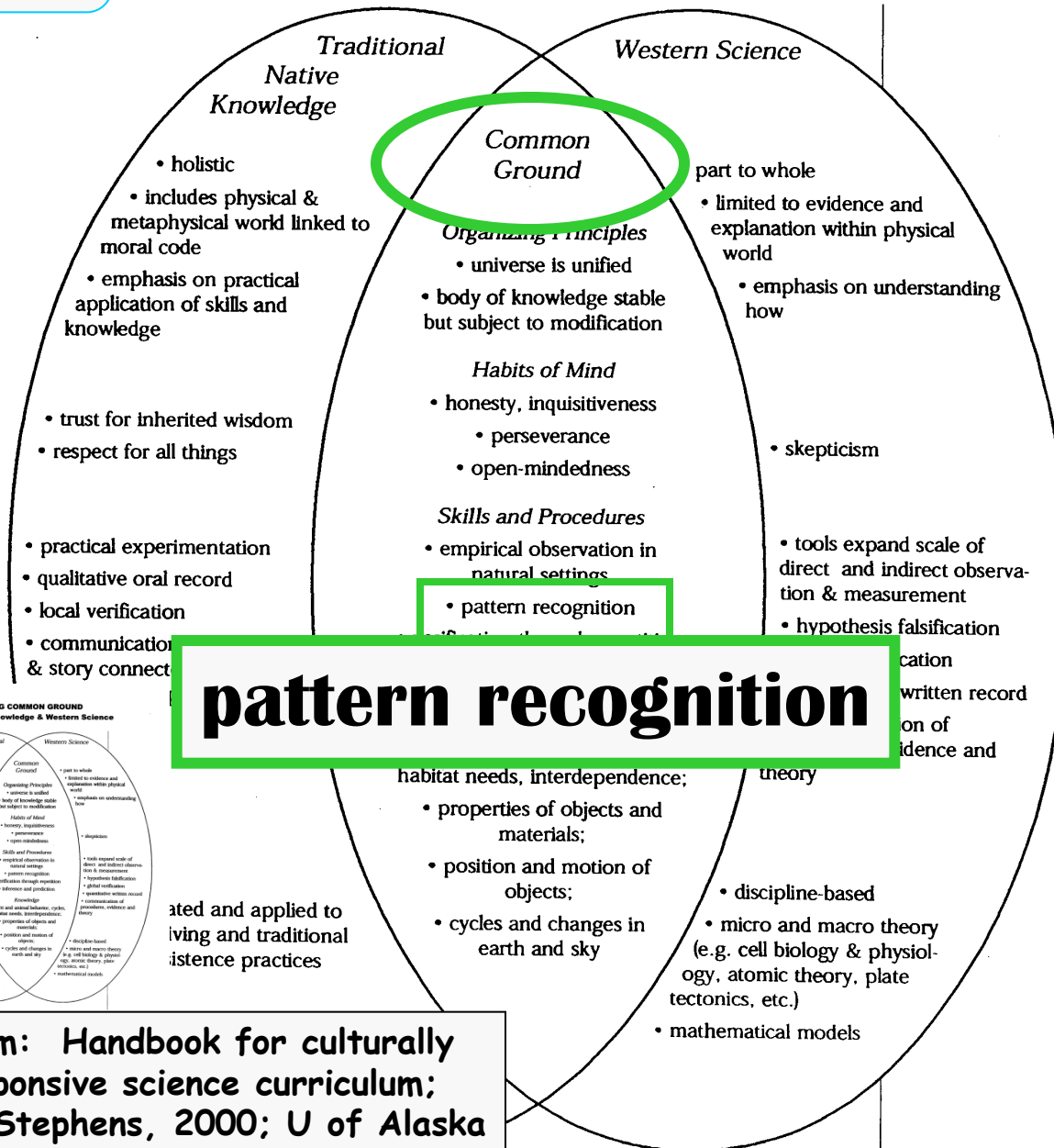
Western science: cosmology-physics-  
chemistry-geology-biology-consciousness

6

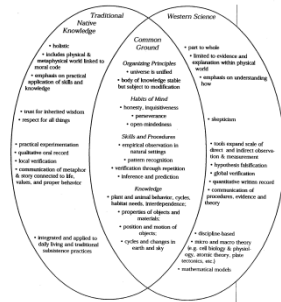


# How?

## SEEING COMMON GROUND Indigenous Knowledge & Western Science



SEEING COMMON GROUND  
Indigenous Knowledge & Western Science



6

from: Handbook for culturally responsive science curriculum;  
S. Stephens, 2000; U of Alaska

**How?**

**PATTERNS**

Indigenous

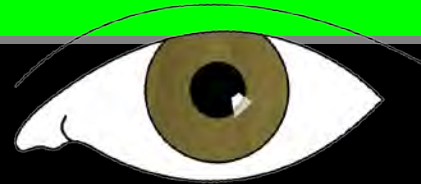
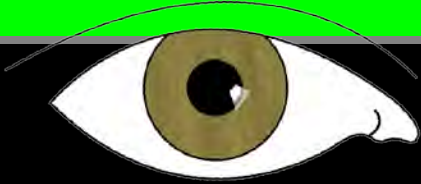
Western



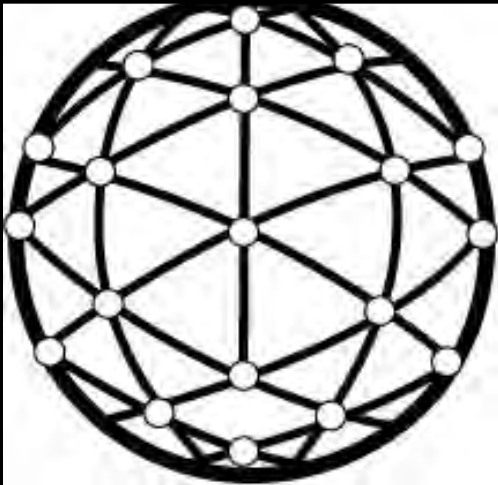
**BIG PATTERN UNDERSTANDING**



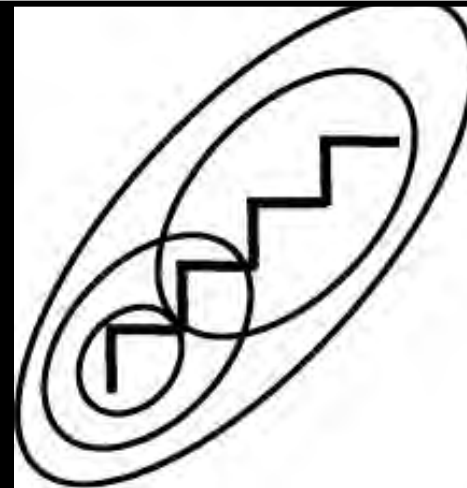
**“two-eyed seeing”**  
how our world is



**interconnected**



**parts & wholes**

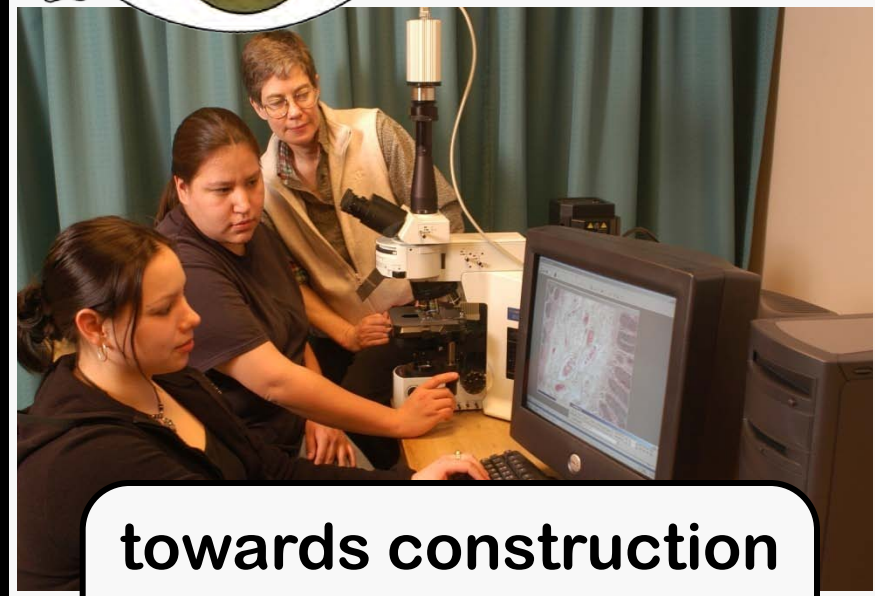


**BIG PATTERN UNDERSTANDING**

# “two-eyed seeing” our overall knowledge objectives



towards resonance  
of understanding  
within environment



towards construction  
of understanding  
of environment

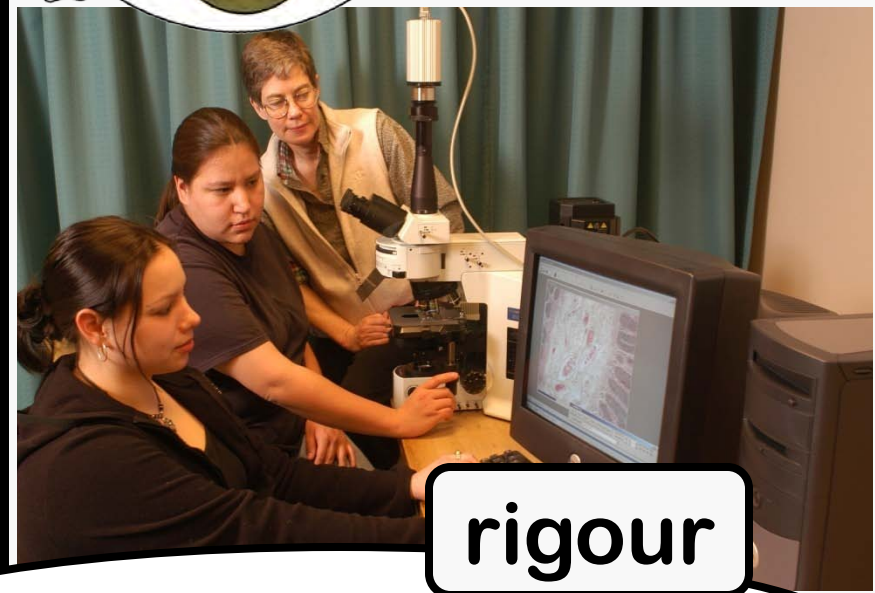
## BIG PATTERN UNDERSTANDING

“two-eyed seeing”  
our language & methodology



vigour

**WEAVING**



rigour

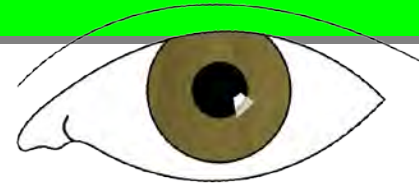
**UN-WEAVING**

**BIG PATTERN UNDERSTANDING**

# “two-eyed seeing” our key concepts & actions



- respect
- relationship
- reverence
- reciprocity
- ritual
- repetition
- responsibility



- hypothesis  
(making & testing)
- data collection
- data analysis
- model & theory  
construction

**BIG PATTERN UNDERSTANDING**

# How?

**creativity**  
**& patterns**

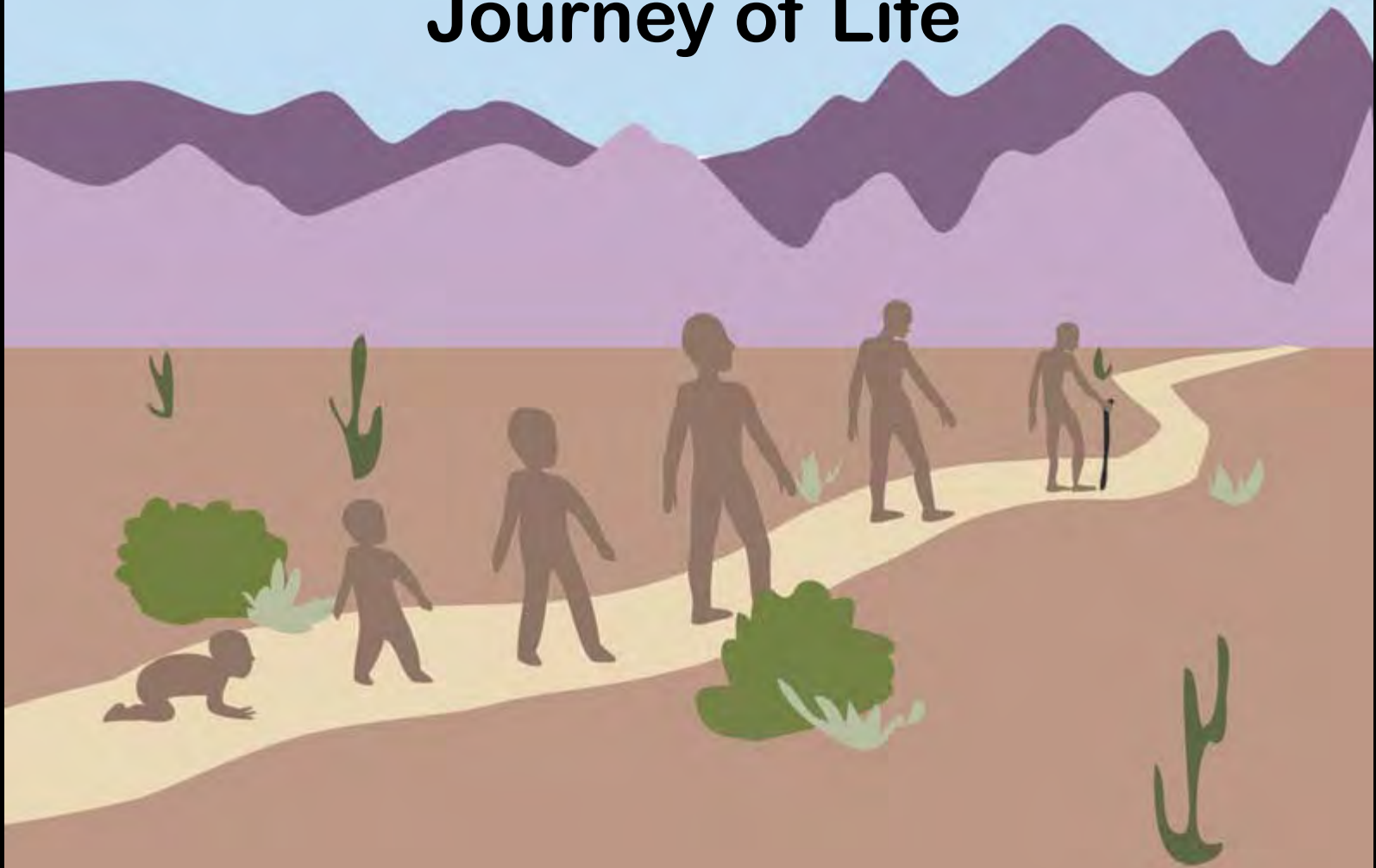
- numbers
- language

- music
- body
- art
- other people
- self
- naturalist

- spiritual

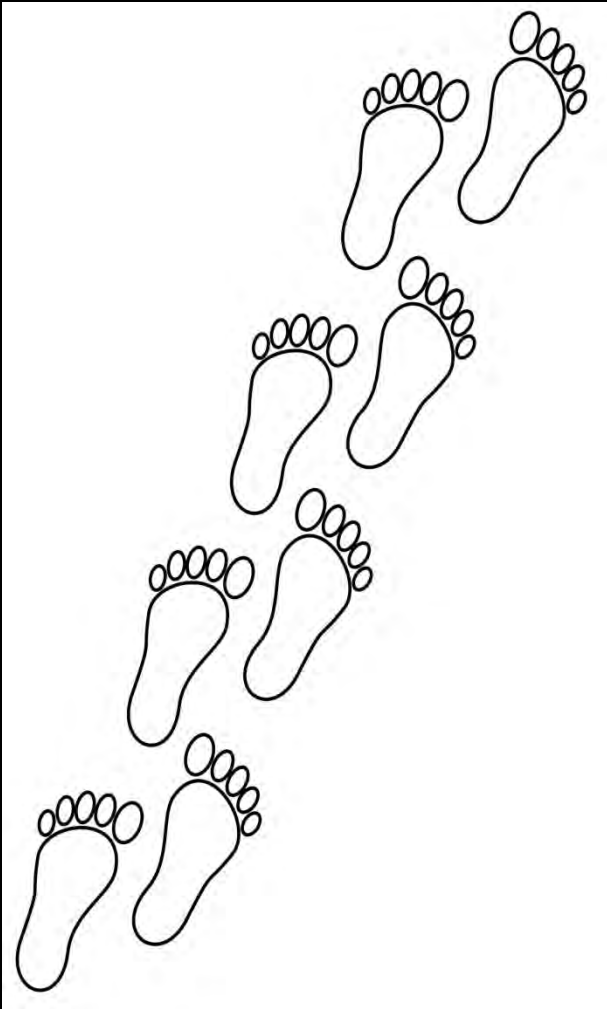


# Journey of Life



university degree

# 4 yr Science Degree Program



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**Integrative Science**

*Bringing Knowledges Together*  
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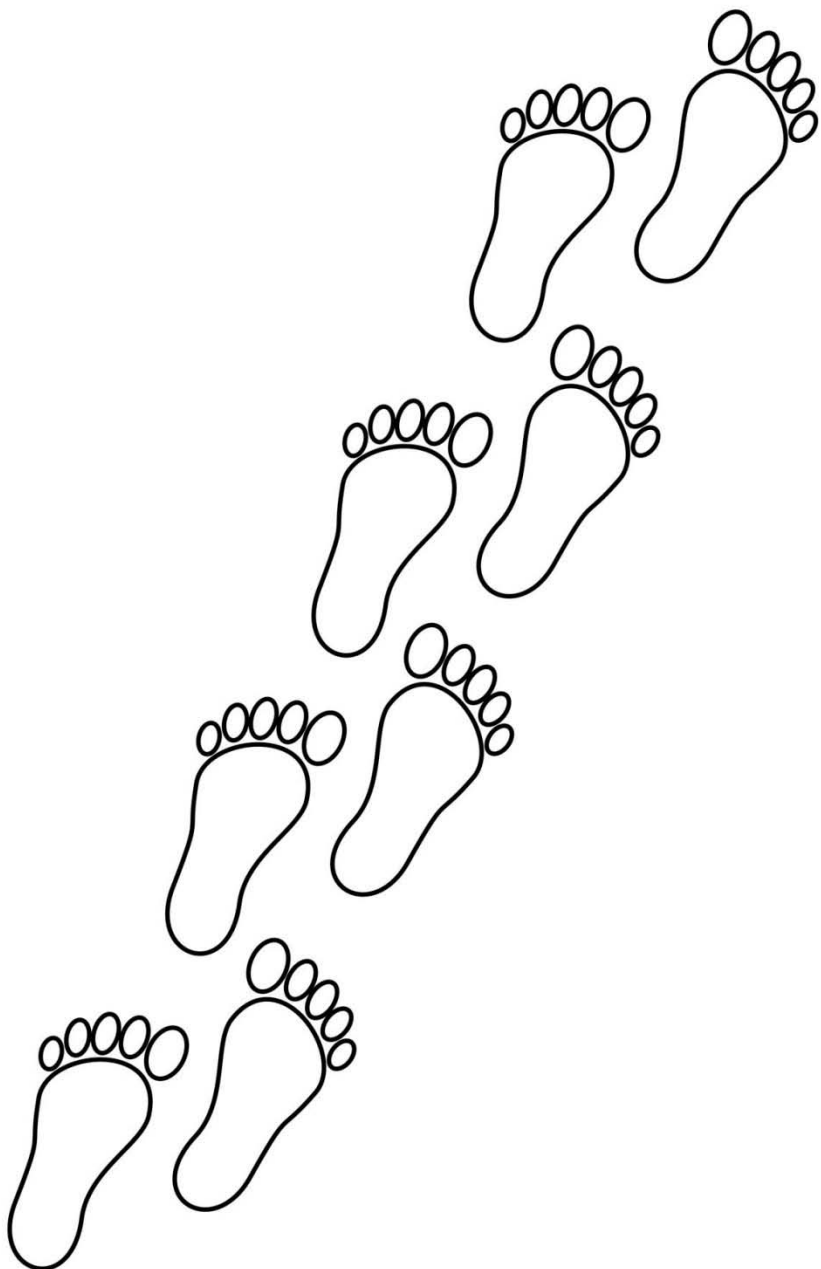
- |                     |                      |
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### Work Placements (paid or voluntary, each at least 120 hours)

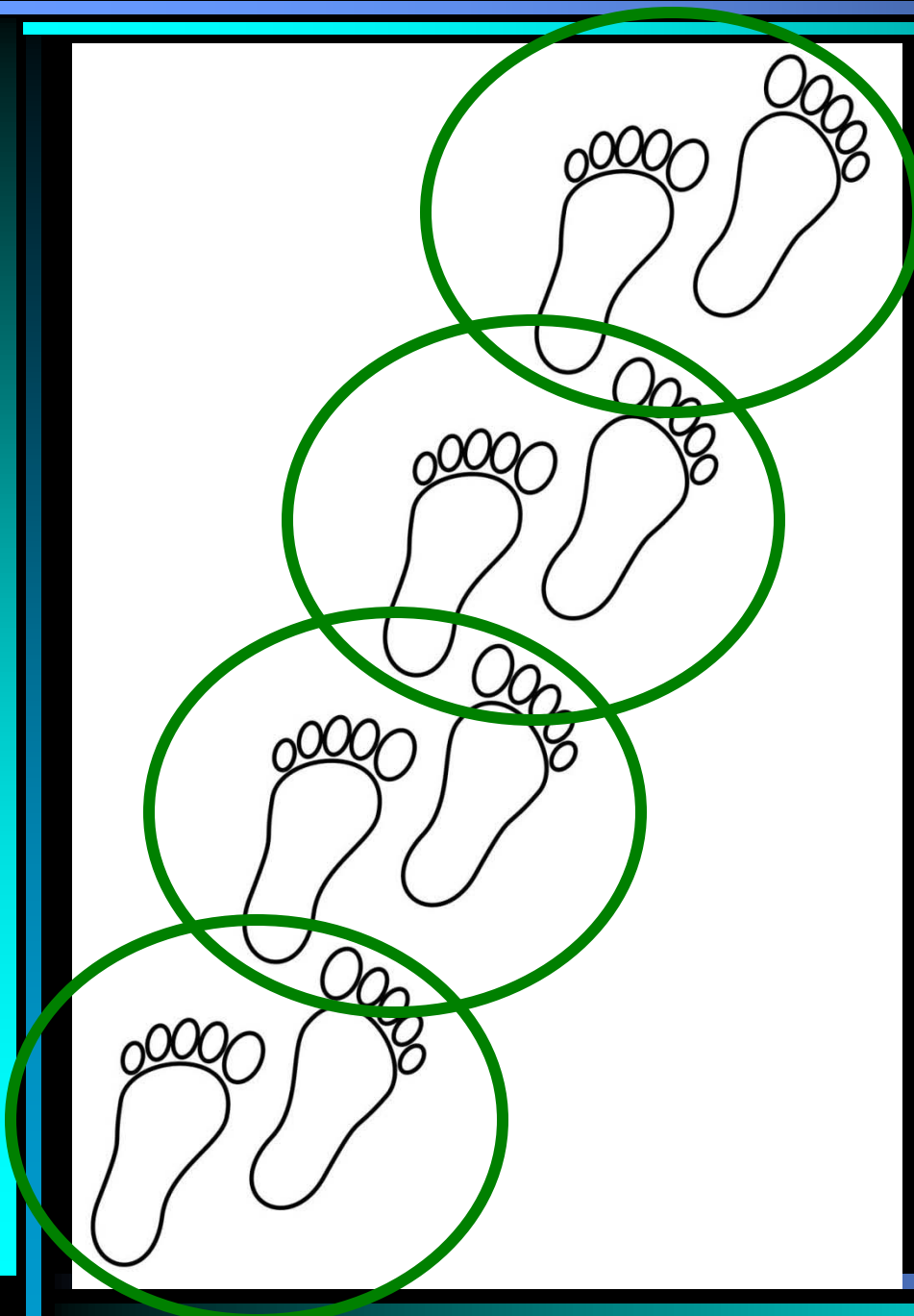
- 1) \_\_\_\_\_
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**An overall average of 60% (in courses over your four years) is required for graduation.**









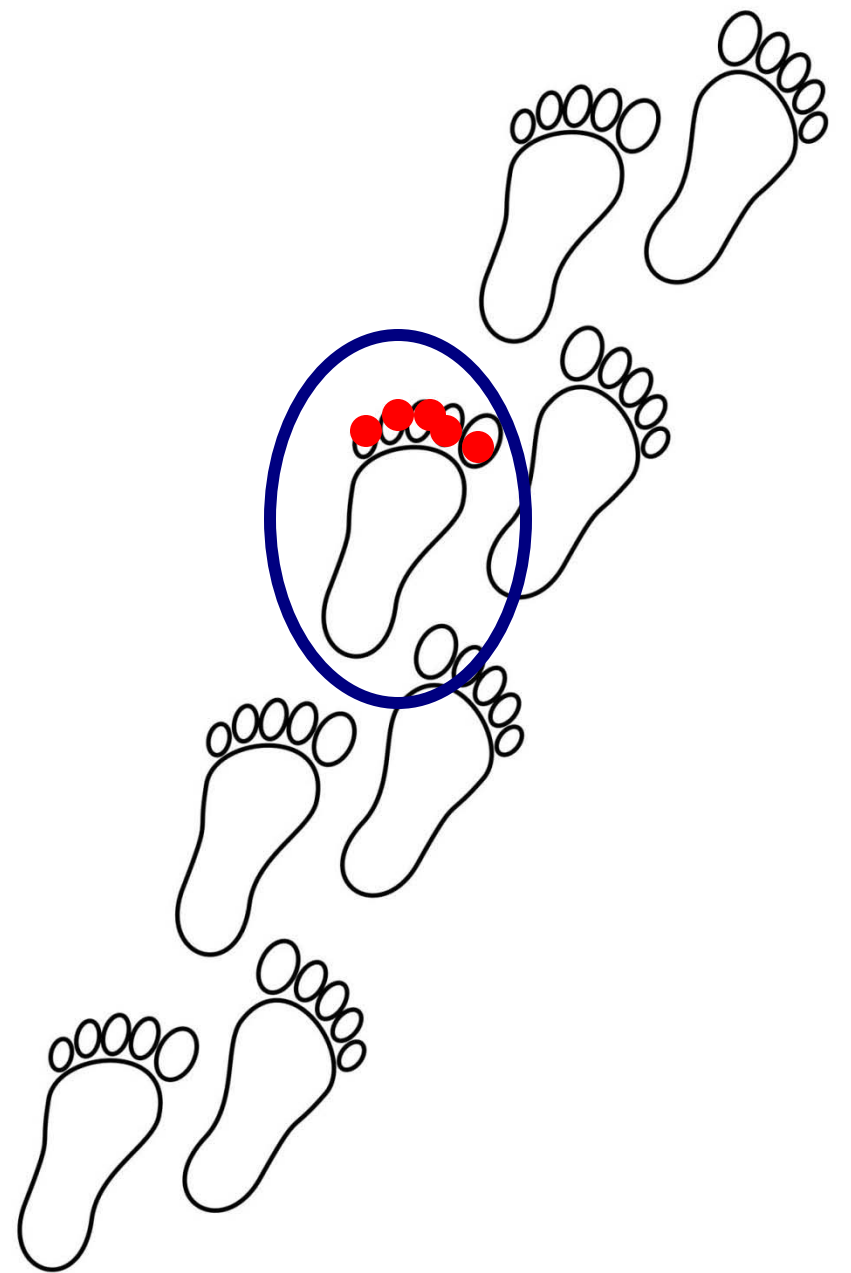
- 4
- 3
- 2
- 1

4 Years



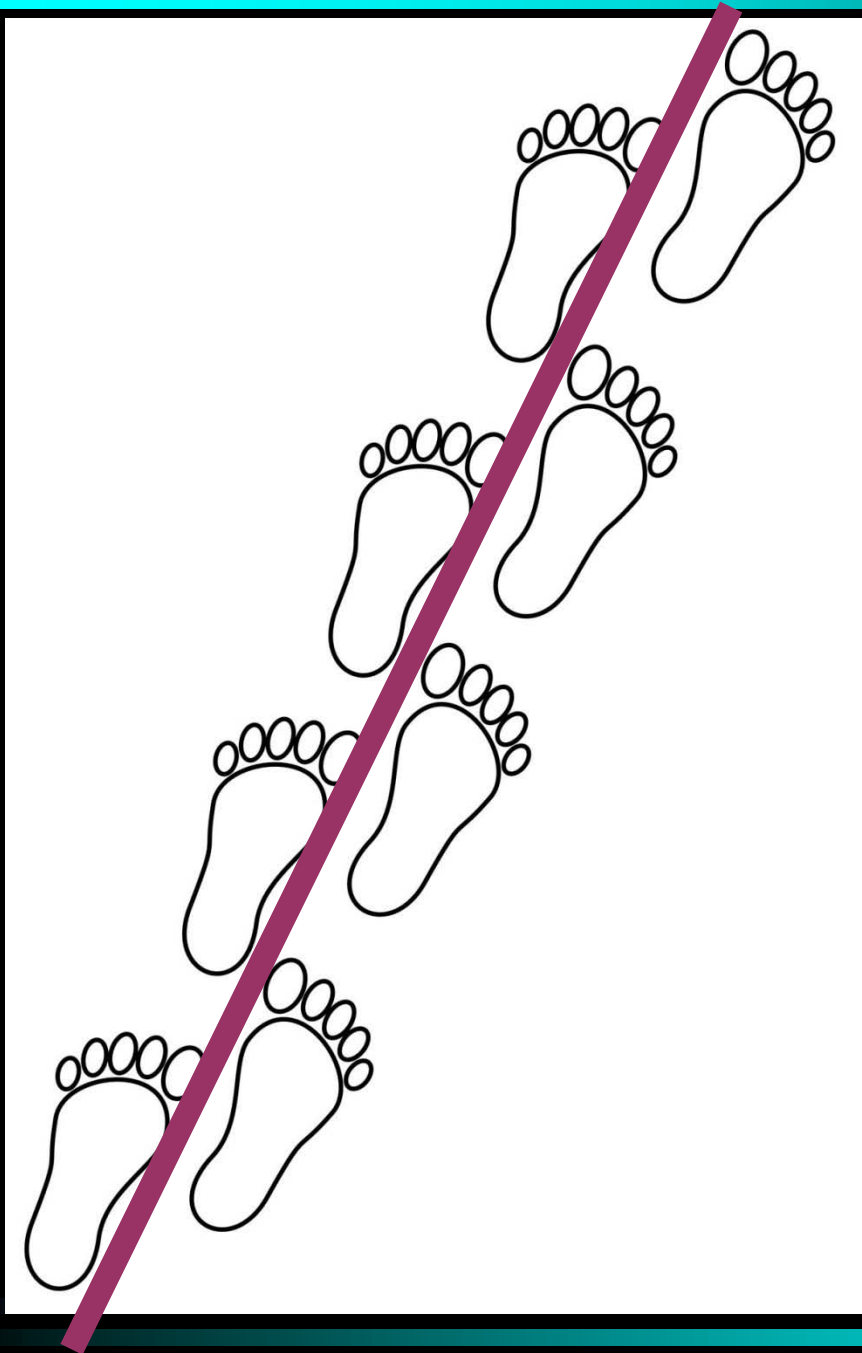
- 4
- 3
- 2
- 1

**Fall terms**  
**Winter terms**



- 4
- 3
- 2
- 1

**Each term  
= 5 courses**



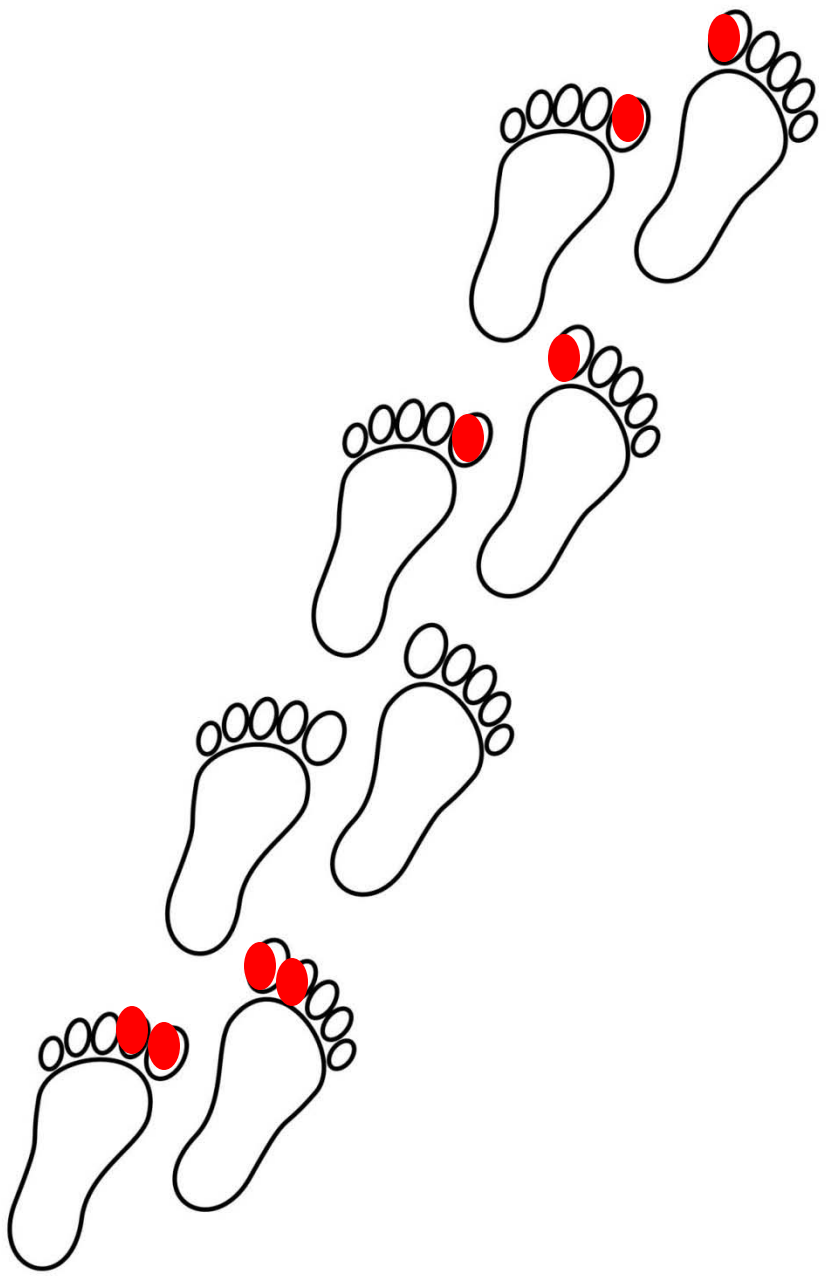
4

**Christmas  
break**

3

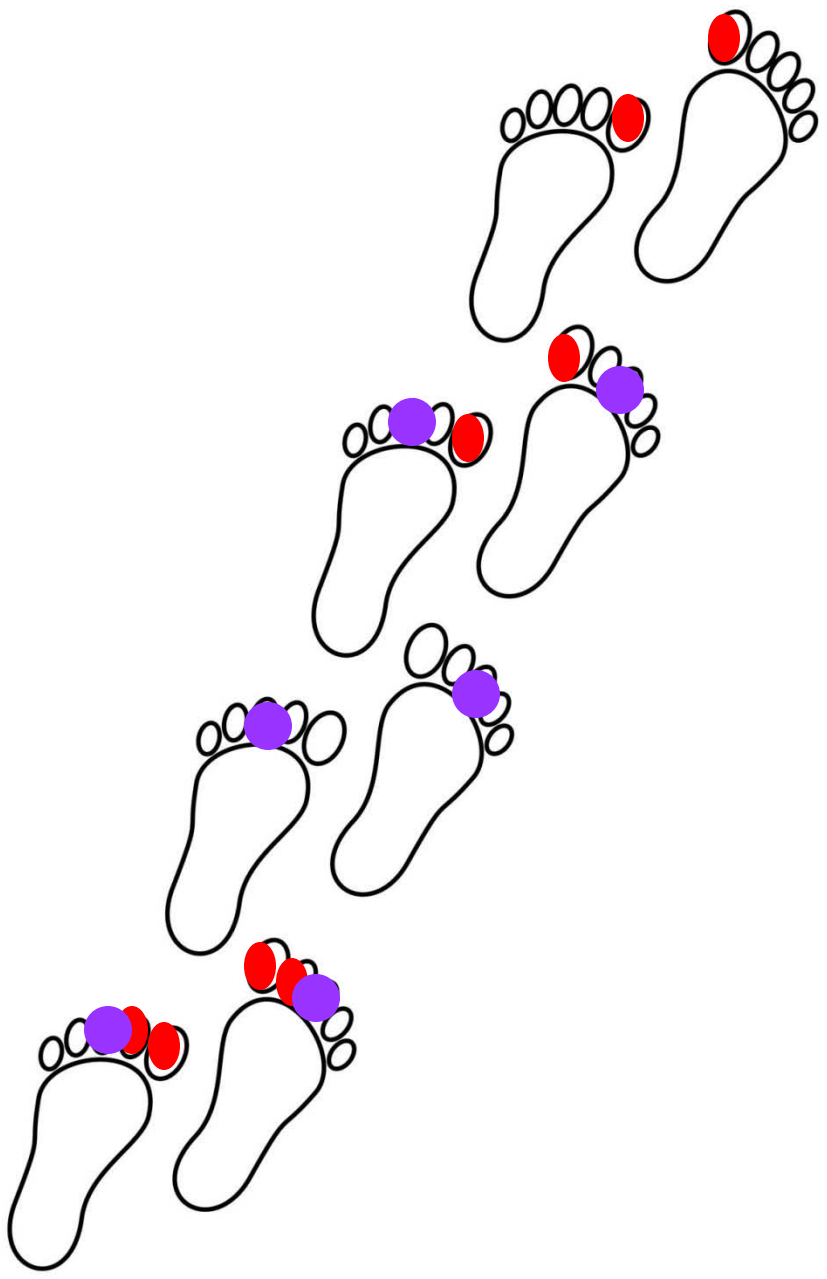
2

1



- 4
- 3
- 2
- 1

**MSTT  
science  
courses**



4  
3  
2  
1

**MSTT  
science  
courses**

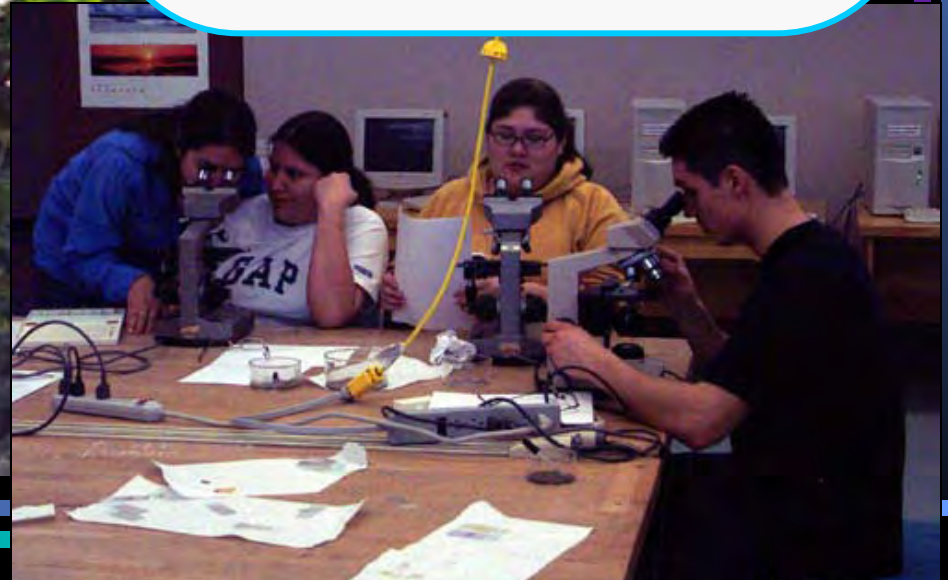
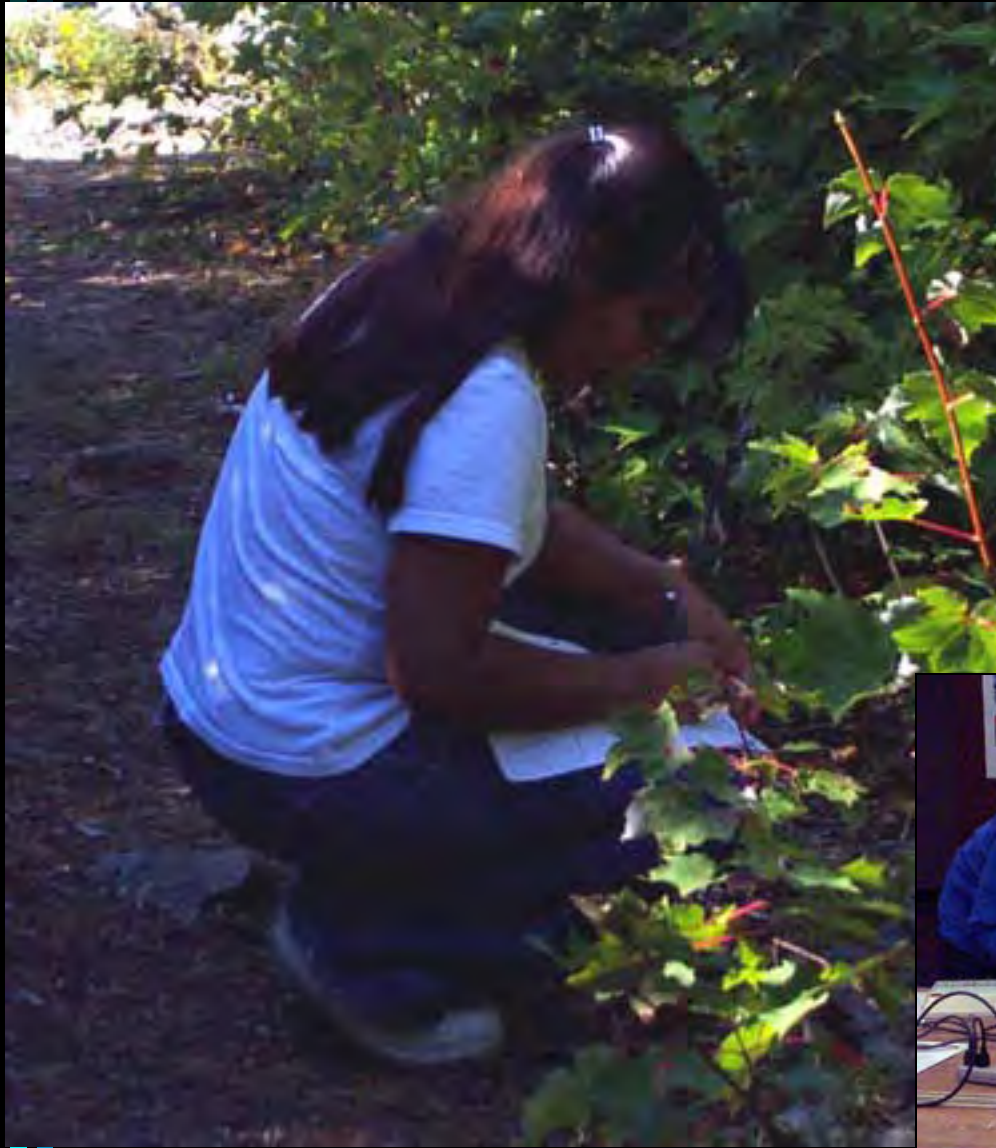
**PCS  
courses**

# Growth

CAPE BRETON  
UNIVERSITY

1999-2005

-----  
≈ 100 Mi'kmaq  
students in  
1<sup>st</sup> year science



# Growth



## CAPE BRETON UNIVERSITY

**2004-2005:**

**Mi'kmaq science  
students (approx.)**

- 1<sup>st</sup> yr: 10
- 2<sup>nd</sup> yr: 12
- 3<sup>rd</sup> yr: 6
- 4<sup>th</sup> yr: 6

---

• **grads: 6**  
(total)



# Growth



Indigenous

Western

“bringing our stories together”

# Growth

## research projects

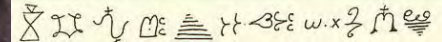


**MI'KMAQ  
ELDERS**

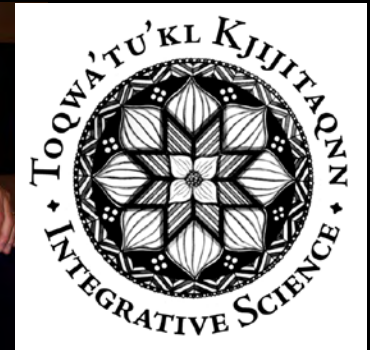


**KECCA**

Knowledge: Education and Cultural Consultant Associates



**CAPE BRETON  
UNIVERSITY**



**“bringing our stories together”**

# Growth

## research projects



“bringing our stories together”

# Growth

## youth outreach

# Toqikutimk

Together we  
are growing



“bringing our stories together”

# Growth

## youth outreach

# Toqikutimk

Together we  
are growing



“bringing our stories together”

# Growth

## youth outreach



TOQWA'TU'KL KJIJITAQNN  
Integrative Science

### Nipuktuk Wejiaql A'tukuaqnn

FROM THE FOREST COMES OUR STORY

**Apl'kmuj**  
*Lepus americanus*  
SNOWSHOE HARE

**Kaqajulman**  
*Clintonia borealis*  
BLUE BEAD LILY

**Pukusp**  
DECAYING WOOD

**Kawatk**  
*Picea sp.*  
SPRUCE CONE

**Stoqn**  
*Abies balsamea*  
DWARF FIR

**Wso'qmanasit**  
*Cornus canadensis*  
DOUGLABERRY

**Qqnn**  
TWIGS

**Kuow**  
*Pinus strobus*  
PINE NEEDLES

A small multi-cultural group of young artists worked at the University College of Cape Breton during the summer of 2018 to create puppets for the M'ikmaq Nation. The puppets were made from natural materials found in the forest of the M'ikmaq Nation. The puppets are part of a larger project to create a puppet show for the M'ikmaq Nation. The puppets are made from natural materials found in the forest of the M'ikmaq Nation. The puppets are made from natural materials found in the forest of the M'ikmaq Nation.

For 30 days (August-September 2018) - Member Number: 982-179-2208  
For additional information contact: Integrative Science Program, University College of Cape Breton, P.O. Box 1700, Sydney, Nova Scotia, B1P 6L2. E-mail: our website: www.ubc.ca

TOQWA'TU'KL KJIJITAQNN  
Integrative Science

### Nipuktuk Wejiaql A'tukuaqnn

FROM THE FOREST COMES OUR STORY

**T'itikli**  
*Bubo virginianus*  
GREAT HORNED OWL

**Jikoqs**  
*Fomes fomentarius*  
BRACKET FUNGUS

**Kuow**  
*Pinus strobus*  
PINE NEEDLES

**Maskwi**  
*Betula papyrifera*  
BIRCH BARK

**qasaw**  
*Pinus strobus*  
PINE CONE

“bringing our stories together”

had a very special role to play in the life of the M'ikmaq Nation. Jikoqs, Keeper of the Sacred Flame, was used to ensure that embers of the fire remained alive when the

# Growth

youth outreach

## Toqikutimk

Together we  
are growing



Royal Canadian  
Mounted Police

Gendarmerie royale  
du Canada



IWK Health Centre  
Foundation



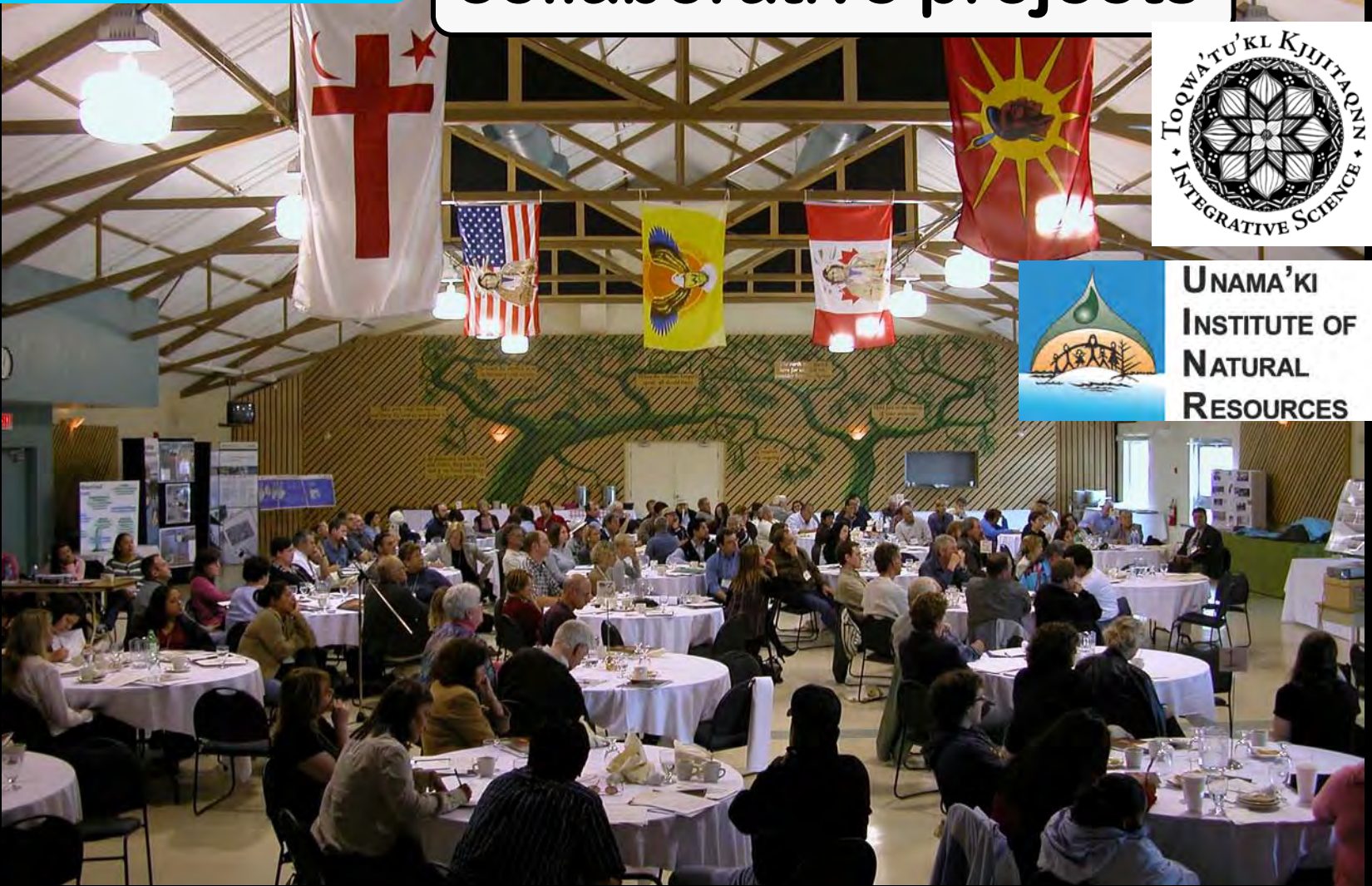
children learn  
about growth  
and TLC and  
community via  
... a “sunflower  
project”



“bringing our stories together”

# Growth

## collaborative projects



UNAMA'KI  
INSTITUTE OF  
NATURAL  
RESOURCES

“bringing our stories together”

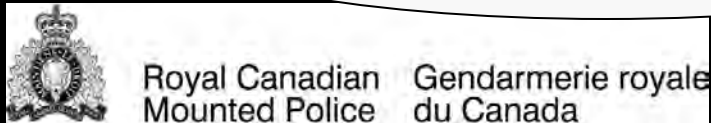


# Growth

collaborative projects

About You:  
Eskasoni Youth

Nemi'simk



Dr. Nancy Comeau  
(& Doreen Stevens)



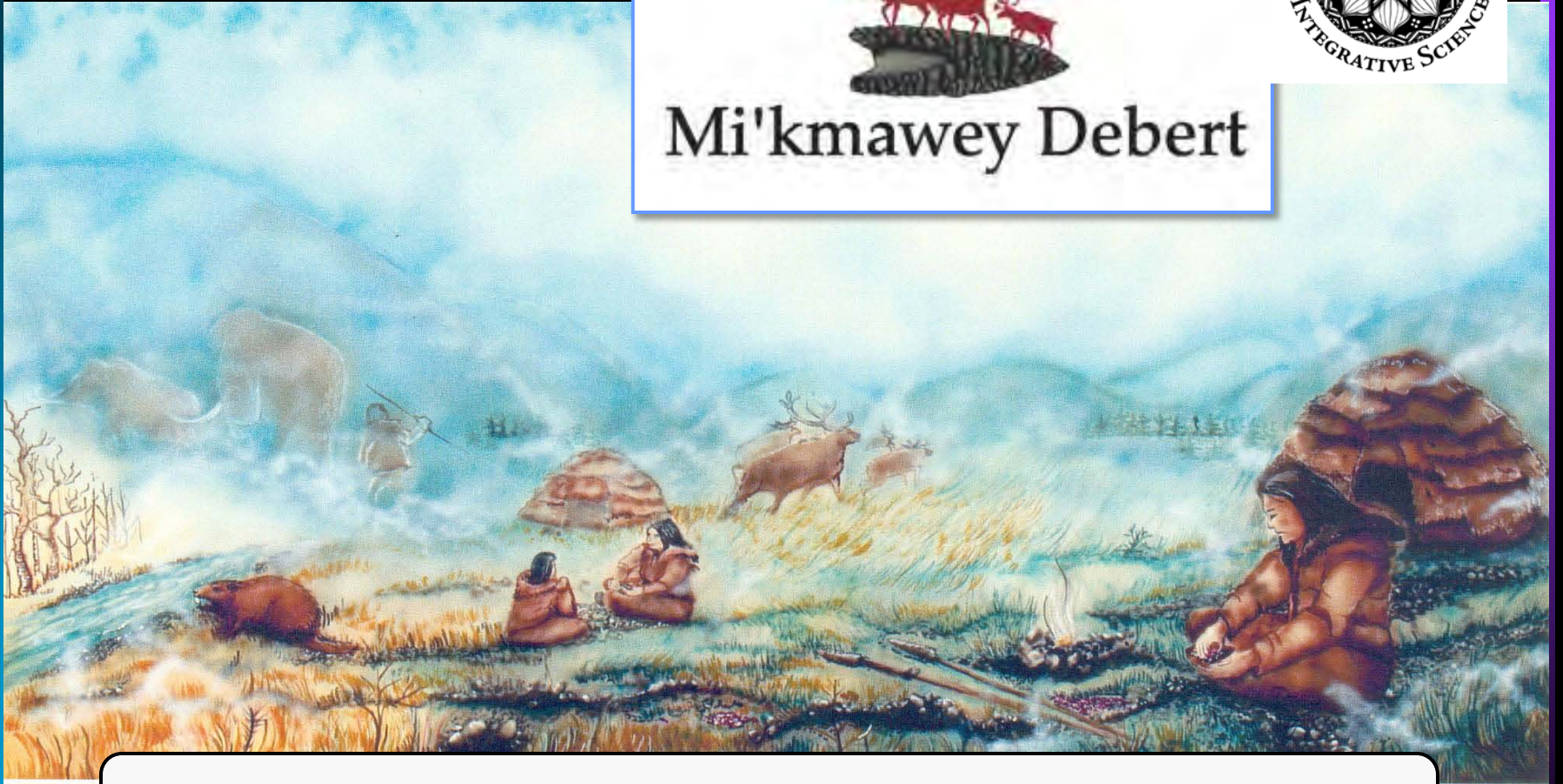
“bringing our stories together”

# Growth

collaborative projects



Mi'kmawey Debert



“bringing our stories together”

# Growth

## research projects



Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada

Canada



Canada Research  
Chairs

Chaires de recherche  
du Canada

Canada

## PATTERN RECOGNITION

enriching the common ground  
in bringing our knowledges together for  
science  
education



“bringing our stories together”

# PATTERN: CONCEPTUAL FRAMEWORK

natural

ideal

abstract

outer

inner

outer



recognize pattern

express pattern

# PATTERN: CONCEPTUAL FRAMEWORK

natural

ideal

abstract

outer

inner

outer



via expression

observe

interpret

share

# pattern expression smarts

multiple intelligences theory

(H. Gardner, Harvard Univ.)

use ... tied to  
cultural value

- ◇ numbers (logical-mathematical)
- ◇ language (linguistic)
- ◇ music (musical)
- ◇ body (body-kinesthetic)
- ◇ spatial (spatial)
- ◇ other people (interpersonal)
- ◇ self (intrapersonal)
- ◇ naturalist (naturalist) ✨

"Western"

"Aboriginal"

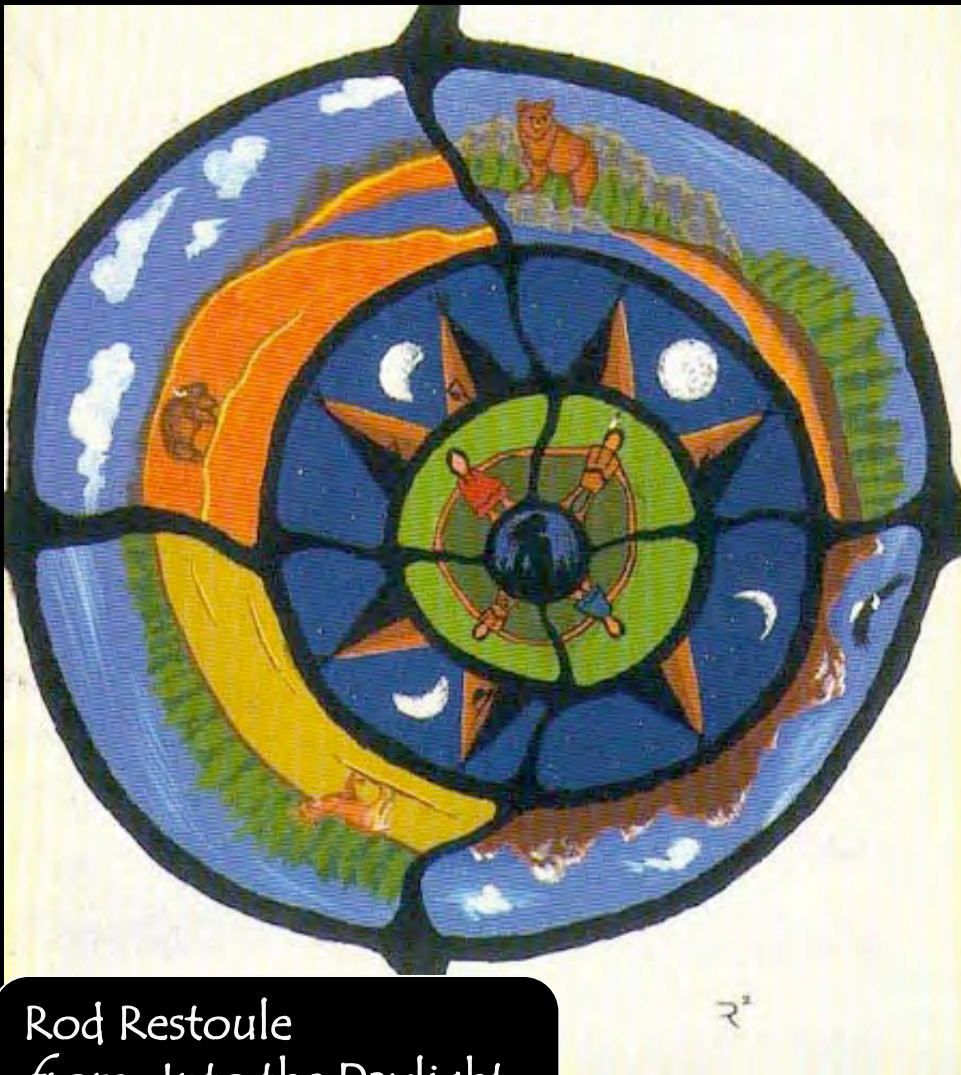
- 
- spiritual / existential



We are  
all inter-  
connected.

*from: Mi'kmaq Family  
and Children Services*

“bringing our stories together”

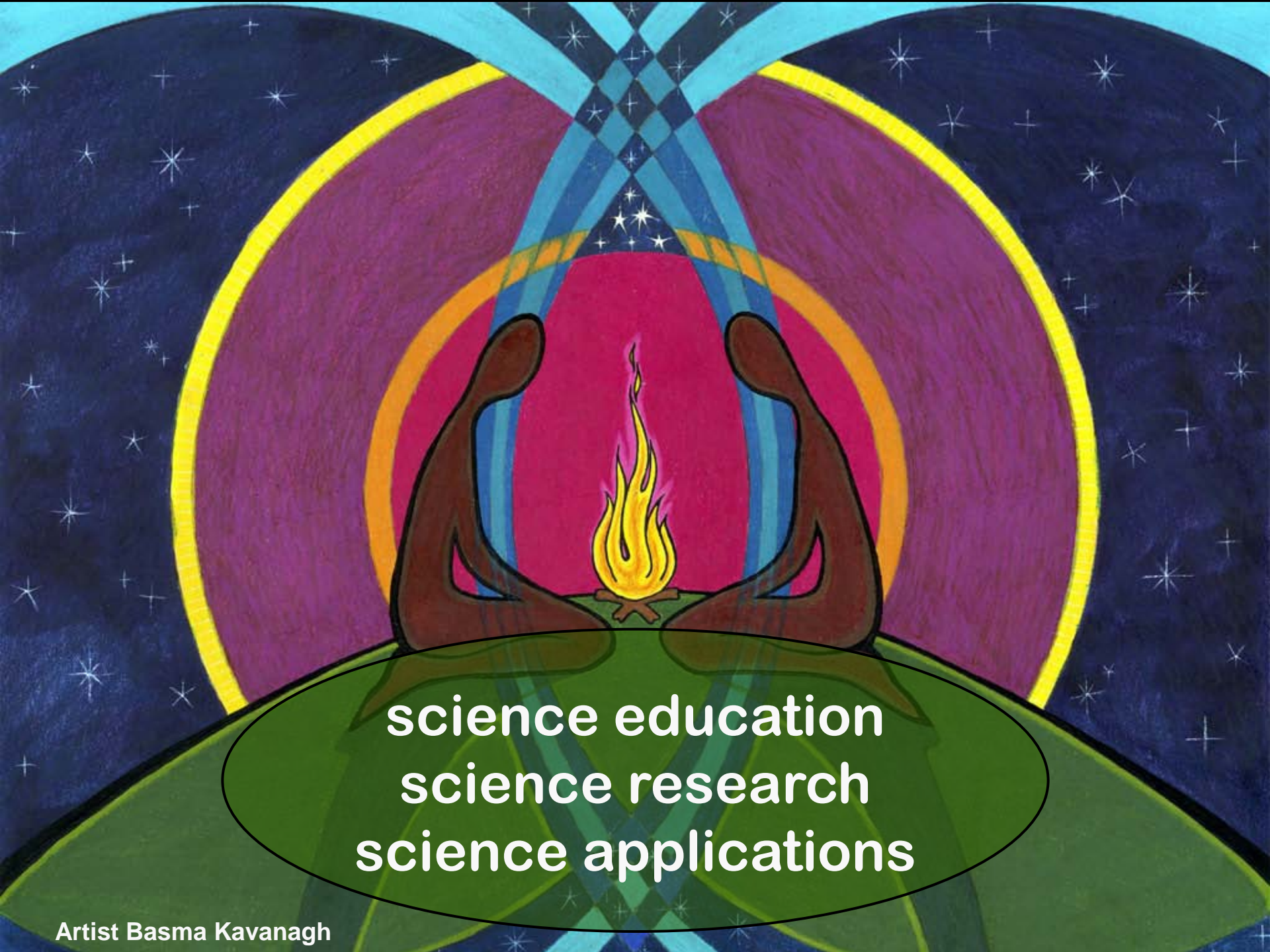


Rod Restoule  
*from: Into the Daylight;*  
C. Morriseau, 1998

We need to  
stay connected  
to the earth ...  
... and be able  
to work  
with Nature ...  
... not be a  
“master over”.

“bringing our stories together”






**science education  
science research  
science applications**

# Two-Eyed Seeing educational and knowledge posters and booklet available

TOQWA'TU'KL KJIJITAQNN  
Integrative Science

## Nipuktuk Wejiaql A'tukuaqnn

FROM THE FOREST COMES OUR STICKY



**Ti'tikli**  
*Bubo virginianus*  
GREAT HORNED OWL

**Jikoqs**  
*Fomes fomentarius*  
BRACKET FUNGUS

**Kuow**  
*Pinus strobus*  
PINE NEEDLES

**Maskwi**  
*Betula papyrifera*  
BIRCH BARK

**Wisgasaw**  
*Pinus strobus*  
PINE CONE

**Pukusip**  
*Dicranum sp.*  
MOSS

**Oqnn**  
TWIG

**Ulnetuk**  
*Pleurozium schreberi*  
SCHREBER'S MOSS

**Jikoqs - Bracket Fungus:** This hard, woody, slow growing bracket fungus once had a very special role to play in the life of the Mi'kmaq Nation. Jikoqs, Keeper of the Sacred Flame, was used to ensure that evidence of the fire remained after when the people moved to a new camp. The fungus was set on fire and then placed in a clamshell for protection. Jikoqs would burn slowly and thus keep the fire alive. At the new campsite, Jikoqs would be used to start a new campfire - this was in the time before we had wooden matches. Similarly to ensure that the fire could be re-created every morning at the camp, Jikoqs and a clamshell were tied to safeguard an ember each night. The species of fungus used was probably *Fomes fomentarius*, which is known in English as tinder many *they* birds (under polytype).

A small multidisciplinary group of young people worked at the University College of Cape Breton during the summer of 2018 on this project. The members of the team are: Miki Brown, Ignace, Hwa-Rahel Gur, Jia-Lang Fan and Hwa-Bing Wu. Contact: All projects are made possible through funding provided to the Office of Student Life at Cape Breton. The project was part of a larger research effort to help youth learn traditional Mi'kmaq and modern scientific understandings of our forests' relationships with natural resources, especially in their understanding of the forest as a source of food and medicine, as well as places of learning, ceremony, and spirituality. The project is funded by the Canadian Institutes of Health Research - Institute of Aboriginal Peoples' Health.

For Mi'kmaq language information contact: Marlene Marshall - 902-379-2508  
For information on the Integrative Science Program, University College of Cape Breton - PO Box 2500 - Sydney - Nova Scotia - B1P 6L2 - 416-529-6666 (toll-free)



TOQWA'TU'KL KJIJITAQNN • INTEGRATIVE SCIENCE

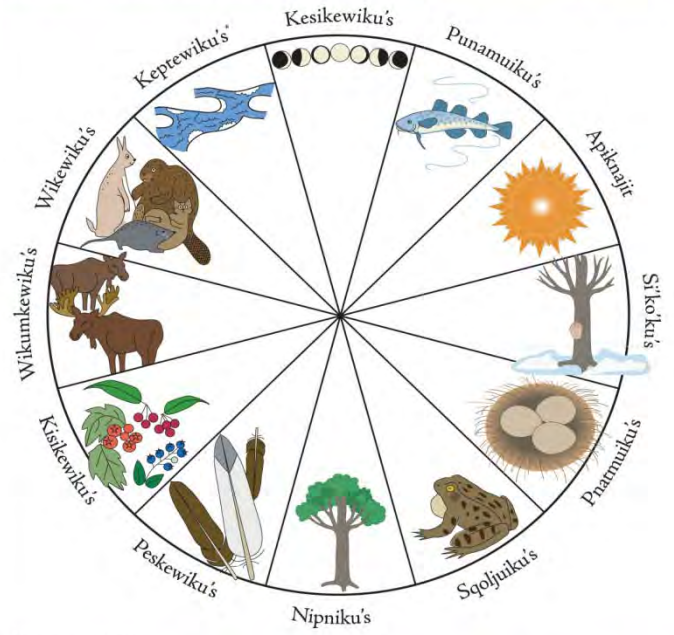
### Frogs of Unama'ki

<b>Mink Frog</b>			<small>Small text describing the Mink Frog's characteristics and habitat.</small>
<b>Green Frog</b>			<small>Small text describing the Green Frog's characteristics and habitat.</small>
<b>Pickerel Frog</b>			<small>Small text describing the Pickerel Frog's characteristics and habitat.</small>
<b>Eastern American Toad</b>			<small>Small text describing the Eastern American Toad's characteristics and habitat.</small>
<b>Northern Spring Peeper</b>			<small>Small text describing the Northern Spring Peeper's characteristics and habitat.</small>
<b>Northern Leopard Frog</b>			<small>Small text describing the Northern Leopard Frog's characteristics and habitat.</small>
<b>Wood Frog</b>			<small>Small text describing the Wood Frog's characteristics and habitat.</small>



Toqwa'  
Bringing

## Mi'kmawe'k Tepknusetk

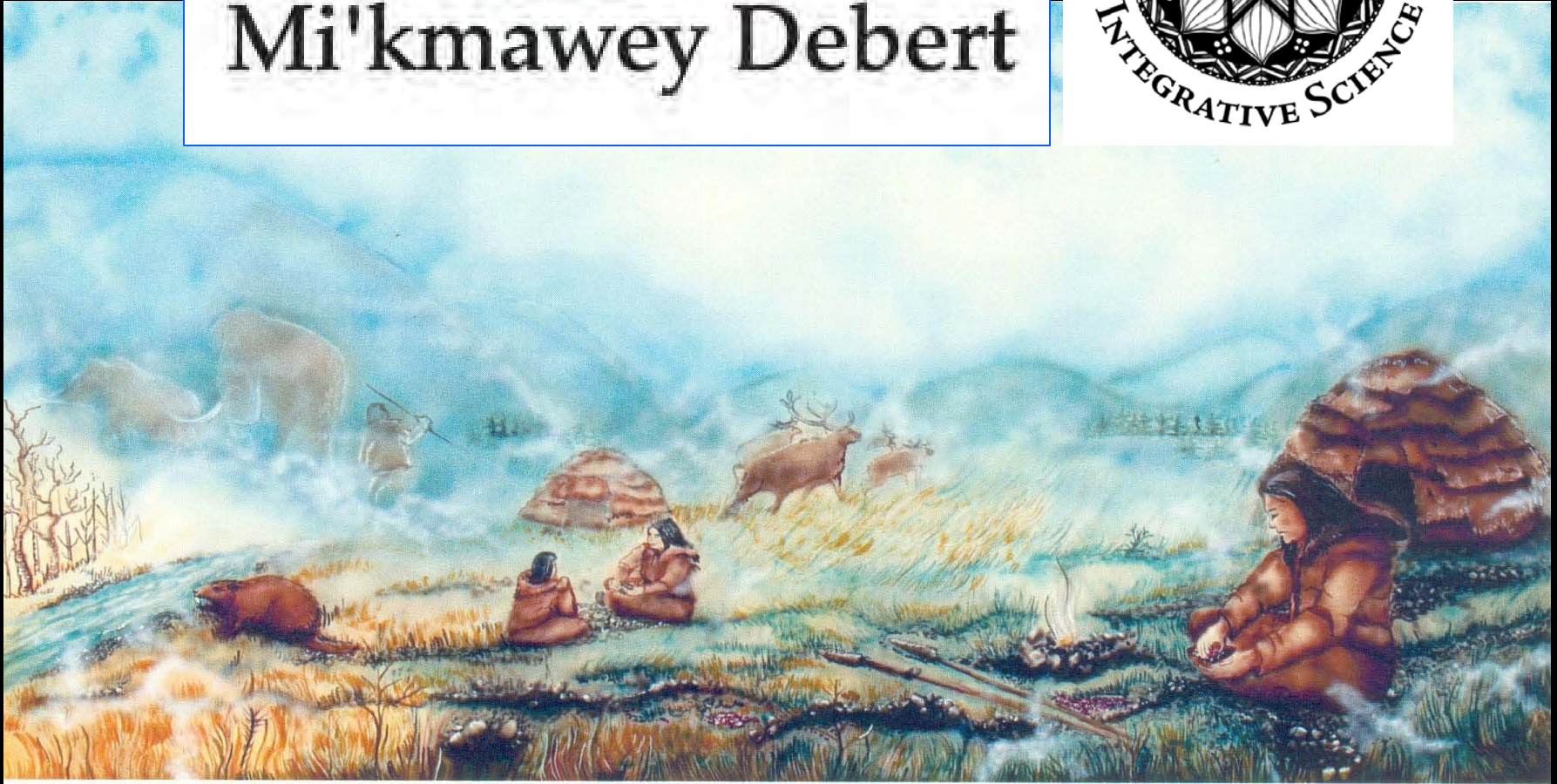
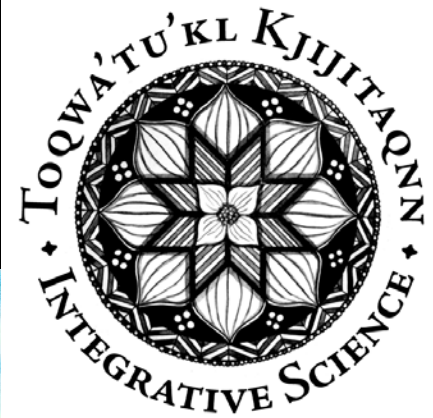


\*Alternative - Keptewiku's





# Mi'kmawey Debert



Artist Dozay Christmas

Thank you - Wela'liog

