

# Welcoming Indigenous Knowledge into Science



18 April 2008; Teachers Workshop, Eskasoni First Nation

## “Science Makes Sense”

## Integration Across the Curriculum

### Cheryl Bartlett, PhD

Canada Research Chair in Integrative Science

Professor of Biology

CAPE BRETON  
UNIVERSITY



# Science

The periodic table is color-coded by groups: Group 1 (purple), Group 2 (blue), Groups 3-10 (green), Groups 11-18 (orange), Group 19 (red), Group 20 (yellow), Group 21 (pink), Group 22 (light blue), Group 23 (light purple), Group 24 (light blue), Group 25 (light purple), Group 26 (light blue), Group 27 (light purple), Group 28 (light blue), Group 29 (light purple), Group 30 (light blue), Group 31 (light purple), Group 32 (light blue), Group 33 (light purple), Group 34 (light blue), Group 35 (light purple), Group 36 (light blue), Group 37 (light purple), Group 38 (light blue), Group 39 (light purple), Group 40 (light blue), Group 41 (light purple), Group 42 (light blue), Group 43 (light purple), Group 44 (light blue), Group 45 (light purple), Group 46 (light blue), Group 47 (light purple), Group 48 (light blue), Group 49 (light purple), Group 50 (light blue), Group 51 (light purple), Group 52 (light blue), Group 53 (light purple), Group 54 (light blue), Group 55 (light purple), Group 56 (light blue), Group 57-71 (red), Group 72 (light blue), Group 73 (light purple), Group 74 (light blue), Group 75 (light purple), Group 76 (light blue), Group 77 (light purple), Group 78 (light blue), Group 79 (light purple), Group 80 (light blue), Group 81 (light purple), Group 82 (light blue), Group 83 (light purple), Group 84 (light blue), Group 85 (light purple), Group 86 (light blue), Group 87 (light purple), Group 88 (light blue), Group 89-103 (yellow), Group 104 (light blue), Group 105 (light purple), Group 106 (light blue), Group 107 (light purple), Group 108 (light blue), Group 109 (light purple), Group 110 (light blue), Group 111 (light purple), Group 112 (light blue), Group 113 (light purple), Group 114 (light blue), Group 115 (light purple), Group 116 (light blue), Group 117 (light purple), Group 118 (light blue), Group 119 (light purple), Group 120 (light blue), Group 121 (light purple), Group 122 (light blue), Group 123 (light purple), Group 124 (light blue), Group 125 (light purple), Group 126 (light blue), Group 127 (light purple), Group 128 (light blue), Group 129 (light purple), Group 130 (light blue), Group 131 (light purple), Group 132 (light blue), Group 133 (light purple), Group 134 (light blue), Group 135 (light purple), Group 136 (light blue), Group 137 (light purple), Group 138 (light blue), Group 139 (light purple), Group 140 (light blue), Group 141 (light purple), Group 142 (light blue), Group 143 (light purple), Group 144 (light blue), Group 145 (light purple), Group 146 (light blue), Group 147 (light purple), Group 148 (light blue), Group 149 (light purple), Group 150 (light blue).

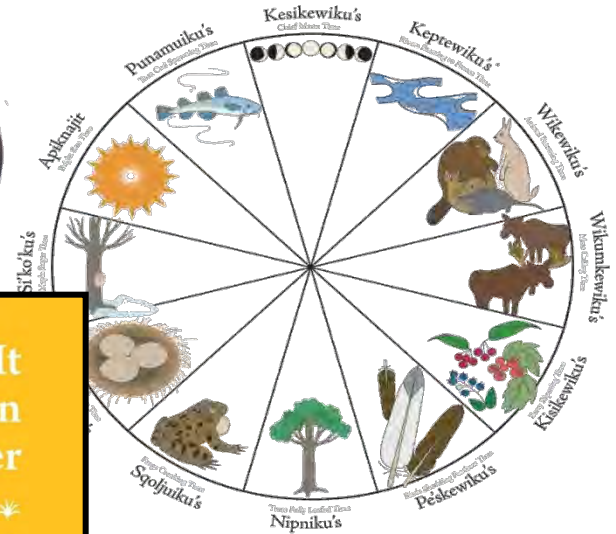
1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt									
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium									
55 Cs Cesium	56 Ba Barium	57-71	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium									
87 Fr Francium	88 Ra Radium	89-103	104 Unq Unnilquadium	105 Unp Unnilpentium	106 Unh Unnilhexium	107 Uns Unnilseptium	108 Uno Unniloctium	109 Une Unnilennium									
		57 La Lanthanum		58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium									
		89 Ac Actinium		90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium									
		63 Eu Europium		64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium						
		95 Am Americium		96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium						

Periodic Table of the Elements

# Welcoming Indigenous Knowledge into Science



I Got It  
From an  
Elder  
\*  
Conversations  
in Healing  
Language



# Welcoming Indigenous Knowledge into Science



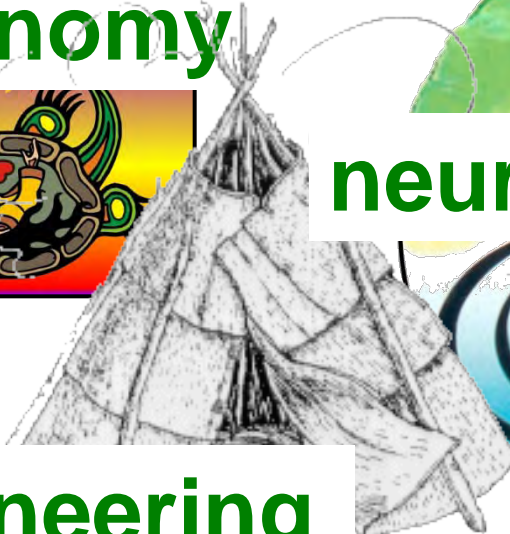
**chemistry**



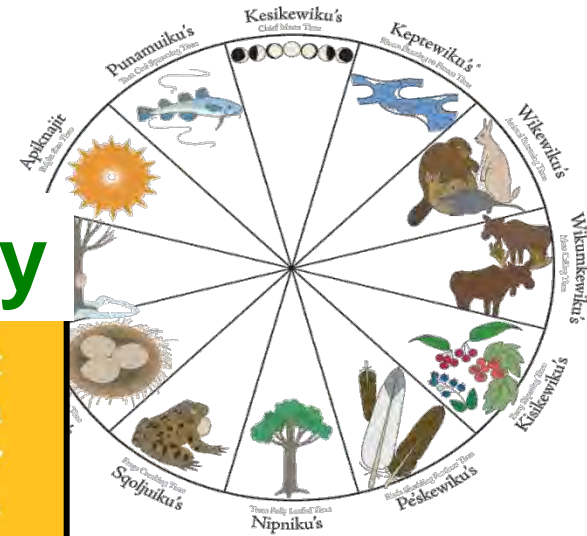
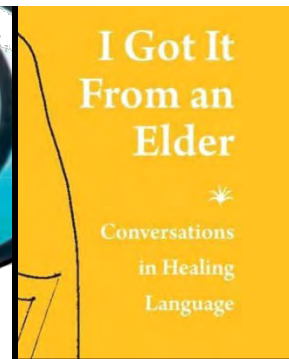
**astronomy**



**engineering**

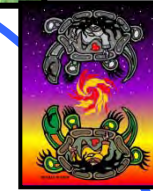
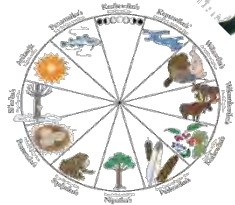


**neuropsychology**



**biology**

# OUTLINE OF TALK



Pattern conceptual framework  
for exploring science topics

Pattern smarts

Four Big Pictures  
for  
Two-Eyed Seeing

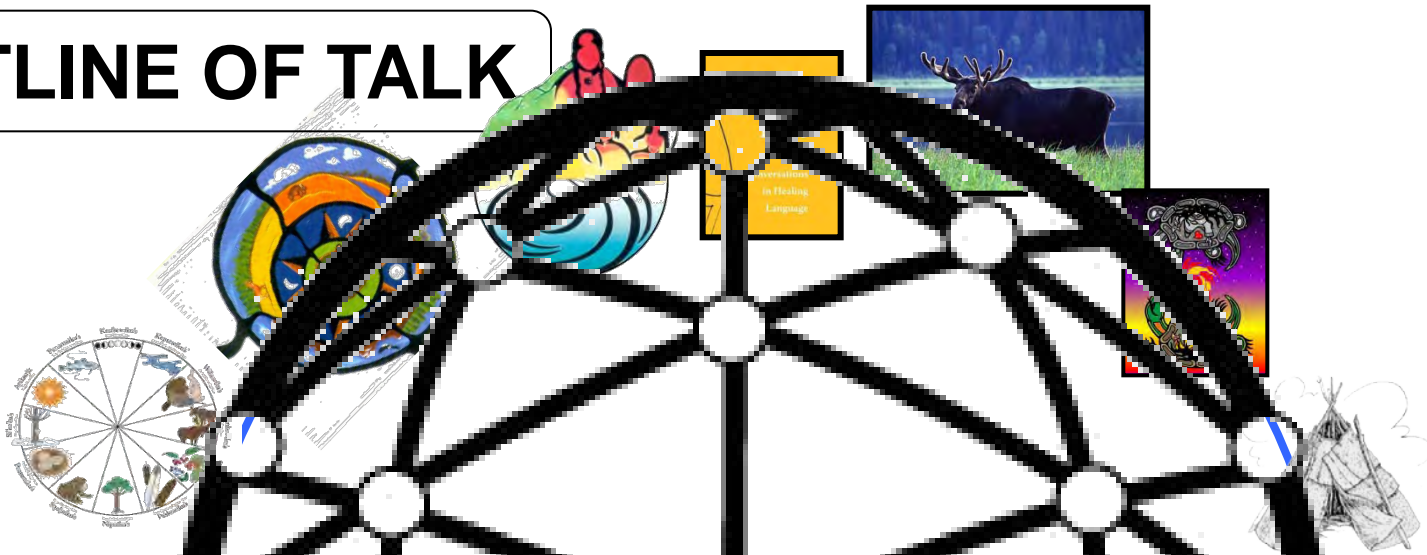
Introduction

Integrative Science

Sense Makes Science

Science as  
“pattern stories”

# OUTLINE OF TALK



Pattern conceptual framework  
for exploring science topics

Introduction

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“pattern stories”

Canada Research Chairs / Chaires de recherche du Canada / Canada

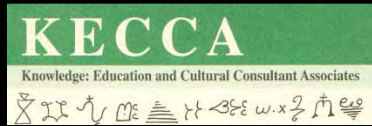
Social Sciences and Humanities Research Council of Canada / Conseil de recherches en sciences humaines du Canada



CAPE BRETON UNIVERSITY



Mi'kmaq Elders



**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, scientist & educator, Univ. of New Mexico

Indigenous

Western



**12+ years: where our journey  
has been and continues to be ...**

## **Integrative Science**

**bringing together Indigenous and Western  
scientific knowledges and ways of knowing**

**Indigenous**

**Western**



Artist: Basma Kavanagh

# Integrative Science

## SCIENCE

education, research, applications,  
youth and community outreach

Indigenous

Western

“bringing our sciences together”

# Integrative Science

## SCIENCE

education, research, applications,  
youth and community outreach

Indigenous

our sciences  
our stories

Western

“bringing our knowledges together”

our worldviews

Artist: Basma Kavanagh

# Science Makes Sense



Artist: Basma Kavanagh

**Science  
Makes  
Sense**

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**WHAT  
Makes  
Science?**



Artist: Basma Kavanagh

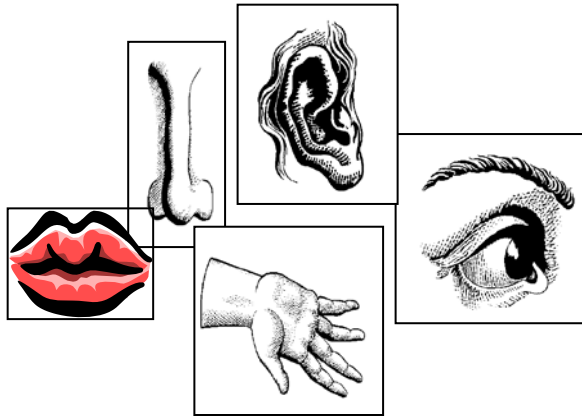
**Science  
Makes  
Sense**

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**SENSE  
Makes  
Science!**



Artist: Basma Kavanagh

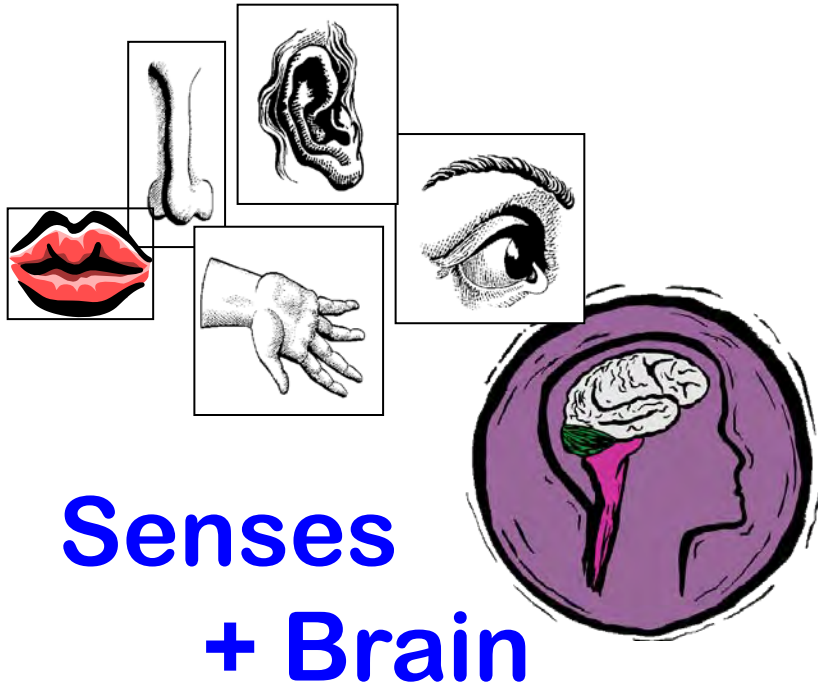


# Senses





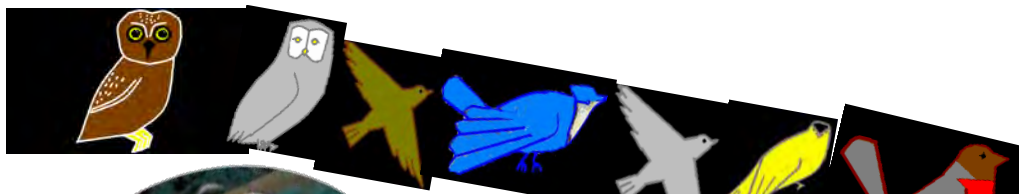
Artist: Basma Kavanagh



**Senses  
+ Brain**

**= Patterns**



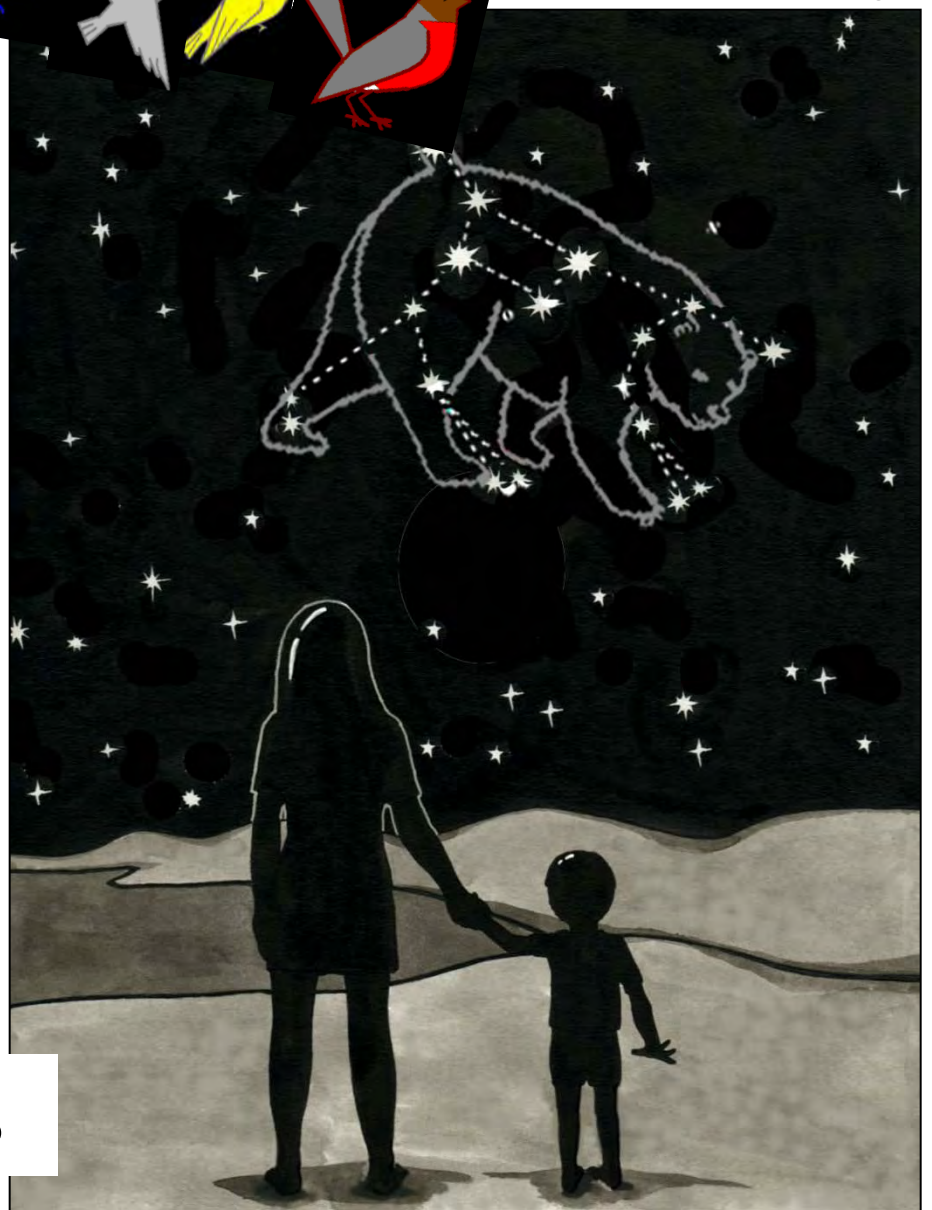


Artist: Basma Kavanagh

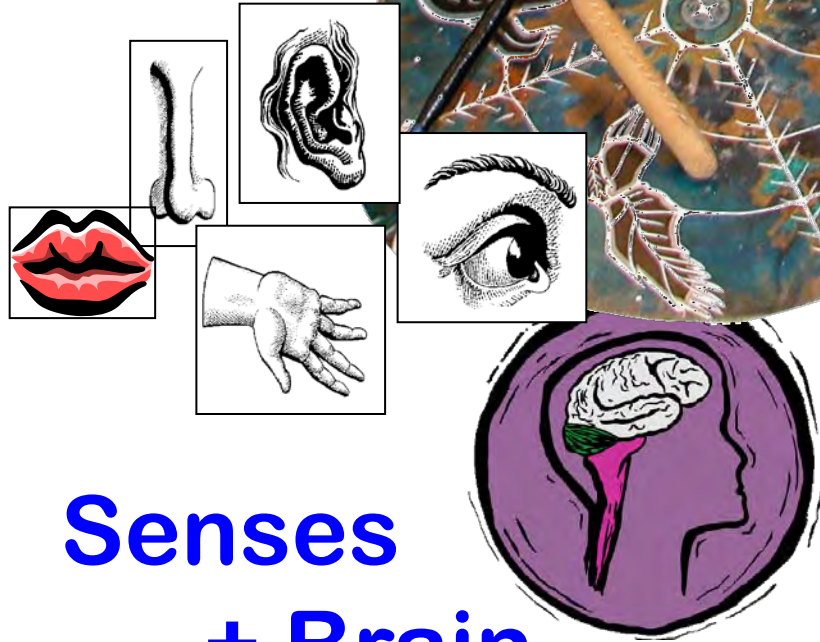


**Senses  
+ Brain  
+ Mind**

**= Patterns → Stories**

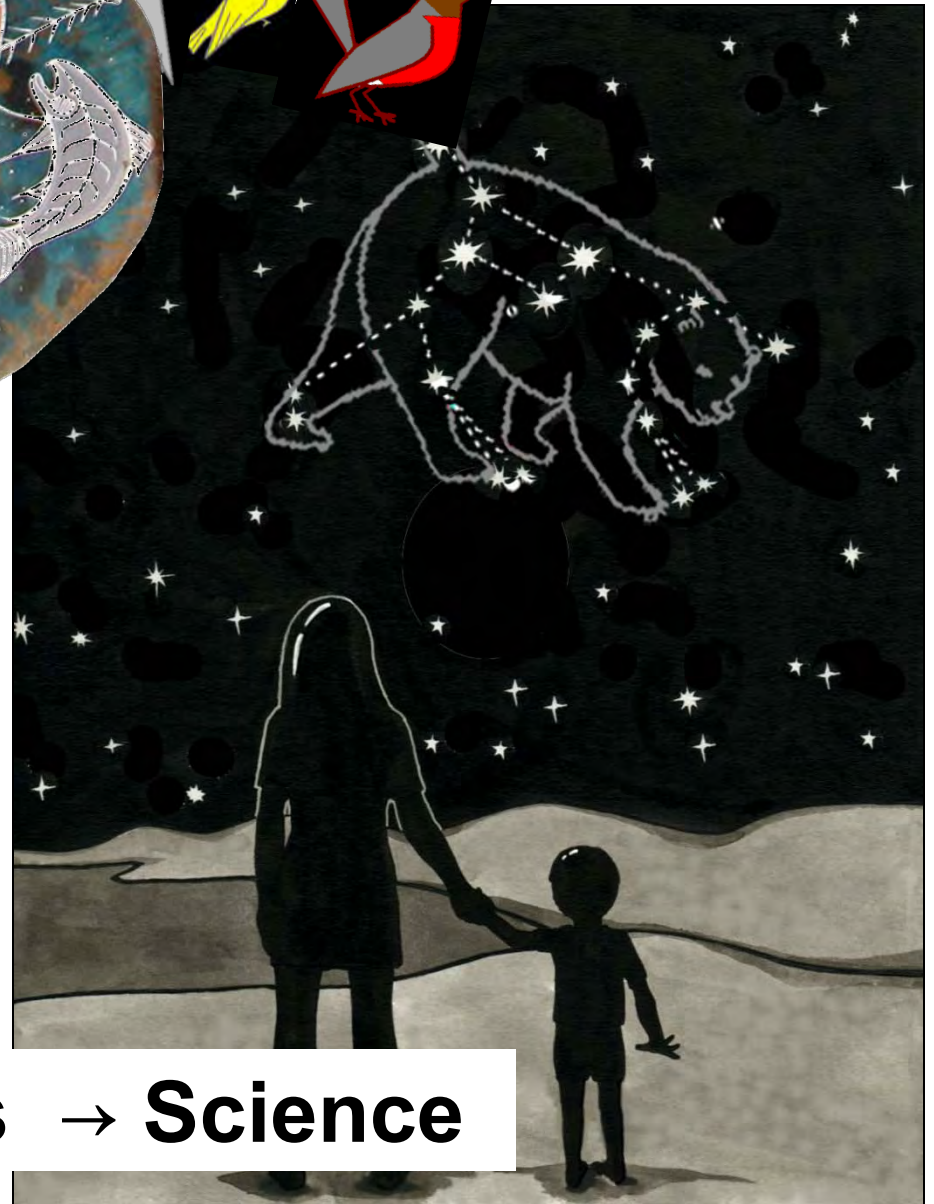


Artist: Basma Kavanagh

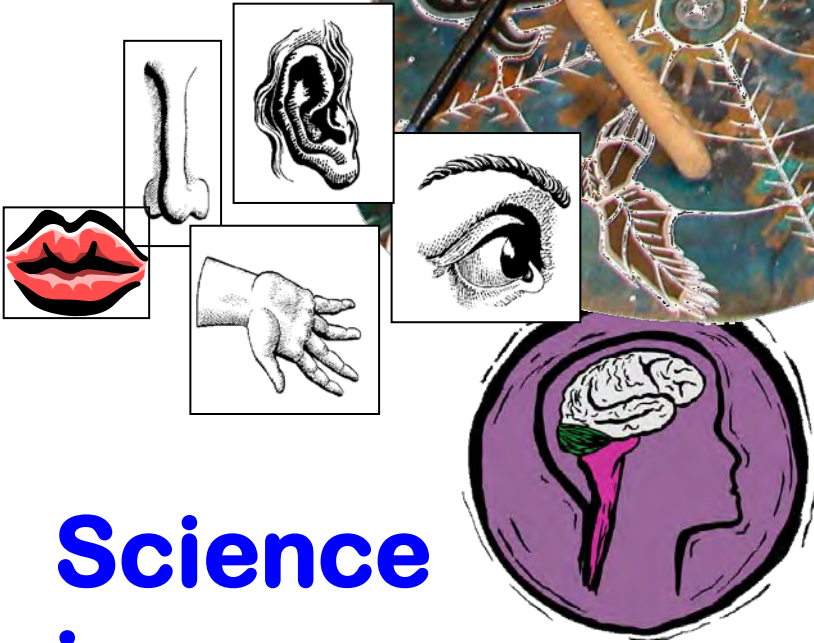


**Senses  
+ Brain  
+ Mind  
& Culture**

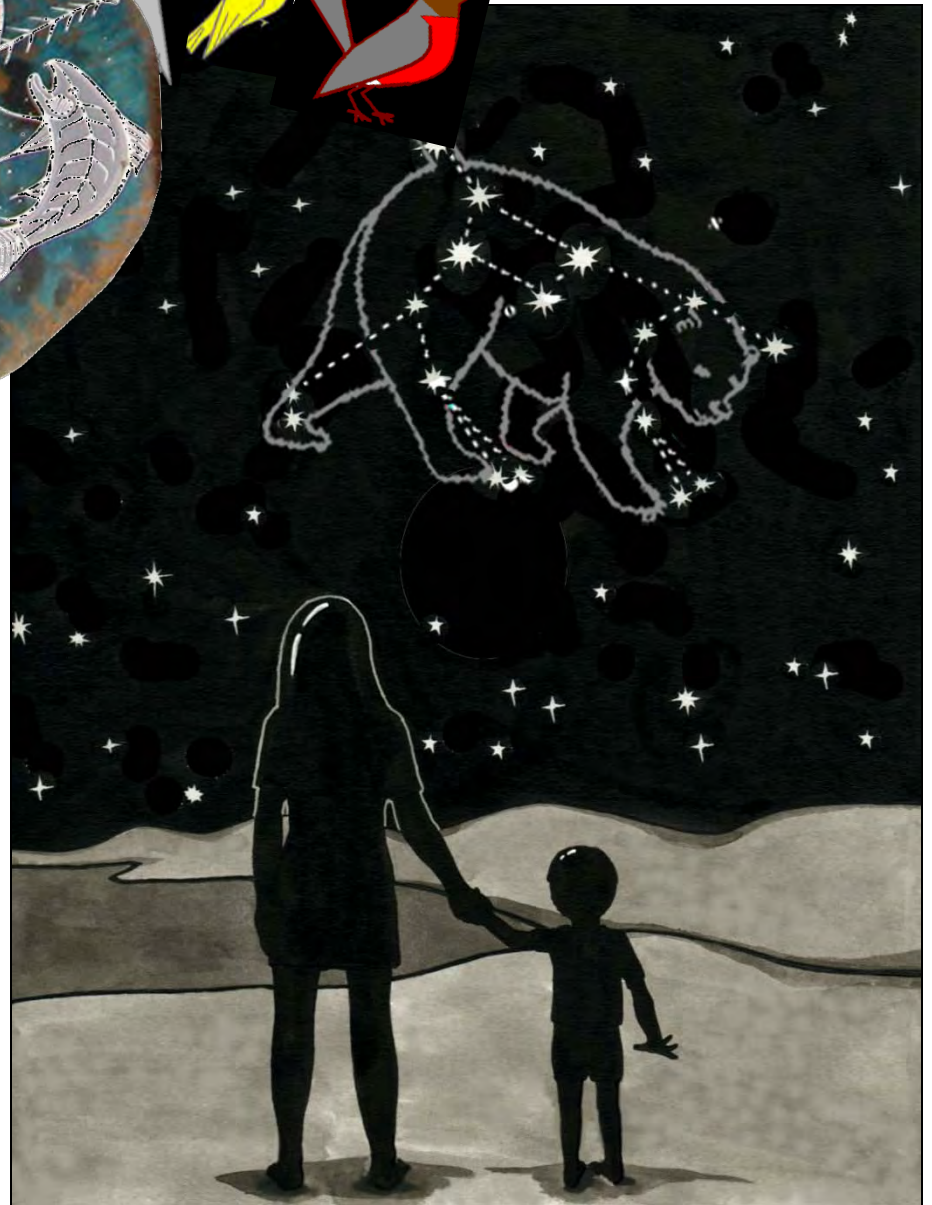
**= Patterns → Stories → Science**



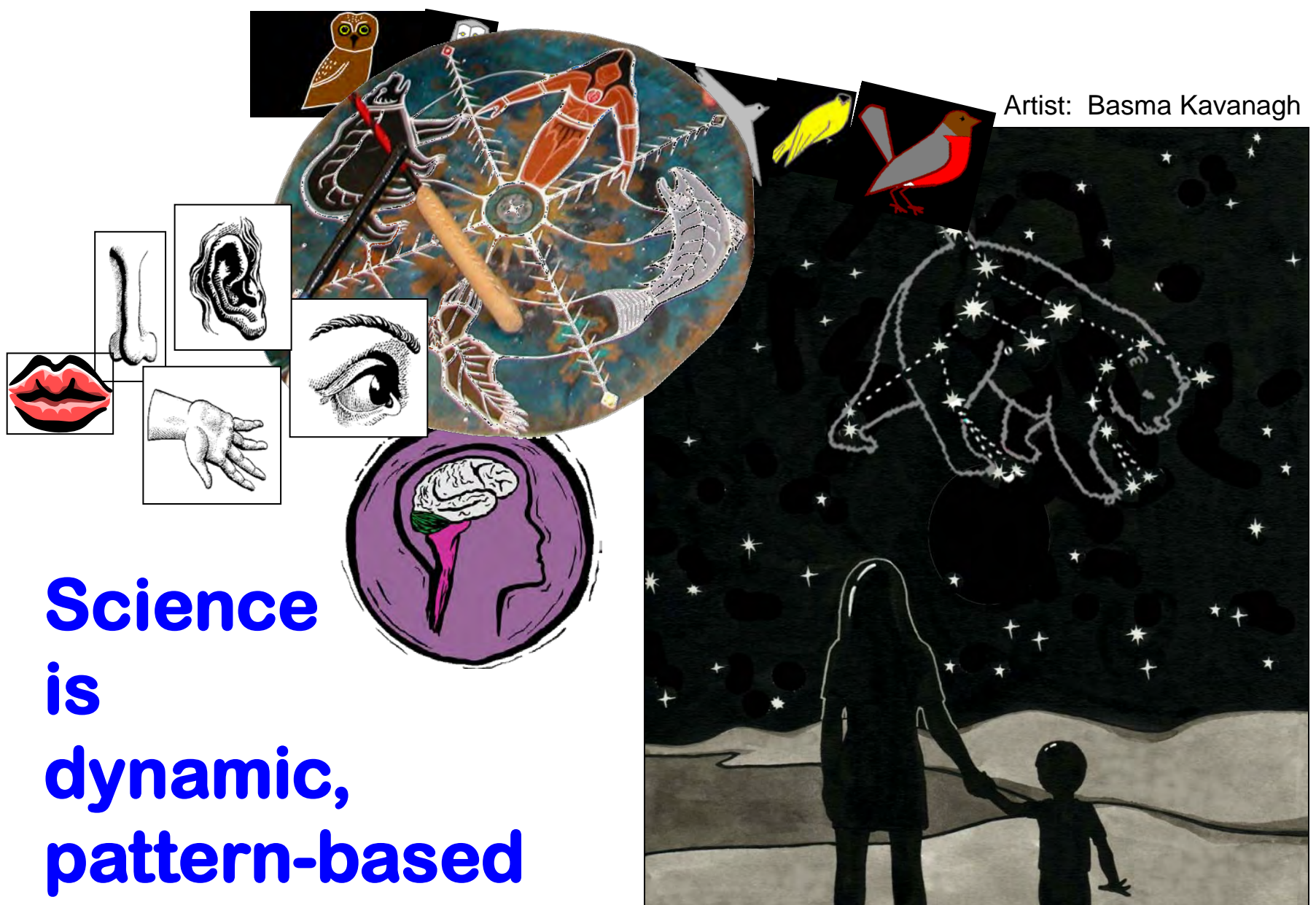
Artist: Basma Kavanagh



**Science  
is  
dynamic,  
pattern-based  
knowledge.**



Artist: Basma Kavanagh



**Science  
is  
dynamic,  
pattern-based**

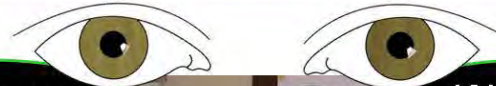
**stories of our interactions with and within nature**

**to Co-Learn, we  
must TALK-WALK the  
“know, do, value” of  
our cultural strengths  
and differences**



**“Two-Eyed Seeing”**

learning to see with the strengths of each & together



Indigenous

Western



**Mr. Albert Marshall, Mi'kmaq Elder  
Eskasoni First Nation**

# “Two-Eyed Seeing”

learning to see with the strengths of each & together



Indigenous



Western



Mr. Albert Marshall, Mi'kmaq Elder  
Eskasoni First Nation

We must become able to put the “**know, do, value**” aspects of ***our own science*** in front of us ... like an object ... and then we must develop the abilities to look at and walk around them ... talk about them, acknowledge them, take ownership of them, understand them, and put them beside those of another worldview ... to see our mutual strengths and to begin working together in a respectful manner.

Indigenous

Two-Eyed Seeing

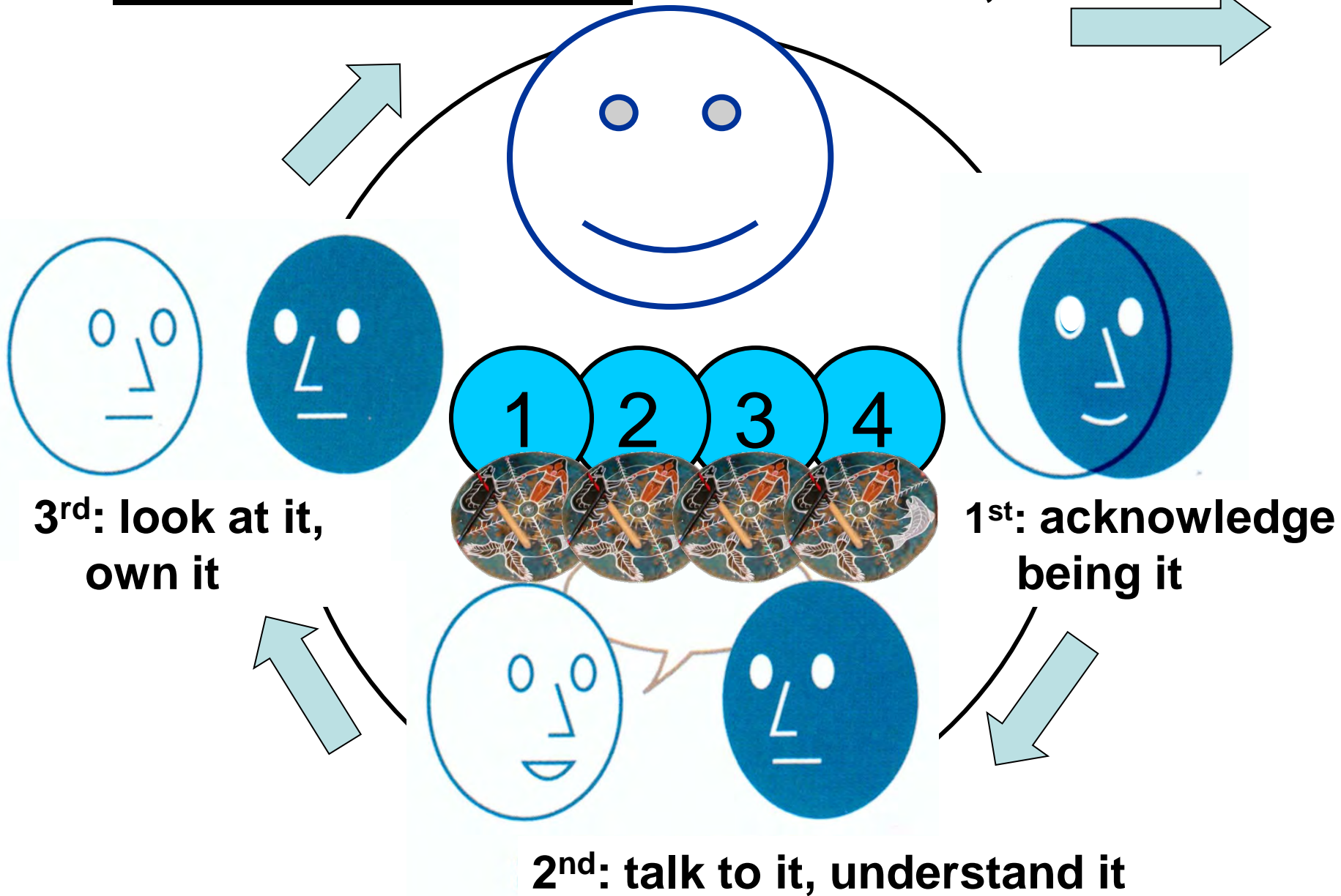
Western

our SCIENCES





4<sup>th</sup>: “KNOW, VALUE, and DO” IT ... GROW IT, SHARE IT



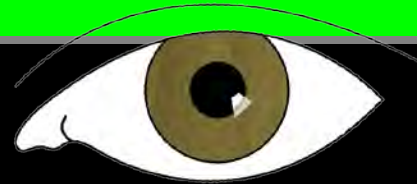
1

# Two-Eyed Seeing

## our key concepts & actions



- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



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

2

# Two-Eyed Seeing our languages & methodologies



**vigour**

**WEAVING**

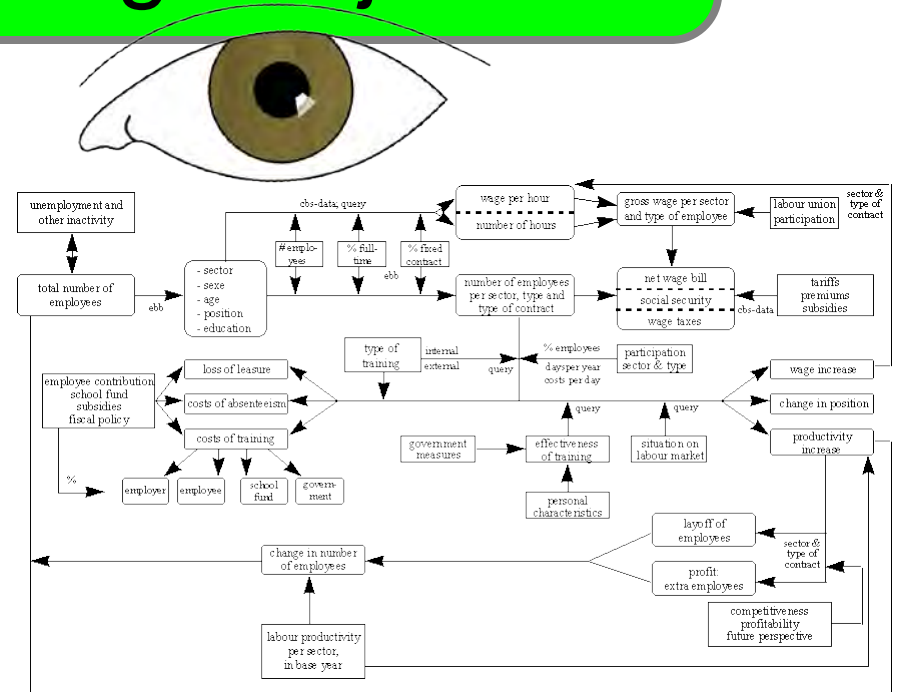
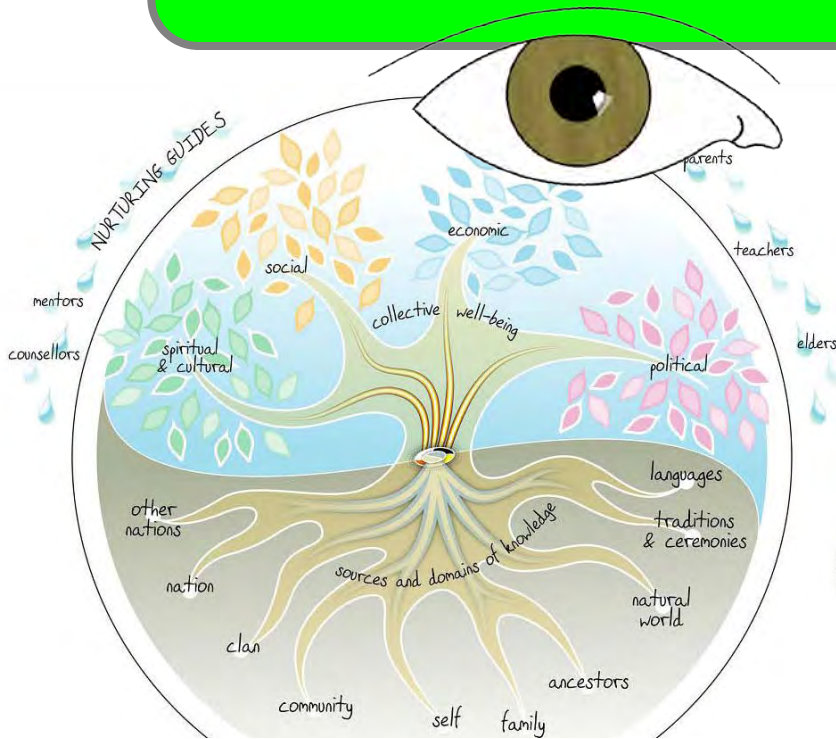


**rigour**

**UN-WEAVING**

3

# Two-Eyed Seeing our overall knowledge objectives



from: CCL Aboriginal Learning Knowledge Centre ([www.ccl-cca.ca/CCL](http://www.ccl-cca.ca/CCL))

from: [www.leads.ac.uk](http://www.leads.ac.uk)

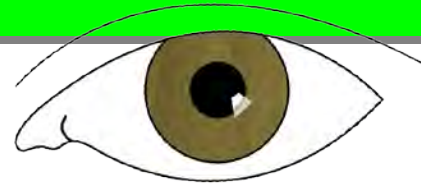
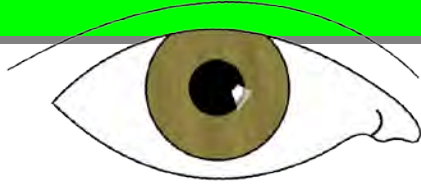
towards resonance  
of understanding  
within environment

towards construction  
of understanding  
of environment

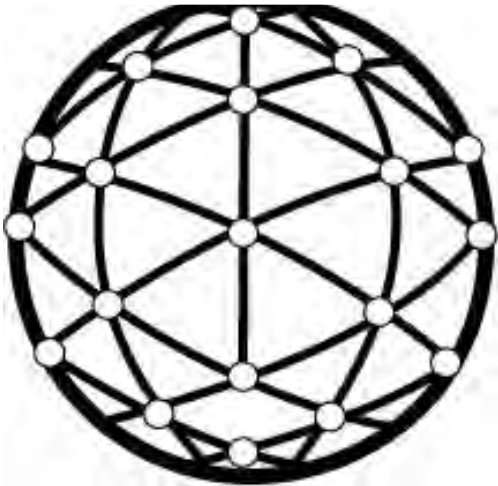
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# Two-Eyed Seeing

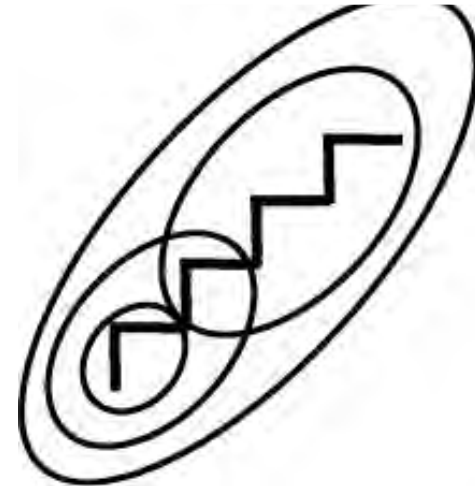
our world is



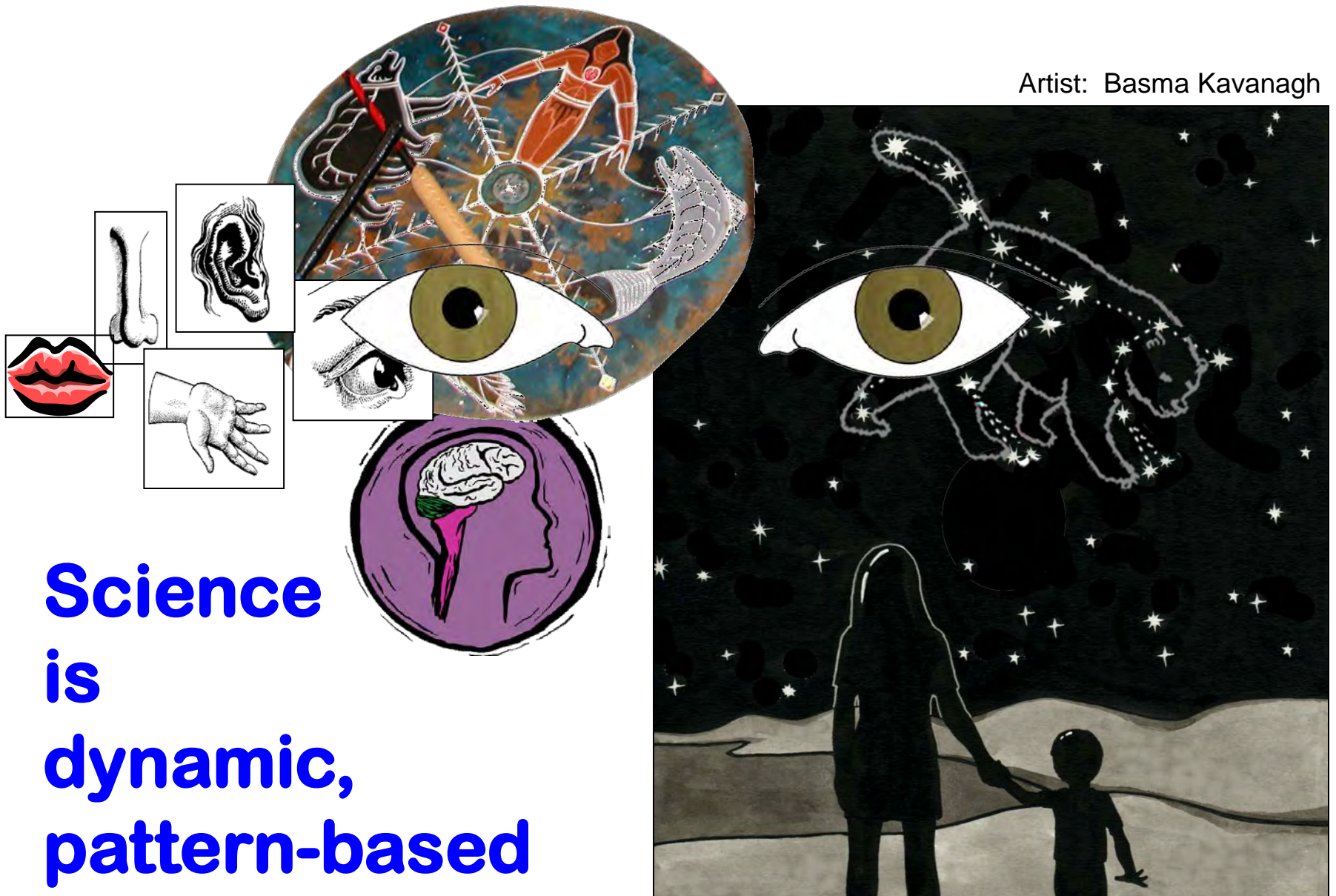
**interconnective**



**parts & wholes**



Artist: Basma Kavanagh



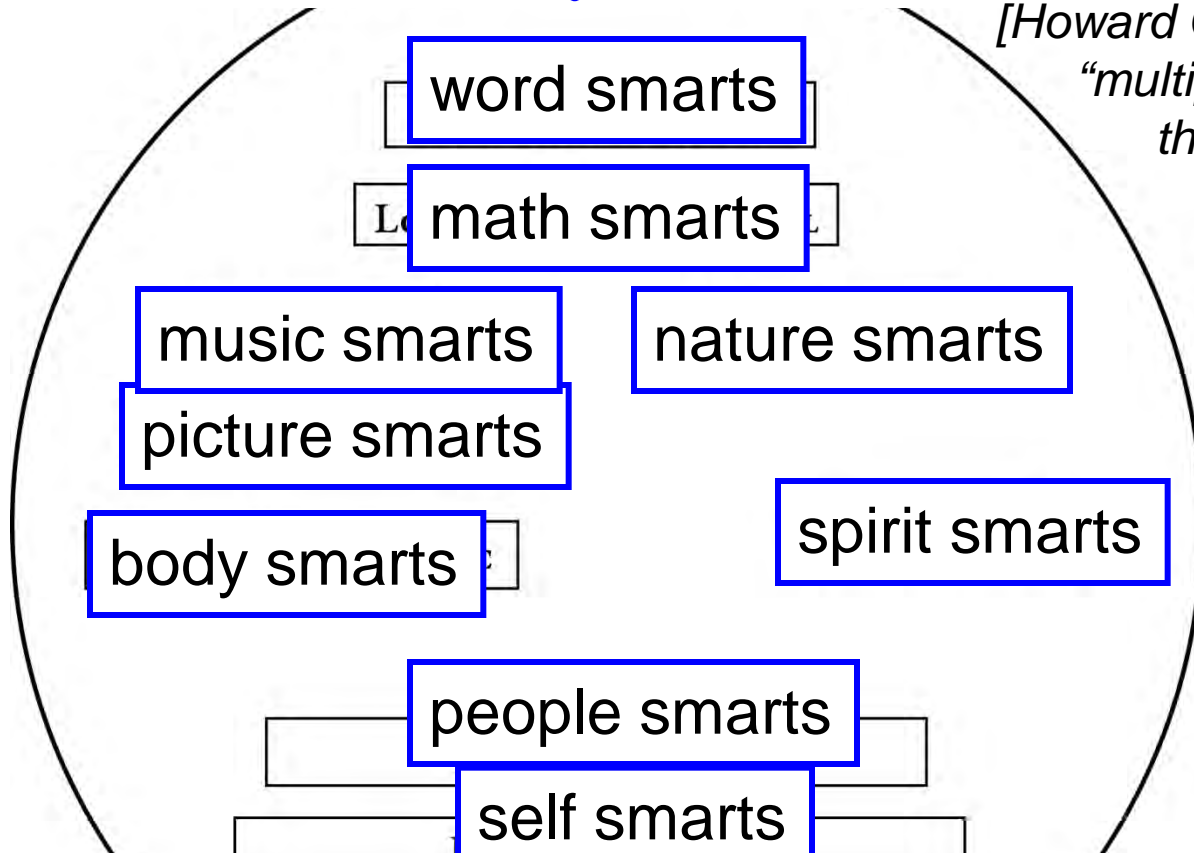
**Science  
is  
dynamic,  
pattern-based**

**stories of our interactions with and within nature**

our science stories ...

draw upon our “**pattern smarts**”

*[Howard Gardner’s  
“multiple intelligences  
theory”]*



**SANCTIONED PERSPECTIVES & INTELLIGENCES:**

who we are; where we are; where we were;  
what we know, do and value

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer





# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



muis / *Ursa major*



# PATTERN CONCEPTUAL FRAMEWORK

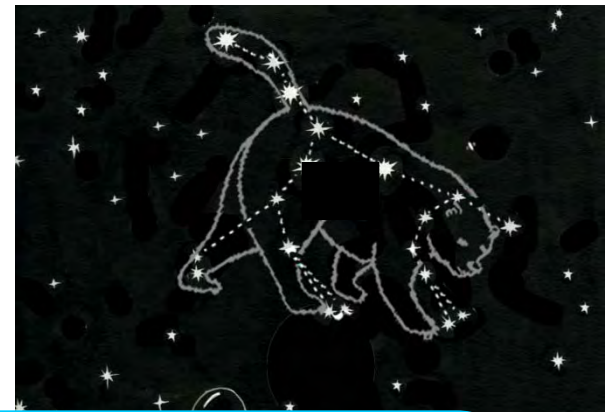
outer

inner

outer



*muiin / Ursa major*



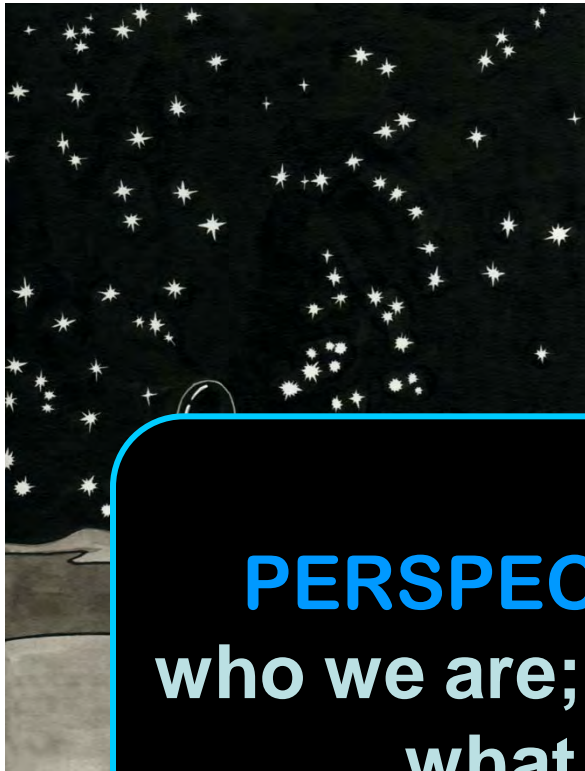
**SANCTIONED  
PERSPECTIVES & INTELLIGENCES:**  
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# PATTERN CONCEPTUAL FRAMEWORK

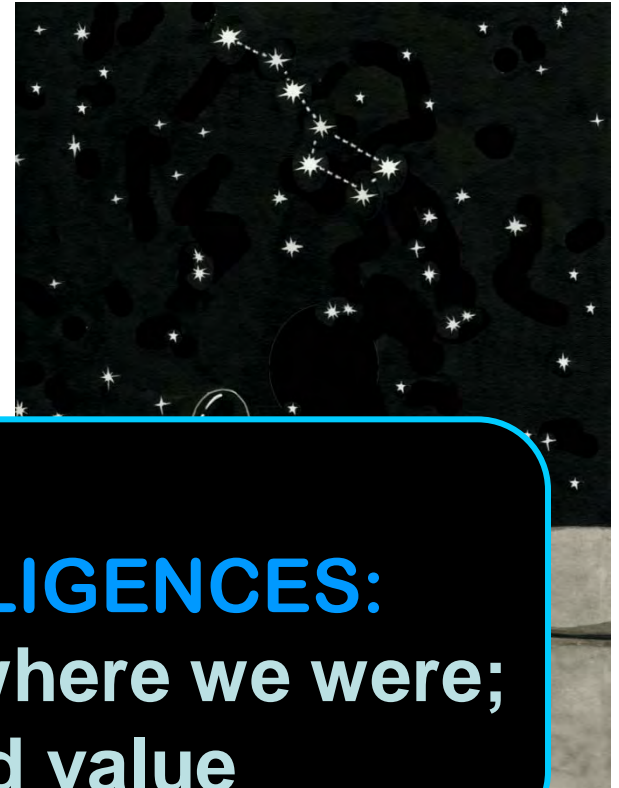
outer

inner

outer



dipper



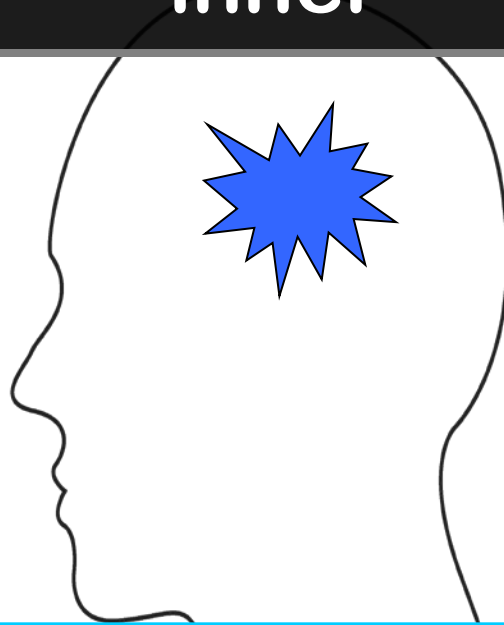
**SANCTIONED  
PERSPECTIVES & INTELLIGENCES:**  
who we are; where we are; where we were;  
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# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



**SANCTIONED**

**PERSPECTIVES & INTELLIGENCES:**

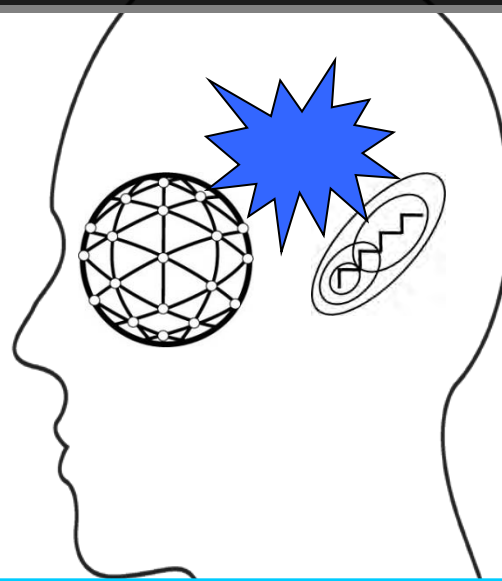
who we are; where we are; where we were;  
what we know, do and value

# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



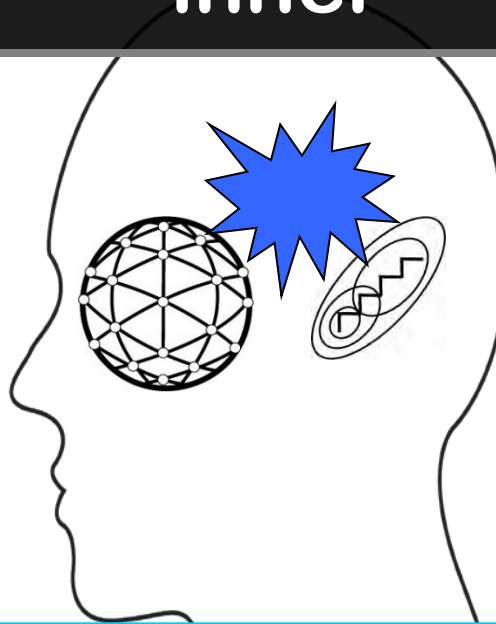
**SANCTIONED  
PERSPECTIVES & INTELLIGENCES:**  
who we are; where we are; where we were;  
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# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer



Step	Year	Month	Day	Time	Location	Activity	Notes	Step	Year	Month	Day	Time	Location	Activity	Notes
01	1948	01	01	00:00	00:00	00:00	00:00	02	1948	01	01	00:00	00:00	00:00	00:00
03	1948	01	01	00:00	00:00	00:00	00:00	04	1948	01	01	00:00	00:00	00:00	00:00
05	1948	01	01	00:00	00:00	00:00	00:00	06	1948	01	01	00:00	00:00	00:00	00:00
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59	1948	01	01	00:00	00:00	00:00	00:00	60	1948	01	01	00:00	00:00	00:00	00:00

**SANCTIONED  
PERSPECTIVES & INTELLIGENCES:**  
who we are; where we are; where we were;  
what we know, do and value

**participatory &  
creative choice**



**Wjipenuk Etek  
Lnuimlkikno'ti  
- Spirit of the East -**

**East (sunrise)**

**... a place of  
beginnings and  
enlightenment**

**... where new  
knowledge can be  
created or received  
to bring about  
harmony or right  
relations.**




**participatory &  
creative choice**



**Wjipenuk Etek  
Lnuimlkikno'ti  
- Spirit of the East -**

**Two-Eyed Seeing**  
our key concepts & actions

- 
- respect
  - relationship
  - reverence
  - reciprocity
  - ritual (ceremony)
  - repetition
  - responsibility

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



# Physical Direction

# detached & instrumental

East (sunrise)

... measurement of the time of sunrise

... for each new day over the course of one full year.

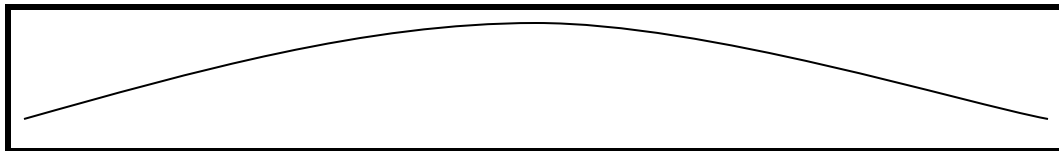
SYDNEY, NS  
Rise and Set for the Sun for 2004

Location: W060 11, N46 09      Zone: 4h West of Greenwich

Astronomical Applications Dept.  
U. S. Naval Observatory  
Washington, DC 20392-5420

Day	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
01	0743	1625	0724	1705	0639	1748	0540	1830	0447	1910	0413	1945	0413	1956	0443	1930	0522	1839	0600	1740	0642	1646	0723	1617
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03	0743	1627	0722	1708	0635	1750	0536	1833	0444	1912	0412	1947	0415	1955	0446	1927	0524	1835	0602	1736	0645	1643	0725	1616
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# Physical Direction

detached & instrumental

## Two-Eyed Seeing our key concerns & actions



- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility



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



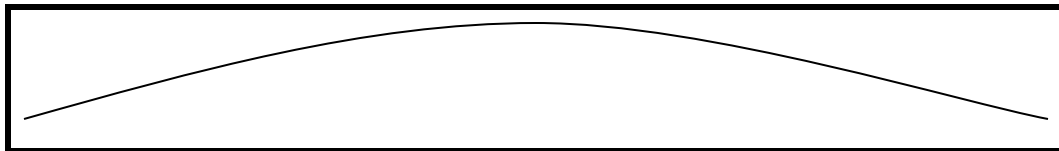
SYDNEY, NS  
Rise and Set for the Sun for 2004

Location: W060 11, N46 09      Zone: 4h West of Greenwich

Astronomical Applications Dept.  
U. S. Naval Observatory  
Washington, DC 20392-5420

Day	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
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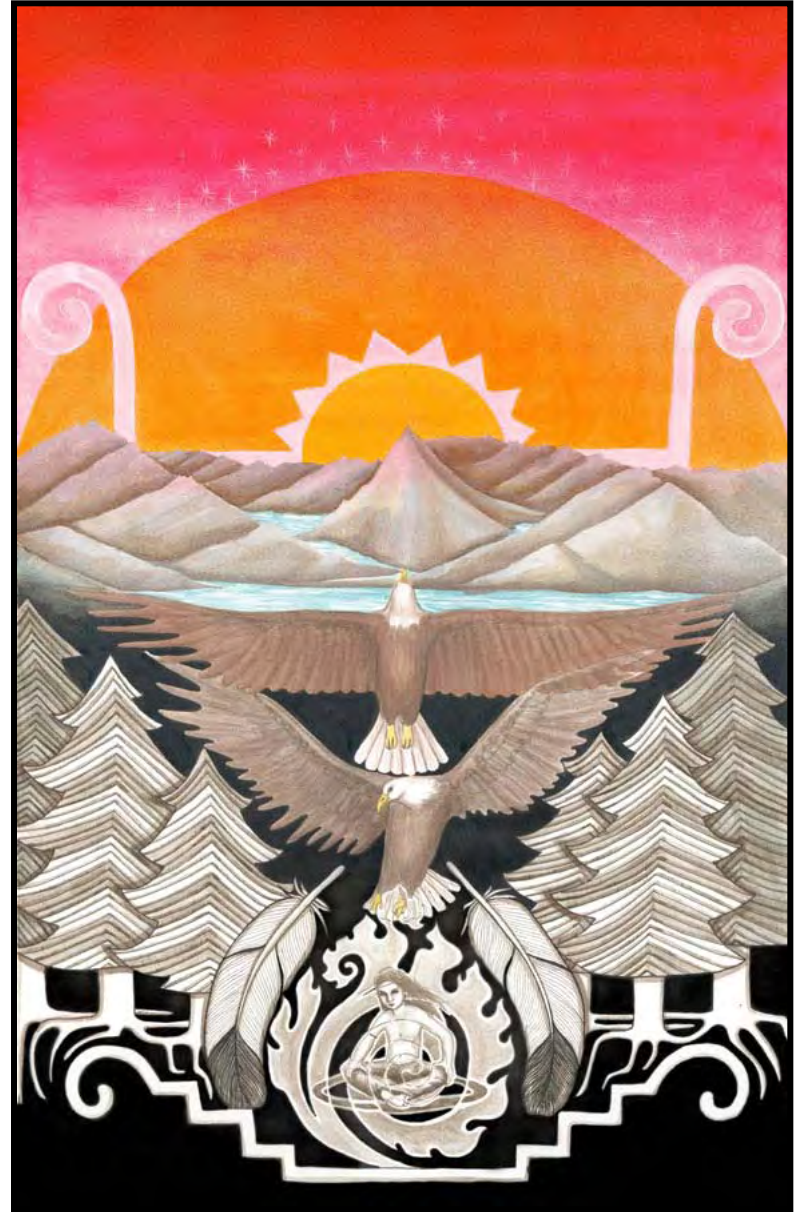


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# Welcoming Indigenous Knowledge into Science

psychology

... of creative  
thinking  
and  
transformative  
learning

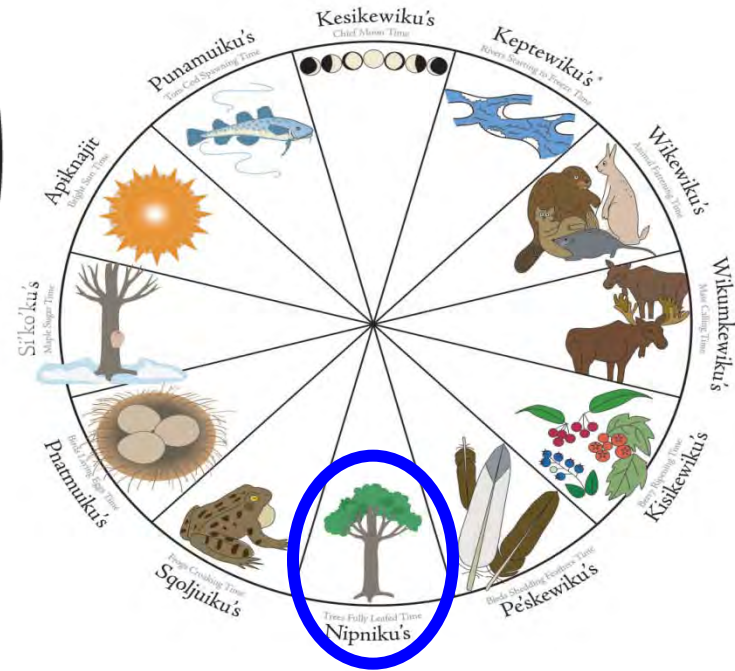
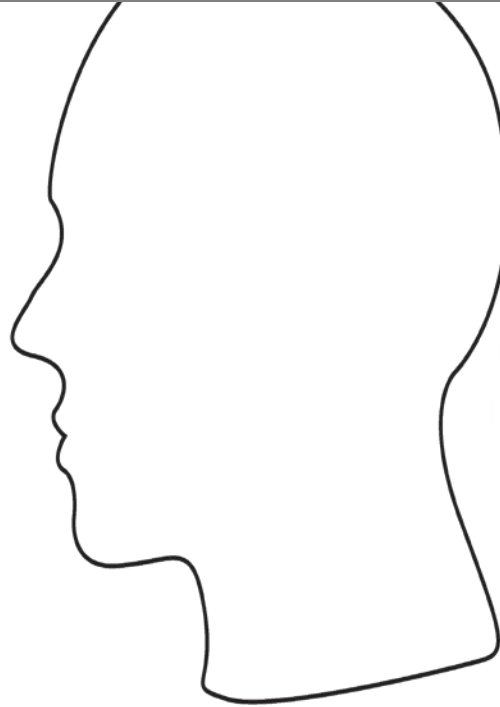


# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

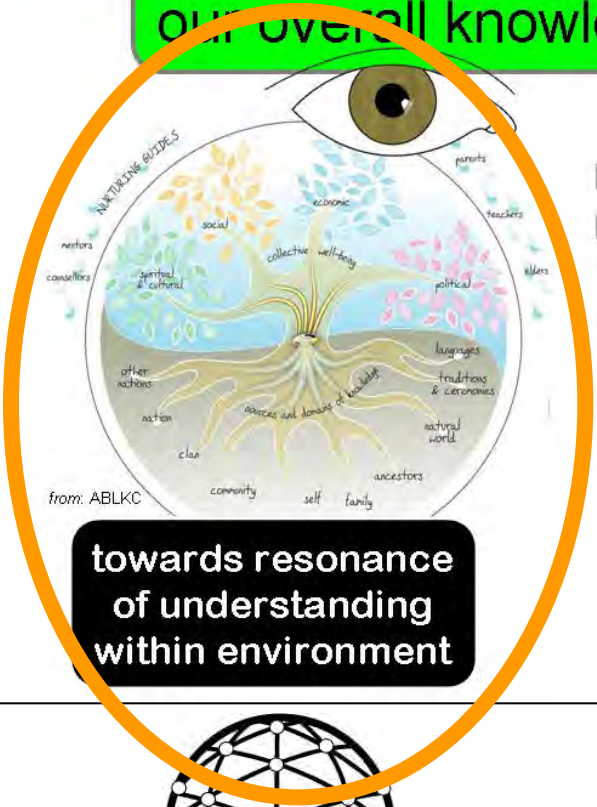
outer



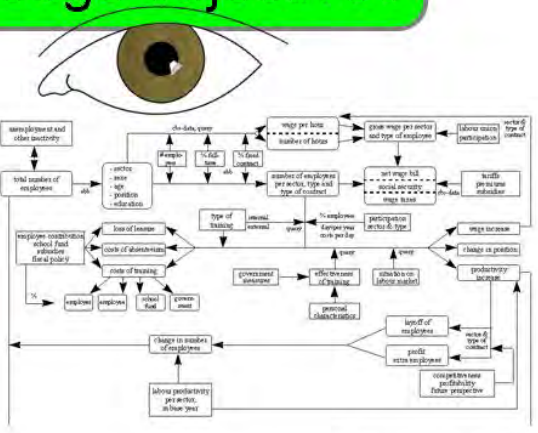
# PATTERN CONCEPTUAL FRAMEWORK

outer

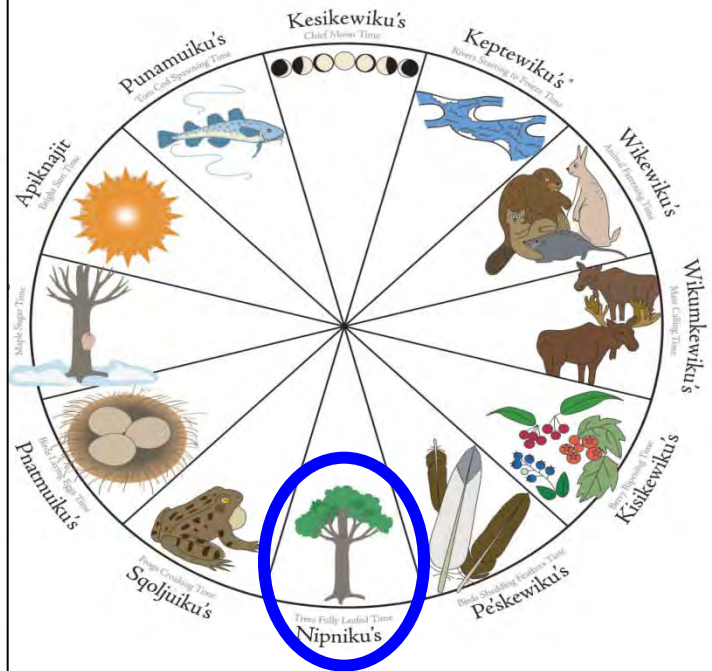
**Two-Eyed Seeing**  
our overall knowledge objectives



towards resonance  
of understanding  
within environment



towards construction  
of understanding  
of environment



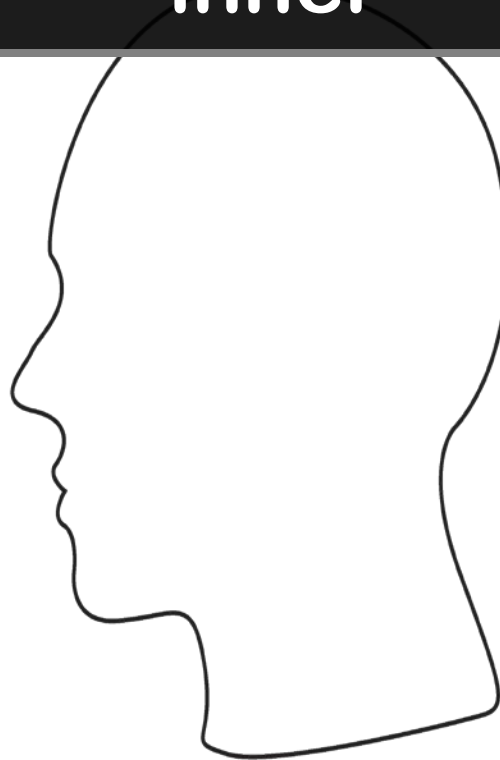
# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

**X**



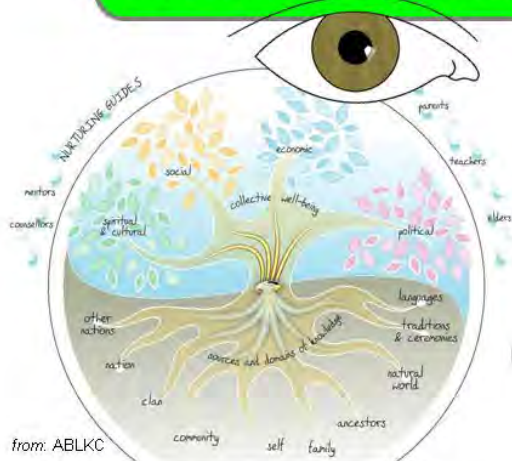
**June**

... in honour of  
"Juno", the  
Roman Queen  
of the Gods

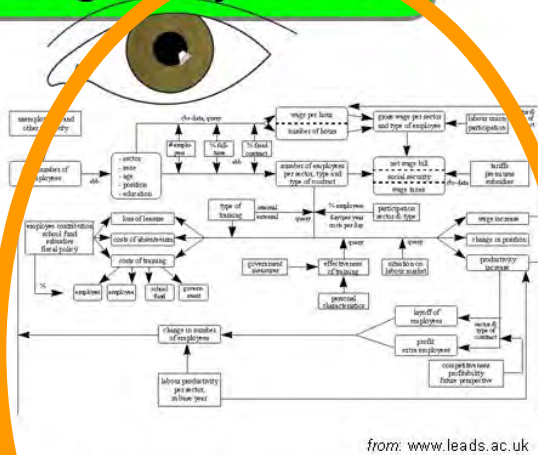
# PATTERN CONCEPTUAL FRAMEWORK

outer

**Two-Eyed Seeing**  
our overall knowledge objectives



towards resonance  
of understanding  
within environment



towards construction  
of understanding  
of environment

June

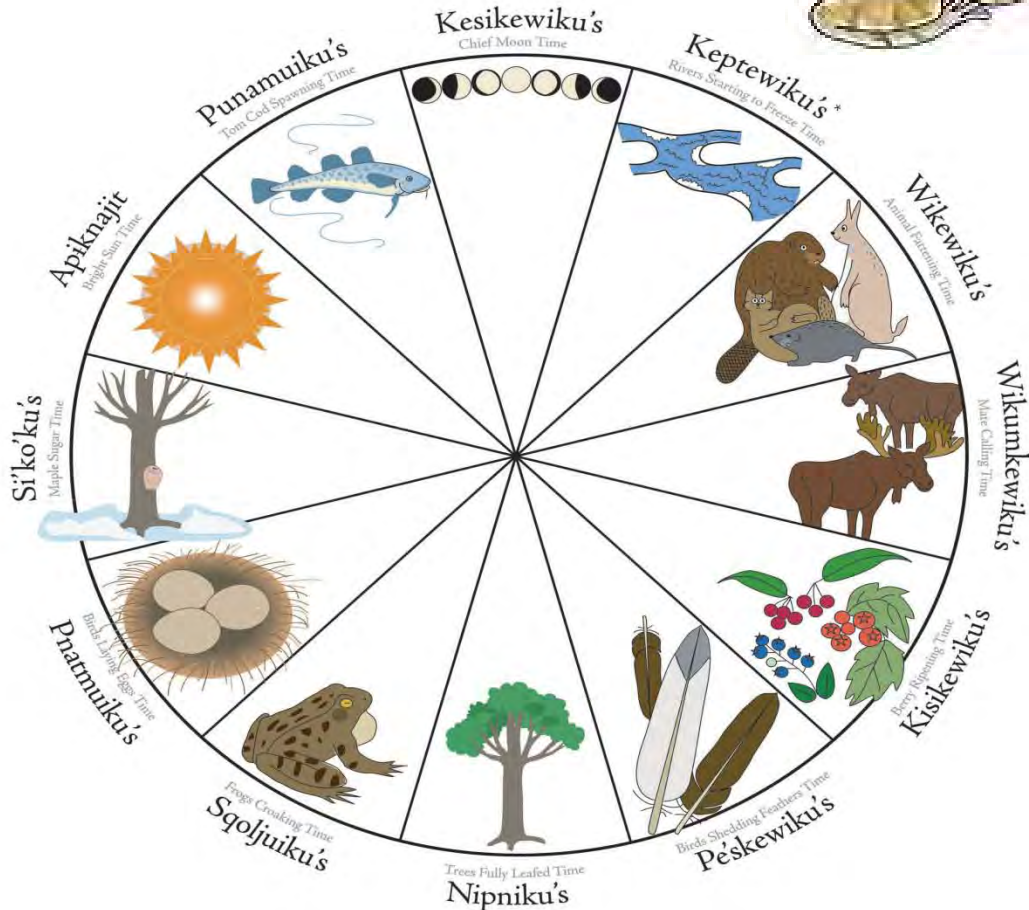
... in honour of  
"Juno", the  
Roman Queen  
of the Gods





# Welcoming Indigenous Knowledge into Science

## biology



### ECOSYSTEM HEALTH CONSCIOUSNESS

Difference, Pattern, Variation

TOQWA'TUKI KIJITAQNN • INTEGRATIVE SCIENCE

#### Frogs of Unama'ki

<b>Mink Frog</b>		<b>Mink Frog • <i>Rana septentrionalis</i></b> Mink Frog is green with many dark markings and is 4 - 7 cm long. He gets his common name from his mucky colors; he smells like a mink. Mink Frogs sing sounds like pieces of wood being tapped together... "TAC TAC". While other frogs live on both land and water, Mink Frog spends most of his life in the water. He prefers permanent bodies of water like ponds and lakes. Female Mink Frog lays 2000 to 4000 eggs in a round jelly mass. The jelly mass is attached to an underwater plant stem or submerged log. Mink Frog eats dragonflies, damselflies, water beetles, aphids, minnows, tadpoles, snails, mollusks, and spiders.
<b>Green Frog</b>		<b>Green Frog • <i>Rana clamitans</i></b> Green Frog is green with just a few brown markings on its back and legs and has a dark belly marked with dark streaks. Male Green Frog has a bright yellow throat and is 6 - 10 cm long. Green Frogs sing sounds like a loose hinge being jiggled, or like a woodpecker dropping into water... "LUNK LUNK". Green Frog prefers to be close to water, and spends its life at the edge of trees, ponds, lakes or streams. Female Green Frog lays 1000 to 4000 eggs in a long jelly mass that floats on the surface of the water like a raft. Green Frog eats beetles, flies, caterpillars, grasshoppers, spiders, snails, slugs, waterbugs, tadpoles, and sometimes other small frogs.
<b>Pickerel Frog</b>		<b>Pickerel Frog • <i>Rana palustris</i></b> Pickerel Frog is light brown with many dark blotches on his back and legs. He is 4 - 7 cm long. Pickerel Frog sings sounds like something rattling on the level of someone slowly pushing open a crate door... "ARRIP-ARRIP". Pickerel Frog lives on the shores of ponds or lakes or on the banks of streams, often staying near permanent bodies of water or flooding areas. However, he will also live in moist fields, bogs, or swamp woods. Female Pickerel Frog lays her eggs in a round jelly mass attached to a plant or rock below the surface of the water. She can lay as many as 800 to 1800 eggs at a time. Pickerel Frog eats beetles, ants, spiders, caterpillars, snails, slugs, water bugs, and many small water creatures.
<b>Eastern American Toad</b>		<b>Eastern American Toad • <i>Bufa americana</i></b> Toad is a plump creature with warty skin and rough, warty skin. He is usually brownish, with darker brown or black markings. Toad has a girth belt with dark spots that become more distinct as he grows. Toad can grow to be 3 - 13 cm long. Toad lives in many different places, for example, in the middle of a field, in a field or meadow, or in a forest. Toad sings sounds like a long, high rattling sound... "WRRR". Female Toad produces temporary ponds for breeding. She lays 4000 to 8000 eggs in a round jelly mass that floats on the surface of the pond or puddle. Toad eats many kinds of insects like caterpillars, crickets, snails, water bugs, and other insects.
<b>Northern Spring Peeper</b>		<b>Northern Spring Peeper • <i>Pseudis crepitans</i></b> Spring Peeper is our smallest frog; he grows to 2 - 4 cm long. We know Spring Peeper from the sound he makes in the spring: Spring Peeper sings at night. His song sounds like a high "PEEP". Spring Peeper lives in the woods near ponds, marshes or swamps. He is our only tree frog and can change the colour of his skin to blend in with his surroundings. Female Spring Peeper lays 400 to 1500 eggs in a round jelly mass in an underwater plant or rock. Spring Peepers, like other frogs, often shed their skin and then eat it. However, most of the time he can digest the spiders, ants, tree toads, katydid, crickets, and small insects.
<b>Northern Leopard Frog</b>		<b>Northern Leopard Frog • <i>Rana pipiens</i></b> Leopard Frog is a slim, green frog 7 - 9 cm long. He has warty skin, spots that are often ringed with bright green or brown, and can make his skin dark to match his surroundings. Leopard Frog sings sounds like a low rumbling sound followed by a throaty growl... "GAAH HAAH HAAH". Leopard Frog lives in fields, meadows, grassy areas, woods, and grassy wetlands. Female Leopard Frog lays 2000 to 4000 eggs in a diamond-shaped jelly mass. She prefers to lay her eggs in shallow water on the edge of lakes, ponds, or slow-moving streams. Leopard Frog eats beetles, aphids, snails, slugs, worms, and sometimes tadpoles.
<b>Wood Frog</b>		<b>Wood Frog • <i>Rana sylvatica</i></b> Wood Frog is a small frog 6 cm long, with a dark oval across his face. Wood Frog sings sounds like the soft click of a stick. "GWAK". Wood Frog lives mostly on land in wooded places (hence his name). Wood Frog prefers temporary ponds for breeding, for example, log piles, ditches filled with water, or swampy areas. Female Wood Frog lays 500 to 1200 eggs in a round jelly mass. Wood Frog eats spiders, snails and slugs, earthworms, caterpillars, beetles, and other bugs.

**MEKAMU'KI KIJITAQNN • Frog Croaking Time • "Moon Month" of May**  
Earth has been water-rich at ponds, ditches, swamps, and small lakes or streams. Frog eggs metamorphose (change) into tadpoles over 1 to 3 weeks, and tadpoles of most species come out of their shells within 2 to 3 months.  
Many other natural patterns occur during Sqoljuiku's, with change out of the mud, tadpoles emerging from the streams, mayflowers and goldfinch bloom, baby eagles peek out of nests, and marsh grasses show new growth.

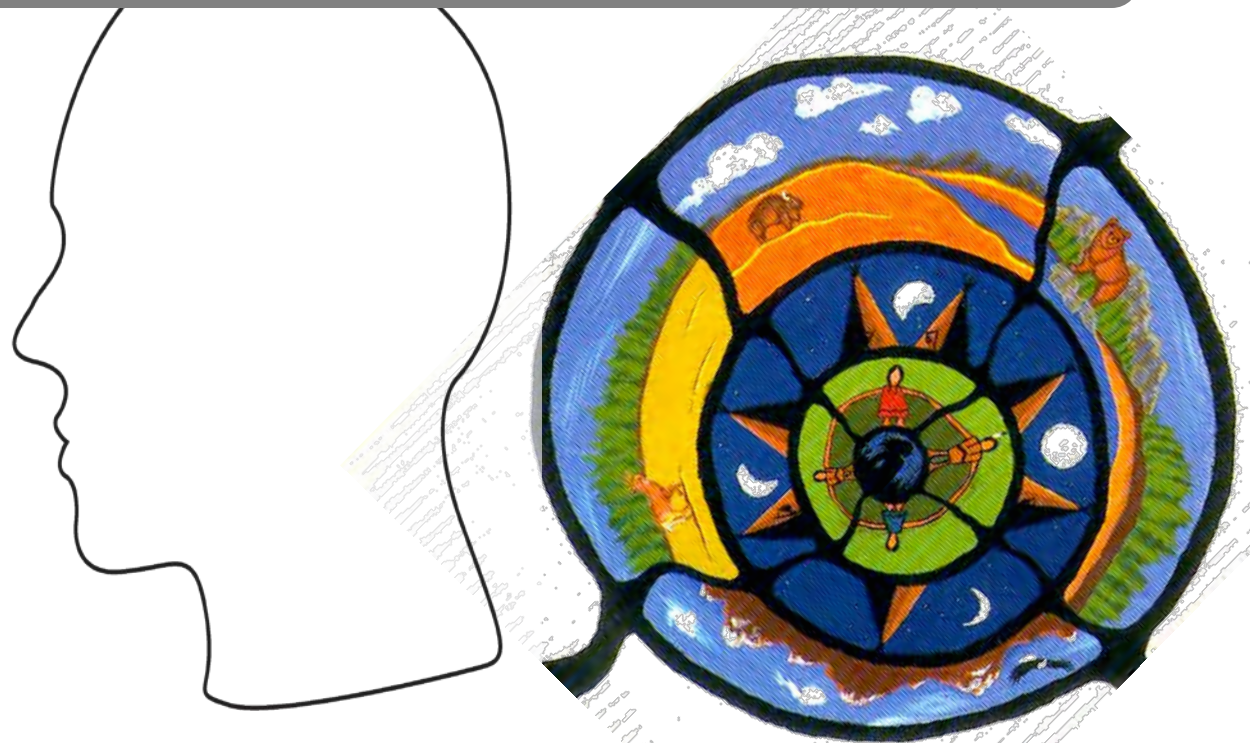
# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

*“human  
health”*



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

# PATTERN CONCEPTUAL FRAMEWORK

outer

Two-Eyed Seeing  
our languages & methodologies



vigour

**WEAVING**



rigour

**UN-WEAVING**



Artist: Rod Restoule  
from: Into the Daylight;  
C. Morrisseau, 1998

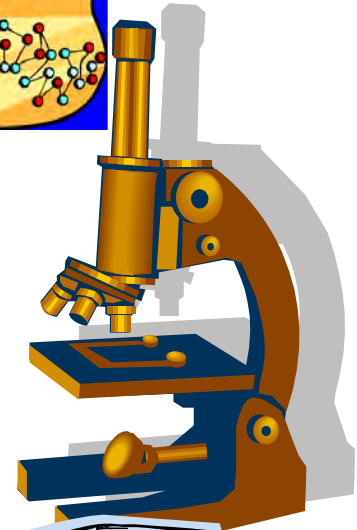
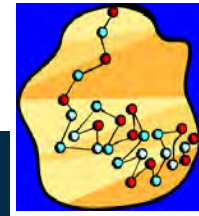
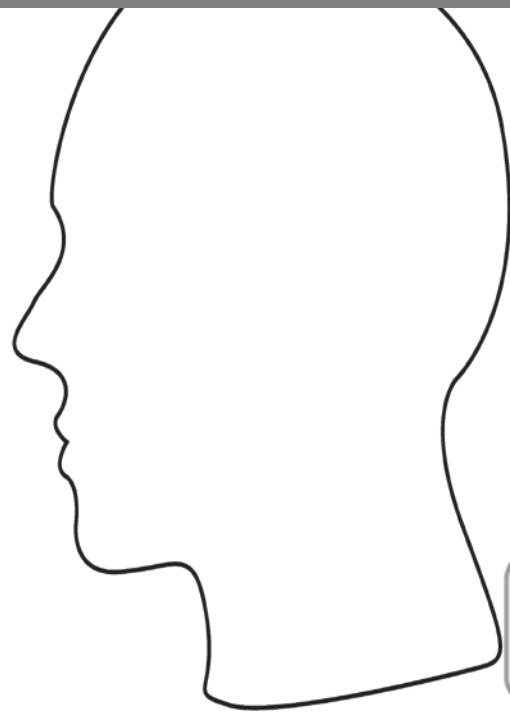
# PATTERN CONCEPTUAL FRAMEWORK

outer

inner

outer

*“human health”*



# PATTERN CONCEPTUAL FRAMEWORK

outer

Two-Eyed Seeing  
our languages & methodologies



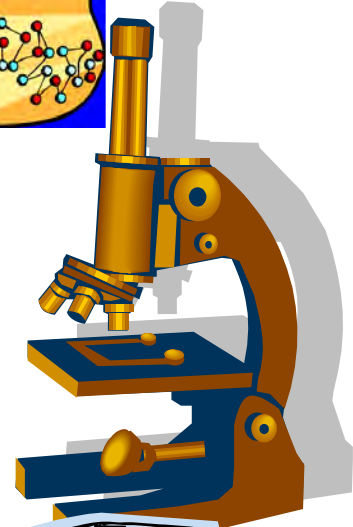
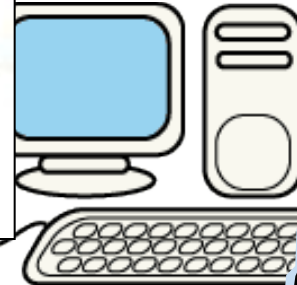
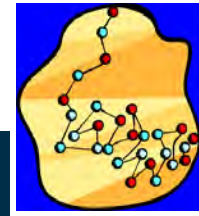
vigour

**WEAVING**



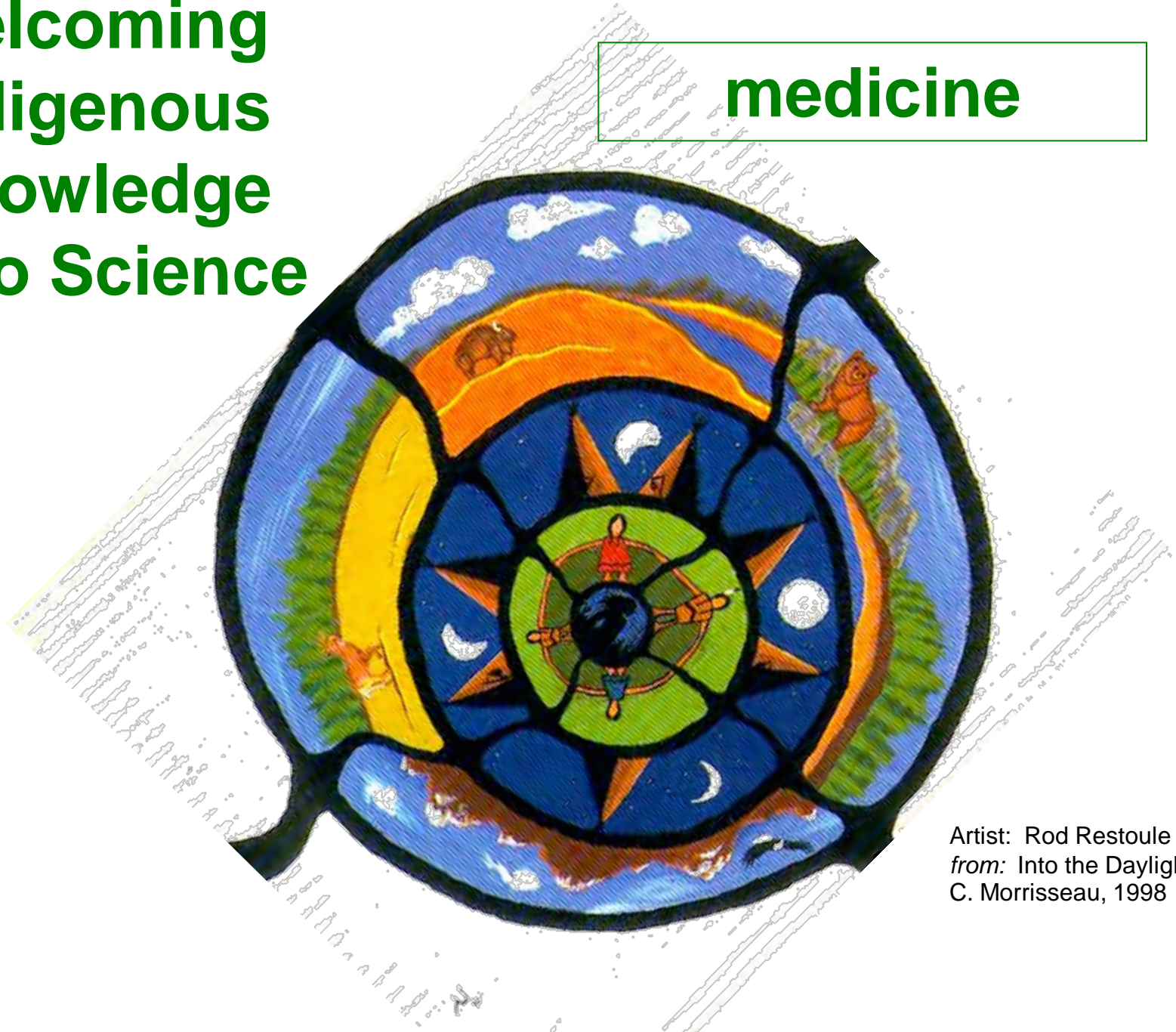
rigour

**UN-WEAVING**



# Welcoming Indigenous Knowledge into Science

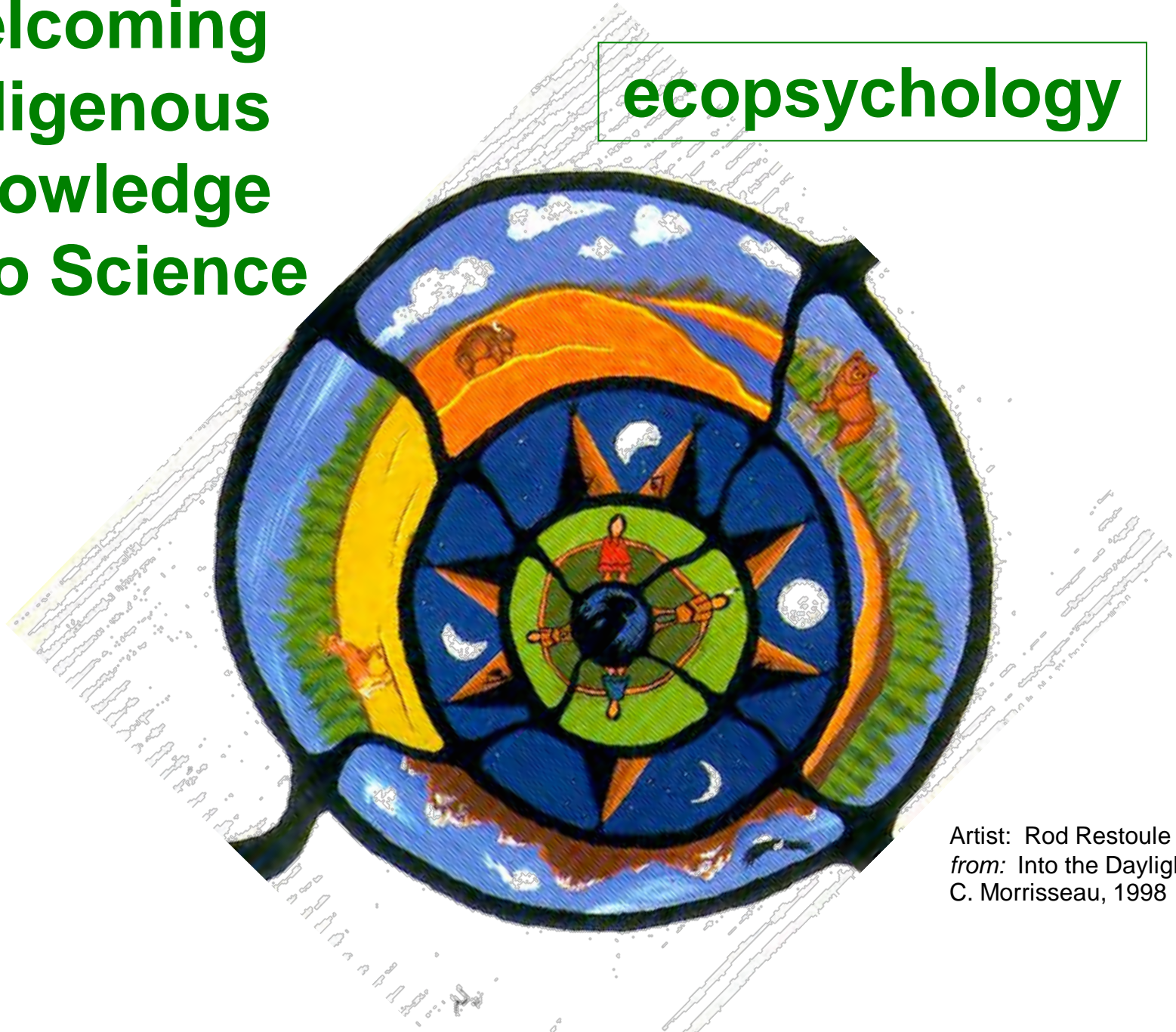
medicine



Artist: Rod Restoule  
from: Into the Daylight;  
C. Morrisseau, 1998

# Welcoming Indigenous Knowledge into Science

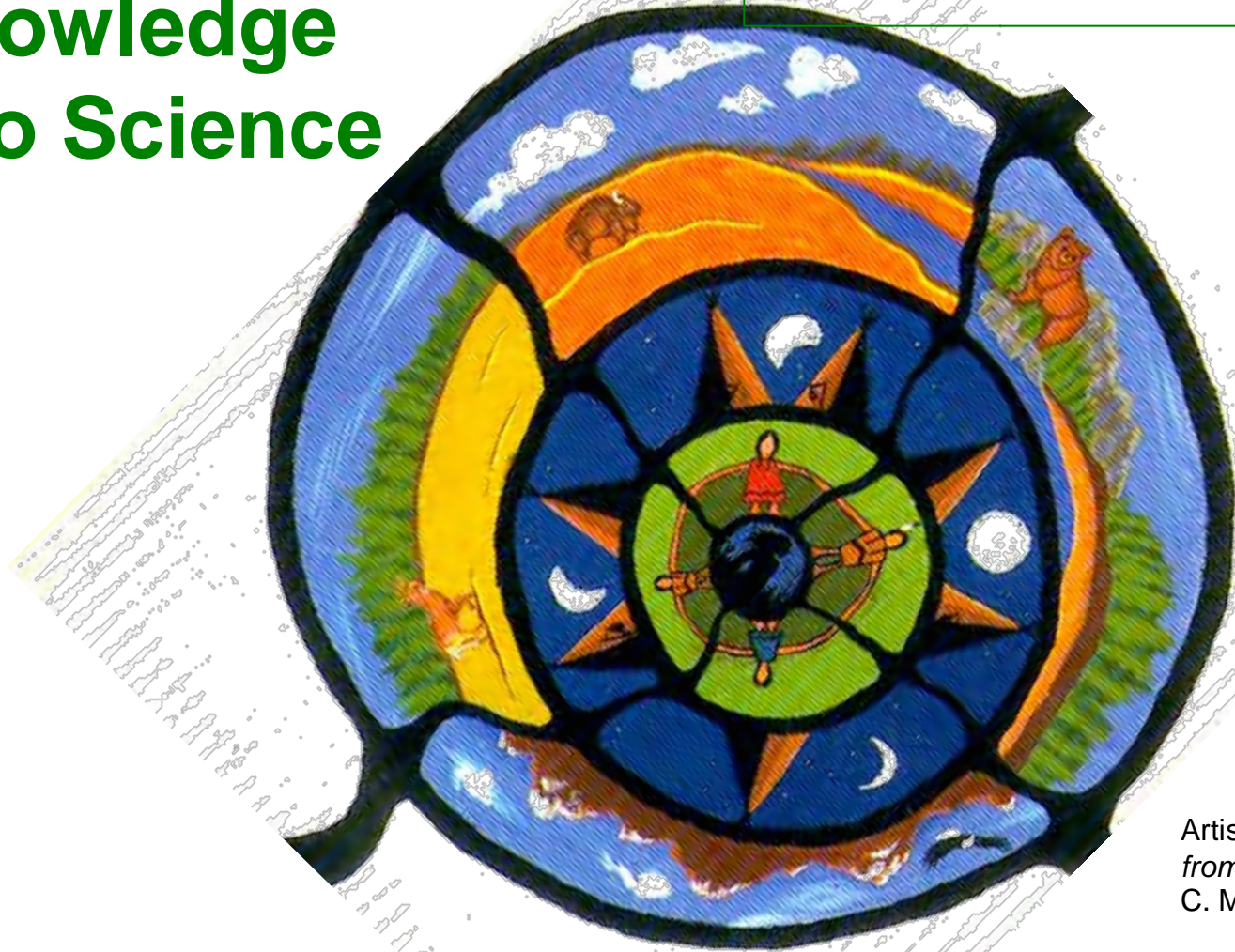
ecopsychology



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

**Welcoming  
Indigenous  
Knowledge  
into Science**

**ecosystem  
stewardship**



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



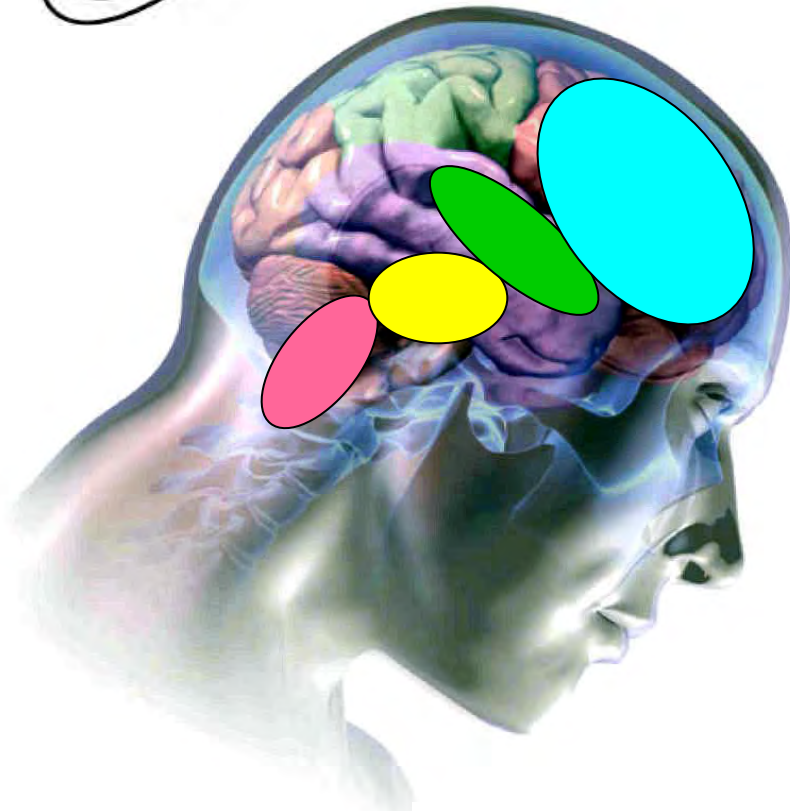
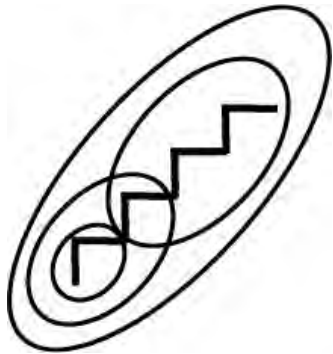
# Welcoming Indigenous Knowledge into Science

neuropsychology



EARLY  
CHILD  
DEVELOPMENT

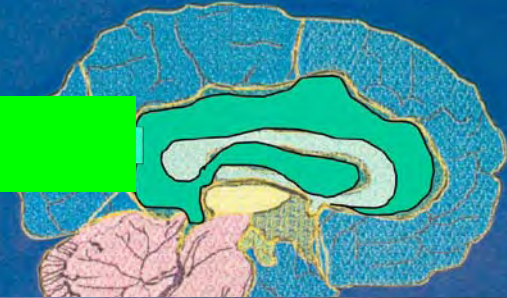
*from:*  
Mi'kmaq Family  
& Children's  
Services



neocortex



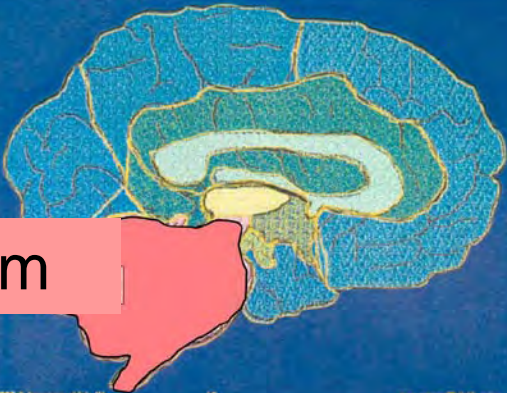
limbic



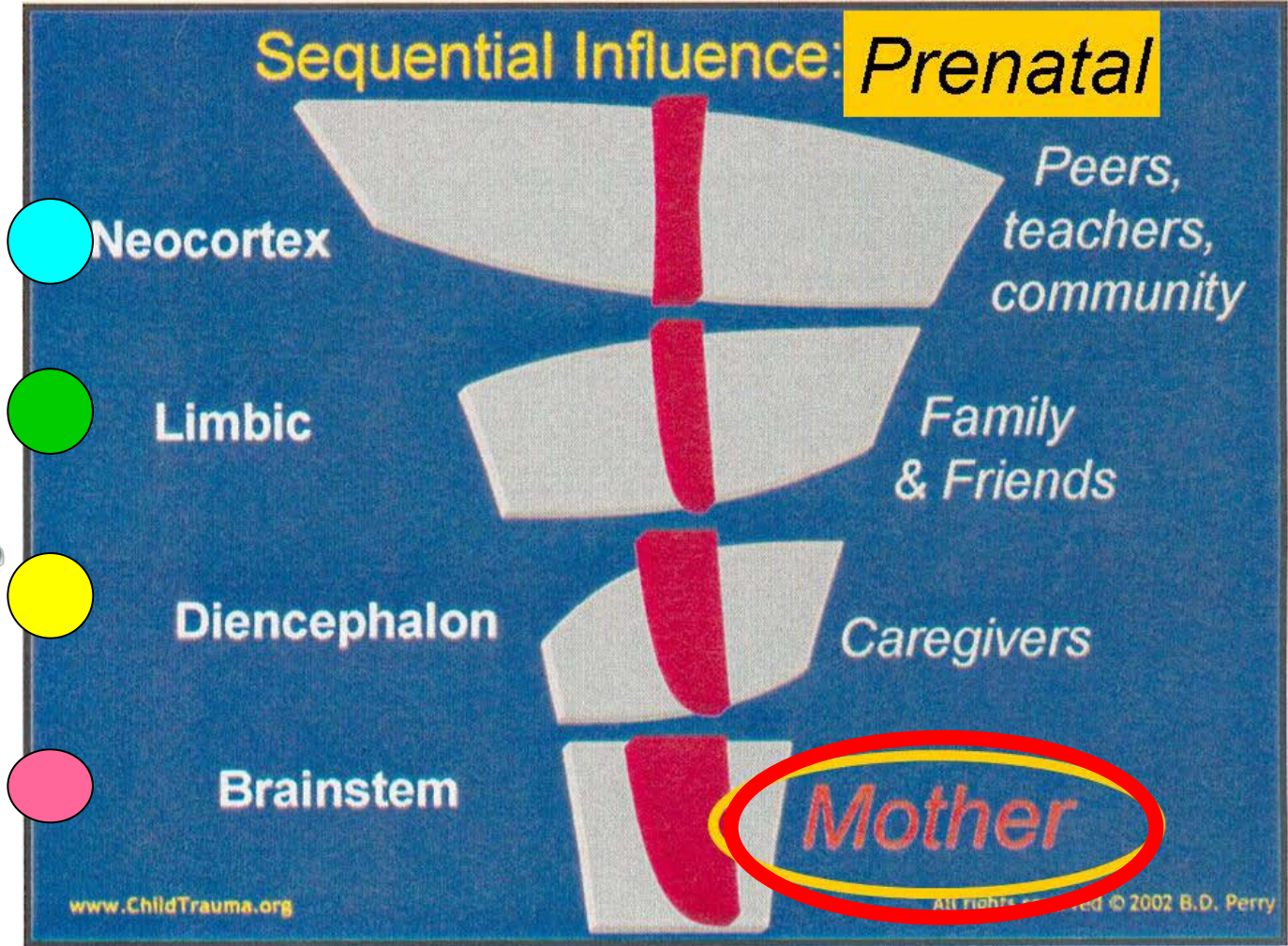
diencephalon

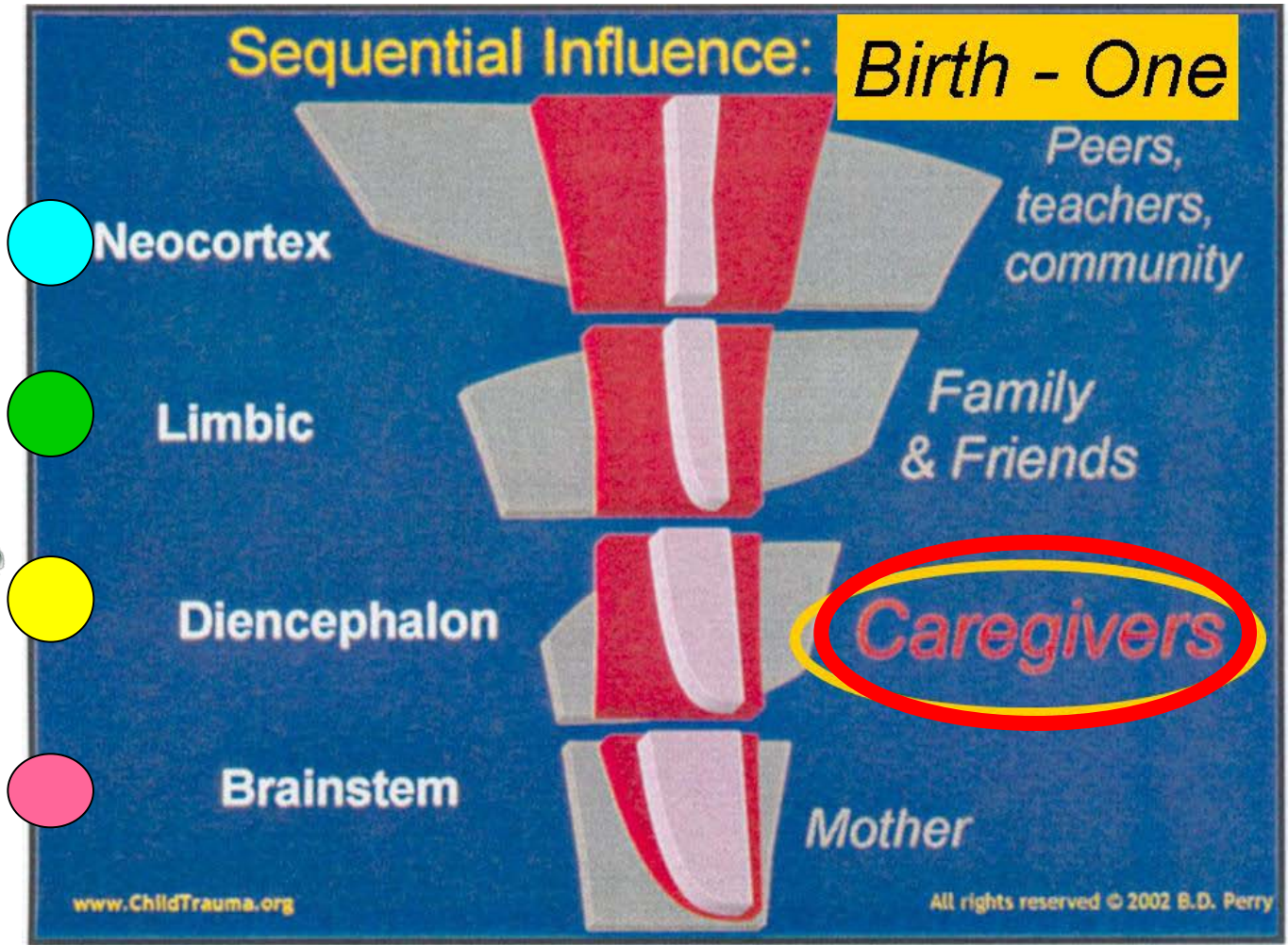


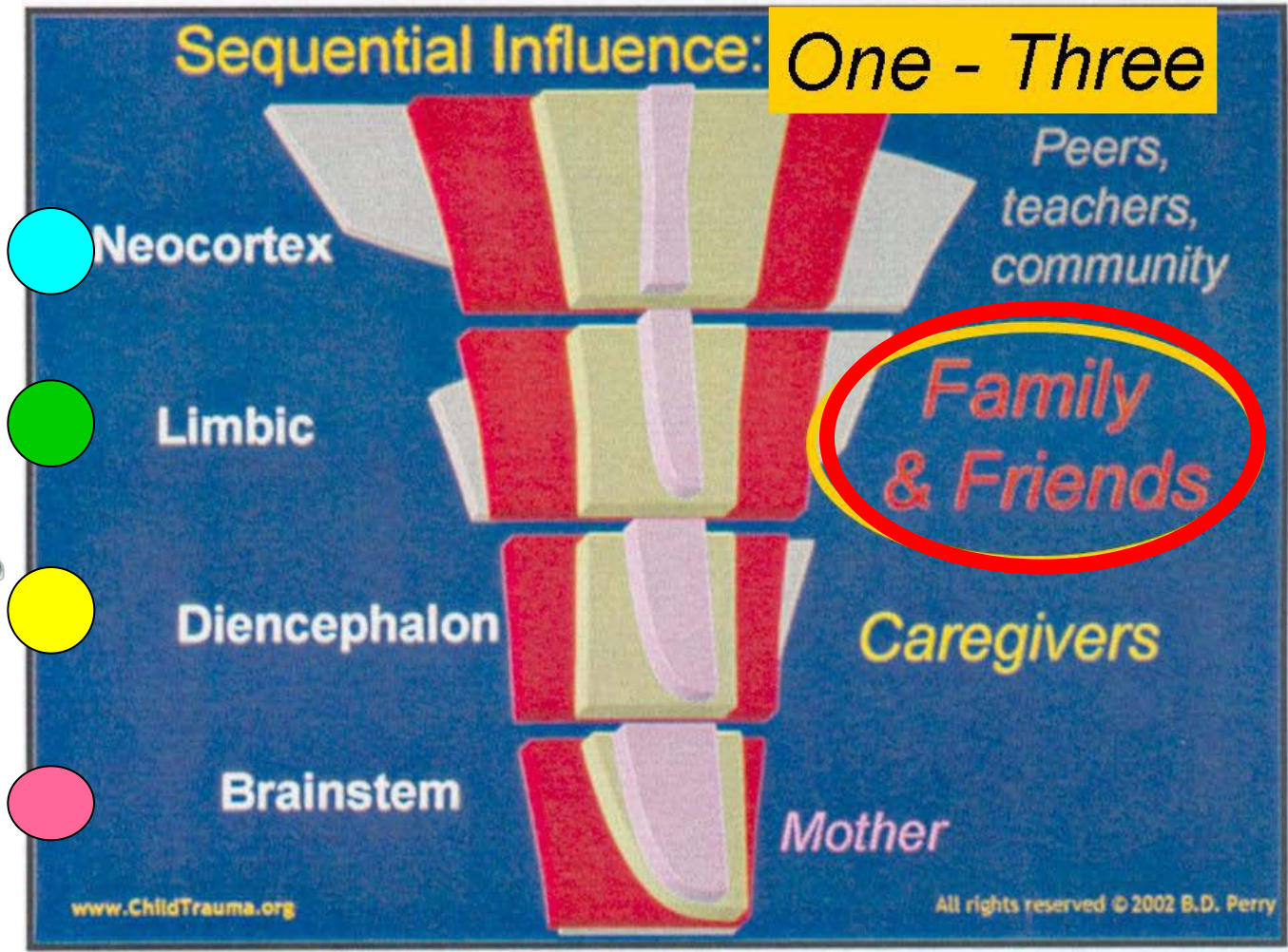
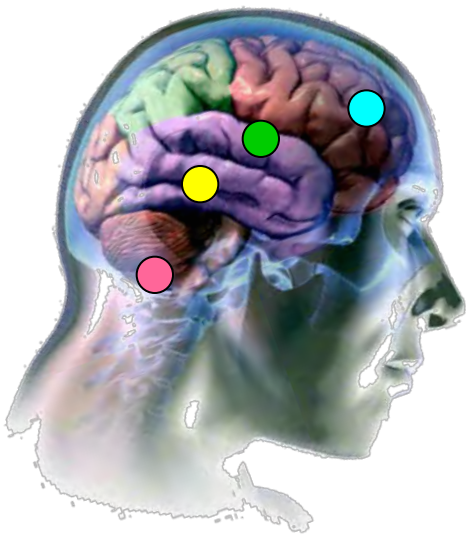
brain stem



adapted from: [www.childtrauma.org](http://www.childtrauma.org)







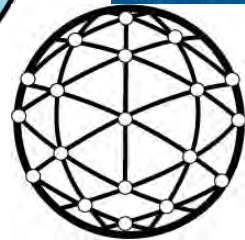
# Sequential Influence: *Three - Ten*



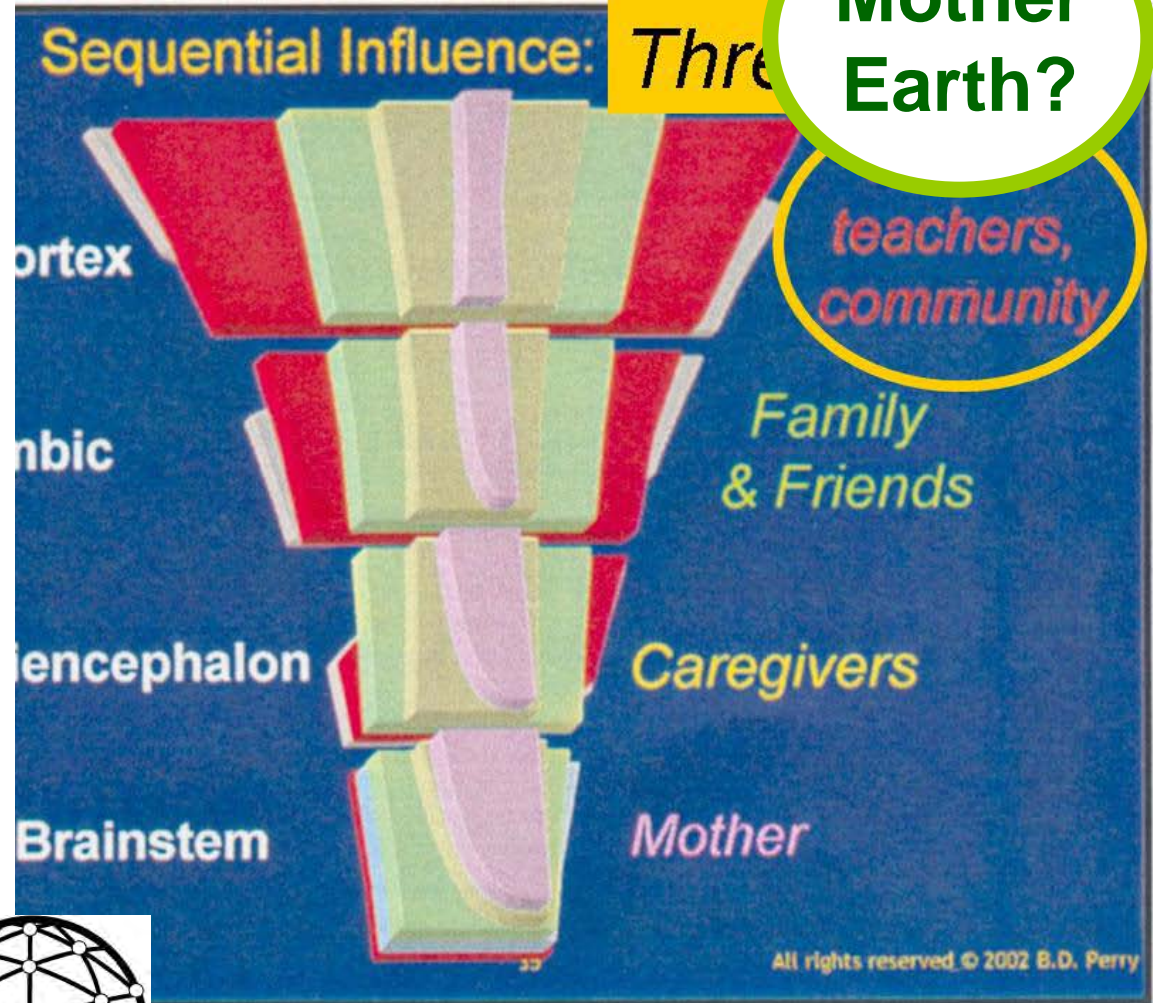
# Welcoming Indigenous Knowledge into Science



from:  
Mi'kmaq Family  
& Children's  
Services



## neuropsychology



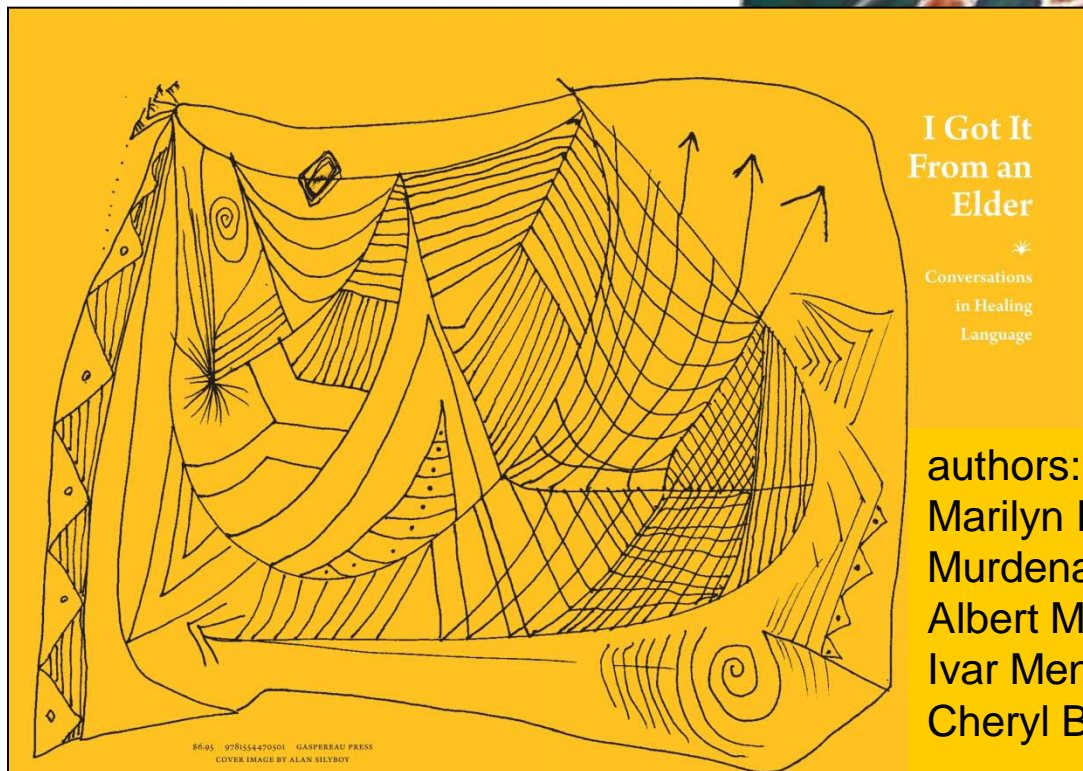
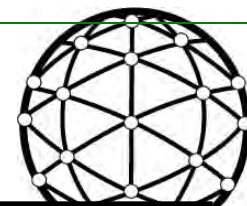
Mother  
Earth?

adapted from: [www.childtrauma.org](http://www.childtrauma.org)

# Welcoming Indigenous Knowledge into Science

neuropsychology

linguistics



I Got It  
From an  
Elder

✧  
Conversations  
in Healing  
Language

authors:  
Marilyn Iwama  
Murdena Marshall  
Albert Marshall  
Ivar Mendez  
Cheryl Bartlett

86-95 9780554470501 GASPHEREAU PRESS  
COVER IMAGE BY ALAN SYLIBOY

I Got It  
From an  
Elder

✧  
Conversations  
in Healing  
Language

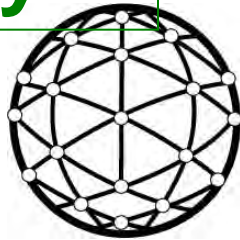
artwork by Alan Syliboy; published by Gaspereau Press Limited



# Welcoming Indigenous Knowledge into Science

astronomy

ecosystem  
biology



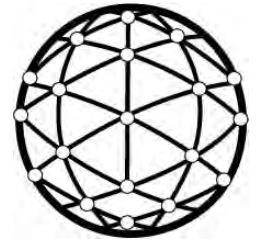
*from:* artist Gerald Gloade,  
Millbrook First Nation



# Welcoming Indigenous Knowledge into Science

chemistry

using the brain  
to tan the hide ...



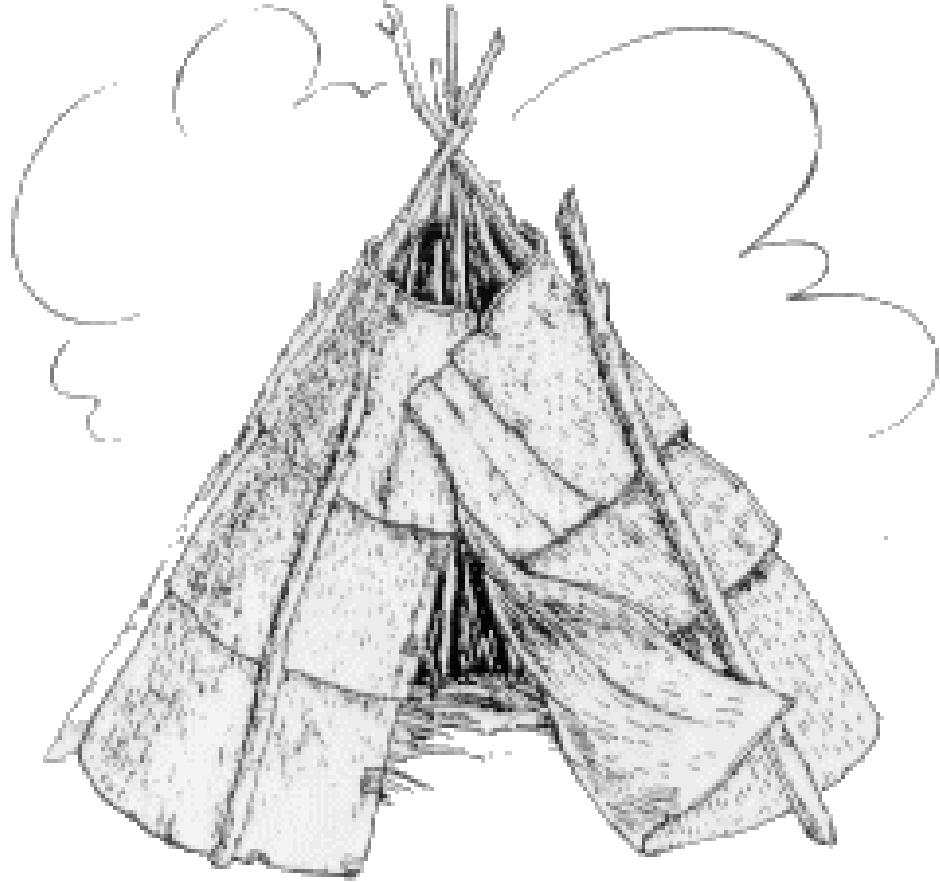
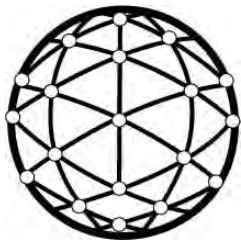
from: [www.chrisharris.com/gallery/g-bull-moose.jpg](http://www.chrisharris.com/gallery/g-bull-moose.jpg)



# Welcoming Indigenous Knowledge into Science

engineering

forestry



from: <http://museum.gov.ns.ca/arch/infos/teepee.gif>

# “Two-Eyed Seeing”

learning to see with the strengths of each & together



Indigenous



Western



Mr. Albert Marshall, Mi'kmaq Elder  
Eskasoni First Nation

# Welcoming Indigenous Knowledge into Science

**1 Two-Eyed Seeing**  
our key concepts & actions

<ul style="list-style-type: none"> <li>- respect</li> <li>- relationship</li> <li>- reverence</li> </ul>	<ul style="list-style-type: none"> <li>- hypothesis (making &amp; testing)</li> <li>- data collection</li> </ul>
--	--

**2 Two-Eyed Seeing**  
our languages & methodologies

**3 Two-Eyed Seeing**  
our overall knowledge objectives

**4 Two-Eyed Seeing**  
our world is

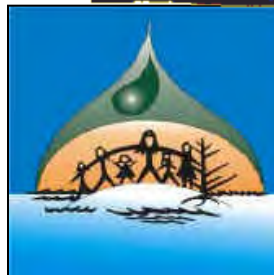
interconnective      parts & wholes



This poster is called Pemi Pungek Mi'kma'ki, which means one continuous year in the Mi'kmaq traditional territory. On the outside, it shows the four seasons and the 12 months of the year. On the inside, it shows the land, water, and sky over a full year. The pictures of plants, animals, and weather show the order of changing events in nature. The pictures of people show when to do traditional and modern activities. Read this poster in a circle to see the rock of the seasons. Spring is on the left, summer is on the bottom, fall is on the right, and winter is on the top.

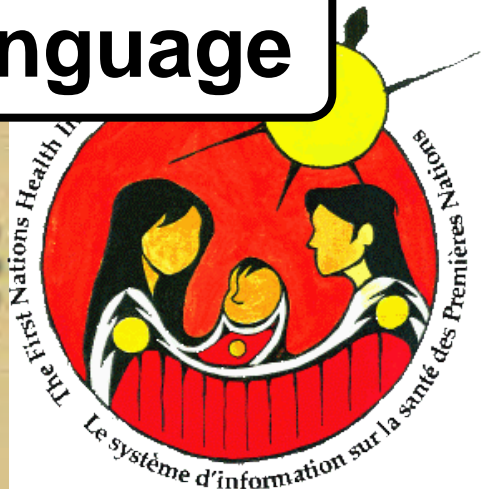
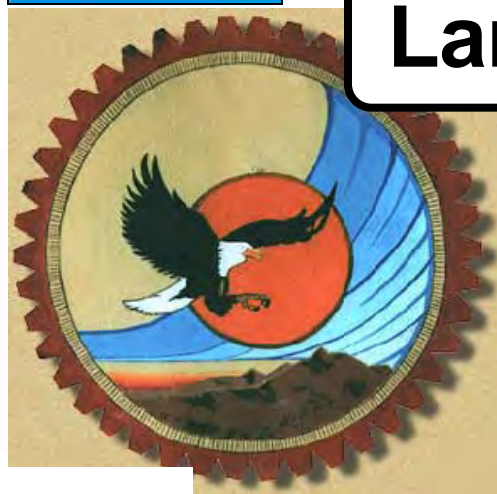
stories of our interactions with and within nature

# Science



Life  
Love  
Land

Language



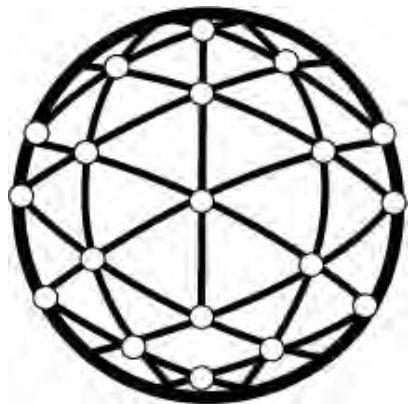
logos from: Aboriginal organizations, various sources

stories of:

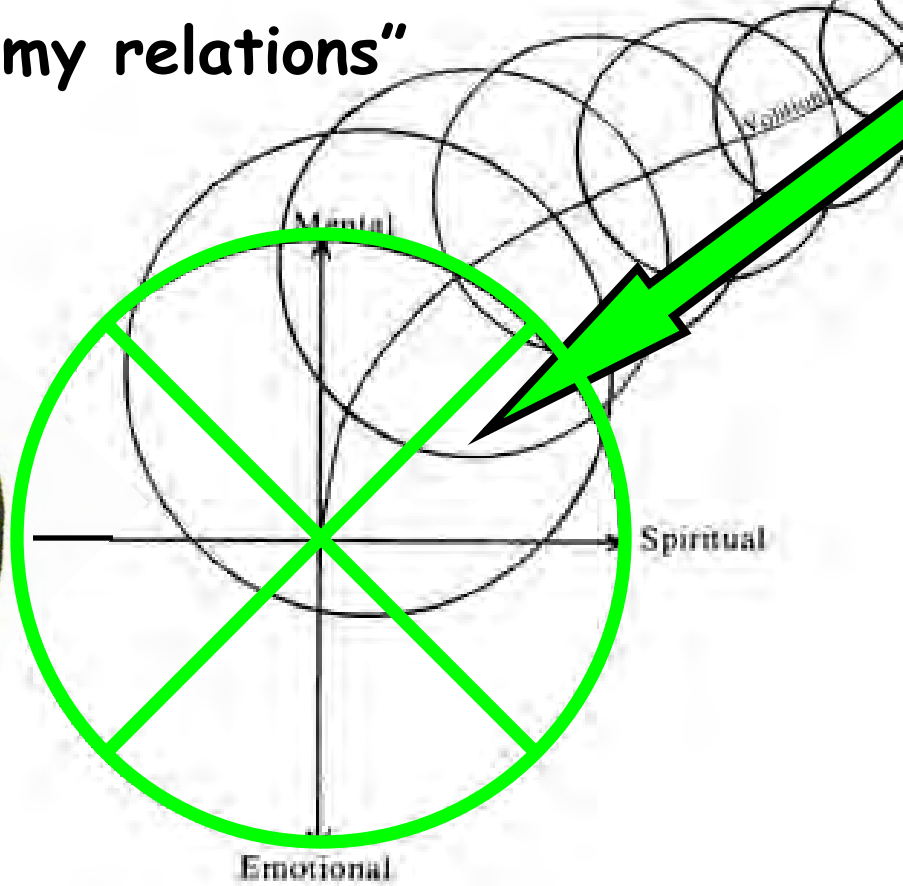
**interconnectiveness**

"all my relations"

Visual 



Artist: Rod Restoule  
from: Into the Daylight;  
C. Morrisseau, 1998



**stories of our interactions with and within nature**





# Universe: Visible Matter (levels of organization - biology)

H																	He									
Li	Be											B	C	N	O	F	Ne									
Na	Mg											Al	Si	P	S	Cl	Ar									
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Cobalt	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr									
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe									
Cs	Ba	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn										
Fr	Ra	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq	Unq									
		La	Ce	Pr	Nd	Pm	Sm											Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
		Ac	Th	Pa	U	Np	Pu											Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

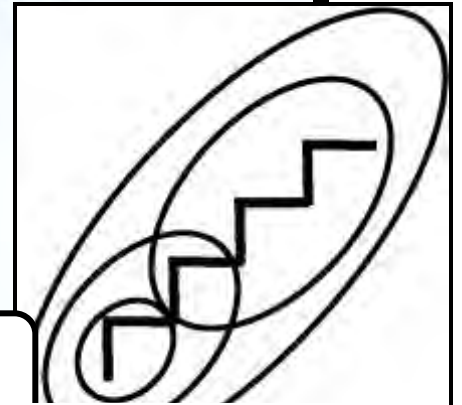
Setford, Steve. 1996. Science Facts. Firefly Books Ltd., Willowdale, ON. (pp. 36-37)



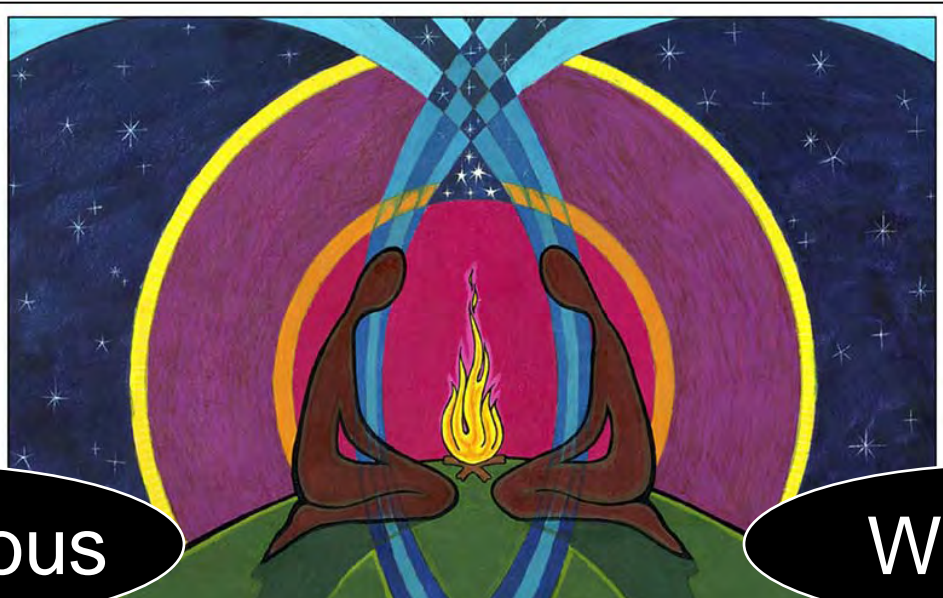
- Universe
- super clusters (Local)
- clusters (Local Group)
- galaxies (Milky Way)
- star systems (Sun)
- planet Earth
- ecosystems
- communities
- populations
- organisms
- organ systems
- organs
- tissues
- cells
- organelles
- molecules & minerals
- atoms (natural elements #1-92; artificial elements #93 & higher)
- baryons (neutrons & protons)
- fundamental particles (quarks & leptons)

stories of:

parts & wholes



stories of our interactions with and within nature



Indigenous

Western

“bringing our sciences together”

**Science**

 A collage of various Indigenous science-related images. At the top left is a quill pen. Below it is a circular logo with the text "Welcome to ACCHS Regional Aboriginal Health Team". To the right is a map of Australia with a red sun and a white figure. Further right is a globe with a person and a bird. Below these are several other circular and rectangular images, including a person holding a staff, a person in a boat, and a person with a staff. A central black circle contains the text "Life Love Land". At the bottom right is a circular logo with the text "The Nations Health Information System" and "Le système d'information sur la santé des Premières Nations".

**Science**

 A standard periodic table of elements, color-coded by groups. The elements are arranged in rows and columns, with their symbols and names. The table is titled "Periodic Table of the Elements" at the bottom.

stories of our interactions with and within nature

Canada Research Chairs / Chaires de recherche du Canada

Social Sciences and Humanities Research Council of Canada / Conseil de recherches en sciences humaines du Canada



Wela'ioq / Thank you



Mi'kmaq Elders

