

Reclaiming Our Science

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BY CHERYL BARTLETT, PhD

In the mid 1990s, a small group of visionaries from the Mi'kmaq community of Eskasoni and Cape Breton University (CBU) gathered together to develop meaningful new actions aimed at reversing the fact that very few Mi'kmaq students could be found in post-secondary science programs anywhere in Atlantic Canada. This low to non-existent participation in university level science was worrisome in the face of the rapidly increasing needs in all Mi'kmaq communities for scientifically-educated personnel in sectors such as health and medical services, natural resource planning and management, and elementary through high school education. Furthermore, this was vexing; for thousands of years prior to the arrival of Europeans, the Mi'kmaq people were the scientists of Atlantic Canada – they had rich and complex knowledge about the medicines, the plants, and the animals in their waters, lands, and skies and they transmitted and enriched this knowledge, generation to generation, via highly effective, traditional modes of teaching and learning.

It was from these basic understandings and visionary goals that a new approach to post-secondary science, to be called *Toqwa'tu'kl Kijijitaqnn* (in Mi'kmaq) and Integrative Science (in English), emerged at CBU.

Toqwa'tu'kl Kijijitaqnn is a program within the four-year Bachelor of Science Community Studies (BScCS) degree, and numerous people at the university and within the Mi'kmaq Nation bring energies to its ongoing efforts. The foundational ideas employed in the conceptual development of *Toqwa'tu'kl Kijijitaqnn* were: bring Indigenous and Western scientific knowledges and ways of knowing together in the science curriculum, teach in an integrated way the knowledges from the various disciplines of Western science, include consciousness as a central curricular topic, and employ a holistic pedagogy that emphasizes all aspects of being human, namely the physical, emotional, cognitive, and spiritual. It was recognized at the outset that new, customized science courses would need to be created as vehicles to implement these ideas, the MSIT courses described in a companion article. Students in the *Toqwa'tu'kl Kijijitaqnn* program must also take other regular university credit courses in several disciplines and complete two science work placements. The *Toqwa'tu'kl Kijijitaqnn* program was developed to attract a diverse range of students, particularly in the environmental fields.

The proposal for the innovative *Toqwa'tu'kl Kijijitaqnn* program was initially submitted to CBU in June 1997 and finally approved by the Maritime Provinces Higher Education Commission in February 2001. The first cohort of students arrived in Fall 1999, entering a "pilot offering". Spring 2003 saw the first graduates of the degree program.



Cheryl Bartlett, PhD is the Canada Research Chair in Integrative Science (as well as a Professor of Biology, and Director, Institute for Integrative Science & Health) at Cape Breton University.

In all that has transpired in the past decade with respect to the Integrative Science journey, the core element has always been the "bringing knowledges together" from Indigenous and Western world views, and especially as this pertains to their scientific knowledges and ways of knowing. Indeed, this "bringing knowledges together" is the English translation of the Mi'kmaq phrase "*Toqwa'tu'kl Kijijitaqnn*".

The very first "key lessons learned" in our journey towards this goal

► First year Integrative Science students hike the trail behind campus to collect natural materials to use in a natural dye lab

Integrative Science: its learning journey towards



"Two-Eyed Seeing" refers to a traditional Mi'kmaq teaching that highlights the importance of an individual striving to see from more than just one perspective

were that: (1) we need to acknowledge that we need each other; and (2) we need to acknowledge we are on a learning journey, indeed a *co-learning journey*. Key individuals in the co-learning journey come from both the university and Aboriginal communities. Today, Integrative Science at CBU works most extensively with various Mi'kmaq Elders in Unama'ki-Cape Breton, as well as with the Unama'ki Institute of Natural Resources based in Eskasoni. And, in that the visionary efforts of Integrative Science have outgrown its early home within an undergraduate academic program, the newly-created **Institute of Integrative Science and Health** at CBU will assist the on-going, co-learning journey and expansion of Integrative Science to the national and international levels.

Program advisor and Mi'kmaq Elder Albert Marshall of Eskasoni First Nation recently provided the phrase "Two-Eyed Seeing" to help enrich the labels for and understandings within Integrative Science as it expands its visionary efforts. "Two-Eyed Seeing" refers to a traditional Mi'kmaq teaching that highlights the importance of an individual striving to see from more than just one perspective. This teaching is particularly relevant for Integrative Science and its on-going, co-learning journey. Those of us involved want ... for the sake of our youth, our communities, and Mother Earth ... that we learn to see from our one eye with the strengths of Indigenous knowledges and from our other eye with the strengths of mainstream scientific knowledges ... and that we use these together for the benefit of all ... as "Living Knowledge for the 21st Century."

The Integrative Science extended family currently includes many people:

- Mi'kmaq Elders, including the core team of Albert and Murdena Marshall, Diana Denny, Jane Meader, and Laurence Wells, plus many others from all five Mi'kmaq bands in Cape Breton who have participated through community workshops or other events;
- Environmental practitioners and managers including Charlie Dennis, Laurie Sutor, and Clifford Paul, Unama'ki Institute of Natural Resources;
- University faculty and staff at CBU including Cheryl Bartlett (Canada Research Chair in Integrative Science), Rod Beresford, Annamarie Hatcher, Chantelle Cormier, Kazimiera Mizier-Barre; and
- Integrative Science researchers and students including Marilyn Iwama, Nancy Comeau, Diane Ingraham, Andrew Sark, Andrea Bungay, Yvonne Mosley, Sana Kavanagh, Nadine Lefort, Kristy Read, Janice Basque, Michael Denny, Dave Forrester, and Sean Howard.
- CBU's past and present students, including the approximately 20 who have worked as Integrative

Science research or teaching assistants over the past seven years, plus dozens more who participated through community workshops or other events.

The Integrative Science extended family gratefully acknowledges that many other individuals and various organizations have supported our journey towards "Living Knowledge for the 21st Century."

MSIT courses in Integrative Science: 'Living knowledge and transdisciplinary Science'

BY ANNAMARIE HATCHER, PhD

MSIT is a Mi'kmaq word meaning 'everything' or 'everything together', and it is the title of the core courses for the Integrative Science program (*Toqwa'tu'kl Kijijitaqnn*) at Cape Breton University. These are science courses which engage students in a holistic understanding of nature, drawing on the strengths of both western and aboriginal scientific knowledge systems. Scientific pursuit in the Western science view is objective, quantitative and usually reductionist. Scientific pursuit in the Aboriginal world view is subjective, non-quantitative, and holistic. At the heart of the pursuit, regardless of world view, are the human abilities to ask questions, recognize patterns, think creatively, think critically, and communicate understandings to others.

The *MSIT* courses were initially developed by Cheryl Bartlett and Murdena Marshall in 1997. Professors and instructors in the *MSIT* courses teach University-level science with a difference.

Content is relevant to the life of the students, the science is organized in several themes, is question-based and transdisciplinary. Students in these classes remain engaged as active learners because they stay interested. The curriculum for the *MSIT* courses centres around a multidisciplinary investigation of eleven themes. Within each theme, classes will explore topics in the context of each course's goals. The themes for the 2006-07 school year are:

- Birds
- The sky
- Cell biology
- Human perception
- Weather and climate
- Parasites and pathogens
- Evolution and adaptation
- Plant biology and ecology
- Animal biology and ecology
- Spirituality (humans in nature)
- The physics and chemistry of everyday life

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Annamarie Hatcher is an Assistant Professor of Integrative Science at CBU, teaching first and third year MSIT courses.

people, visions & achievements on a co- 'Living Knowledge for the 21st Century'

**Knowledge that is current, useful,
relevant, modern**

BY ROD BERESFORD, M.SC. (Ph.d in progress)

The Mi'kmaq people have a deep relationship with and understanding of the Bras D'Or Lakes' (*Pi'tupak*) of Cape Breton Island (*Unama'ki*). Oysters have traditionally been harvested and managed by local native fishers for many thousands of years. In their traditional ecological knowledge, we can find observations that spark new research directions for conventional science approaches.

The knowledge of the Mi'kmaq people around the Bras D'Or is communicated orally. An oyster fisherman from Waycobah summarized his experience with the oysters of the Bras D'Or Lakes as (paraphrase): "oysters in deeper, colder water always do better than those that are closer to shore in the warmer water. The oysters in the shallow water die off every so many years, those in the cold water do much better."

In 2003 the presence of MSX, a pathogenic oyster parasite, was confirmed by histological techniques. It was not known (in conventional scientific circles) exactly how long this parasite had been present in the Bras D'Or Lakes. The traditional knowledge of the fisherman from Waycobah suggests that oysters have died in the past as a result of MSX.

In other areas where MSX is present, mild winters result in greater mortality and cold winters less. Currently, laboratory research funded by AquaNet (Canada's Network of Centres of Excellence for Aquaculture) is underway at CBU to determine the effect of temperature on the parasite.

Concurrently, another research project through the Bras D'Or Institute at CBU is involved with the systematic collection and documentation of traditional ecological knowledge aimed at management of the oyster stocks. This project focuses on interviews of many older oyster fishermen by University science students.

The research is a good, on-going demonstration project of the intermeshing of two world views in a local environment to engage the students in the Integrative Science program and keep the research grounded in the community.

Rod Beresford is an Assistant Professor of Integrative Science in the Biology Department at Cape Breton University.

Patterns in science: understanding nature's 'big picture'

SANA KAVANAGH, B.A.

Perceiving patterns comes naturally to people according to Frank Oppenheimer, scientist and founder of the

famous hands-on museum known as the Exploratorium in San Francisco.¹ Identifying patterns means understanding the overall organization of an object or process. One way to encourage this is by using a "Pattern Conceptual Framework", which is a way to organize patterns visually using three types of patterns: *natural*, *ideal*, and *abstract*.

Natural patterns are observed in nature, such as the apparent movements of the sun over a year. *Ideal* patterns are the result of how we perceive the natural patterns and the way we simplify them in our mind. *Abstract* refers to the way we express these patterns so they can be understood (words, mathematics, illustration). We can name and illustrate a symbol of the sun's movements using a circle as a way to represent an annual cycle. Idealization and abstraction of pattern can occur in many ways. Physicists use mathematical formulae, while Indigenous science employs many modes of abstraction such as song, dance, ceremony, and art. If we look at a species of fern that is found in Cape Breton, commonly known as the ostrich fern in English, we see that the name draws attention to the feather-shaped frond that bears the spores. The scientific name, *Matteuccia struthiopteris*, breaks down into Latin roots that mean of an ostrich and feather. Similarly, the etymological roots of the Mi'kmaq name, *Mtèskmwaqsil*, break down into snake and a plant which is bunched (M. Marshall, personal communication). The natural pattern of the green-coiled fronds is idealized by comparing the fern to the shape of bunched-up snakes. All these names share the common ground of pattern recognition.

Sana Kavanagh is a research assistant in the Integrative Science Program at CBU and a Masters of Environmental Studies student at Dalhousie University.

¹ Oppenheimer, F. The Exploratorium: A Playful Museum Combines Perception and Art in *Science Education*. *American Journal of Physics*, Volume 40/7, July 1972)

Subtle spirit: the enduring principles of Native American science

BY SEAN HOWARD, PH.D.

Native American psychologist Keith James defines both culture and science as "an organized set of tools and techniques for understanding, predicting, and controlling circumstances and events."¹ The organizing principles of science vary greatly from culture to culture, and within cultures over time. In the modern West, the twin-impetus of industrialization and imperialism generated, as physicist

F. David Peat argues in *Blackfoot Physics*, a "world-view...dominated by the need for progress, development, improvement, evolution, and the linear unfolding of time."² Seen through such a lens, the 'natural' role of science is to deliver those improvements, to maintain or accelerate the rate of progress. Traditional Chinese science, in contrast, reflects a cultural preoccupation with *balance*, seeking optimum harmony with the natural order, the Way or Tao, rather than maximum exploitation of natural resources. In similar vein, the key cultural concept of Native American science is *spirit*, the animating energy and essence of life. While this spirit is universal, or, rather, *is* the universe, its effects can be felt (if one knows how to look) in the most local and intimate 'data' of existence.

To be 'native' to a place is, ideally, to live in deep attunement with its spirit. The function of "Native science", correspondingly, is to facilitate this attunement, to foster



Integrative Science students and staff with Isabelle Knockwood of Indian Brook First Nation, who discussed with the class traditional knowledge and roles.

what the Alaskan (Yup'ik) educationalist Oscar Kawageley calls the "eco-psychology" of indigenous inquiry.³ Rather "than seeking to control natural reality" (the characteristic "ego-psychology" of so much Western science in the centuries since the European conquest of America), Native Science, "focuses its attention" upon "inner natures," the "rich textures and nuances of life" where matter and spirit, chaos and order, essence and entity, psyche and physics meet.

Sean Howard is an adjunct professor of political science at CBU.

¹ Onondaga/Minsi Lenape; James, K.; 'Culture: The Spirit Beneath the Surface,' in James, Ed., *Science and Native American Communities: Legacies of Pain, Visions of Promise*, University of Nebraska Press, Lincoln, NE, p. 45.

² Peat, F.D., 2002. *Blackfoot Physics: A Journey into the Native American Worldview*, Phanes Press, Grand Rapids, MI p. xiii.

³ Oscar Kawageley, 'Tradition and Education: The World made Seamless Again,' Chapter 8 in Keith James, Ed., *Science and Native American Communities, Legacies of Pain, Visions of Promise*, University of Nebraska Press, Lincoln, NE, p. 51.

BACHELOR OF SCIENCE COMMUNITY STUDIES Integrative Science program

Cape Breton University offers a unique Bachelor of Science Community Studies (BScCS) four year undergraduate degree, with three possible concentrations or programs:

1. Integrative Science
2. Biodiversity
3. Psychology, Health, and Environment

Integrative Science brings together scientific knowledges and ways of knowing from Indigenous and Western world views to provide science education in multiple settings: the classroom, laboratory, field, individual and team projects, community workshop, and on the job. This "bringing knowledges together" is known as Toqwa'tu'kl Kjjitaqnn in the Mi'kmaq language and as "Two-Eyed Seeing" in the words of Mi'kmaq Elder Mr. Albert Marshall. "Two-Eyed Seeing" is more than a label ... it is a powerful reminder of the Integrative Science program's visionary goal of learning to see from our one eye with the strengths of Indigenous knowledges and from our other eye with the strengths of mainstream scientific knowledges ... and to using these together for the benefit of all.

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