

Mathematics as Medicine

Edward Doolittle

I remember well my first visit to the Navajo reservation in Arizona. I was traveling with a dear friend who had been a few times before. Driving through the desert in near total darkness, I spotted some strange coloured lights flashing on the horizon near the place where the town in the reservation should be, pulses which would stop and then start again in an irregular pattern. "What's that?" I asked. "I don't know," said my friend, clearly disturbed. "I've never seen that before." Thoughts of UFO abduction began to form in my mind. "You're pulling my leg," I said. "No really," she said, "I have no idea what those coloured lights are!" We continued to drive through the darkness, perplexed and staring in wonder at the coloured lights, for what seemed like ages. We were closer, but I still couldn't make sense of the experience. The lights disappeared behind a hill. As we climbed the hill I held my breath, knowing that the truth was on the other side. We reached the top and it finally unfolded clearly before me. The circus had come to the Navajo reservation.

I am an Indian. I am a mathematician. Those two aspects of my identity seem to be in constant opposition, yet I cannot let go of either.

My father, the late Edward Lorne Doolittle, was a Mohawk Indian from the Six Nations reservation in southern Ontario. My father's mother, Belda Brant, attended residential school where she lost her language and learned how to clean hotel rooms. My father's father, Clifford Doolittle, was killed in a railroad construction accident when my father was five years old. The settlement offered by the railroad company was \$35 a month. My grandfather's spirit came to my grandmother to tell her that she should take the family off the reserve to find work, which she did. Although that helped to keep the family fed, it had the effect of further distancing them from their culture.

By the time I was a teenager, my father and mother, Eleanor Naylor, third generation English in Canada, had managed to pull together comfortable middle class existence. I grew up in the suburbs of Hamilton, Ontario, knowing almost nothing of my Indigenous culture. Aside from occasional weekend visits with my aunts and uncles, I had no idea what it meant to be Indian. I learned Latin instead of Mohawk, the Bible instead of *Kayanerekowa* and *Karihwiyo*, fairy tales instead of Coyote tales. I also enjoyed solving puzzles.

Despite all the advantages and privileges and resources available to me, I still felt there was something missing in my life. I tried to find what was missing in religion, but I stopped attending Baptist church at the age of 14. My Sunday school teacher had used some twine to tie my wrist to that of the other student in my age group, a sweet young woman whose name I can't recall, in order to illustrate some point about sin. I thought the problem might have been more with the teacher than with me or the girl. Instead I read about Zen Buddhism and searched for enlightenment. I studied religion instead of biology in high school, disappointing those who wanted to be able to call me Dr. Doolittle. My religion teacher invited a friend of his who we only knew as Krishna to

come and talk about Hinduism. “Ask him whatever you want,” said the teacher. So I asked Krishna, “Is it possible to convert to Hinduism?”

“Yes,” said Krishna reluctantly, “But I discourage it.”

What?

“If you can’t find what you’re looking for in your own tradition, you won’t be able to find it in ours.”

Enlightenment. I don’t even know what my tradition is, I wanted to say. How can I find anything within my own tradition if I don’t even have a tradition? That was my problem, though, not Krishna’s. He could not tell me where to find the something that was missing.

I was accepted to university, and my general intention was to study Artificial Intelligence at the University of Toronto. My parents had not planned for my university education. Instead they relied on the fact that status Indians received education funding from the federal government. While there was no denying that I was a status Indian—I had the card to prove it—I felt that the benefit was for real Indians, not privileged, pale, suburban half-Indians. At first I balked at the suggestion that I should accept Indian Affairs funding for my education, but that upset my parents greatly. I reconsidered, and (in a deal only with myself) accepted on the condition that I would do my best to deserve the benefit offered to me. I resolved to become an Indian.

At the University of Toronto I connected with the Indian Health Careers Program, a program designed to help to increase the representation of Aboriginal people in medicine and other health-related careers. Dianne Longboat, the director of the program, hosted gatherings with traditional teachers and elders, and invited me to attend. The experience of hearing elders speak turned me inside-out. For the first time I directly experienced a powerful tradition of thought and experience which stood completely outside of the Western tradition in which I had been educated. The power and wisdom of the words of the elders were like a streak of lightning shooting through my brain.

It felt like my whole life had been a preparation for those moments, when I understood that there really are different ways of thinking and being. Ways which were not only different, but truly powerful; a tradition that stood on its own, entirely independent from European thought, and had great gifts to offer. Even better, all this could somehow be mine. The search for that which was missing had ended. That is when I really started to become an Indigenous person. The work of bringing it in, filling myself with it had begun, continues to this day, and will not end until my life is over.

I am unbelievably fortunate. Something I could do to satisfy my obligations became something I could do for my own benefit. And not just a way to self-discovery and to fill a hole, but a way to power and strength, a way to change the world. The opportunity to become an Indigenous person is one of the greatest gifts I have ever been granted.

I am not wise, nor deeply knowledgeable about my culture, nor gifted in oratory like the elders. How can I, with my lack of gifts of expression, convince you that our way is a powerful way? I often think about three simple words spoken by Chief John Snow: “We have survived.” Our ways must be powerful if they have helped people survive through one of the greatest holocausts in human history: one hundred million dead of disease, starvation, and warfare; loss of land, wealth, culture, and knowledge; injustice and wanton destruction all around. Through it all, we (the survivors) have survived.

Back in the regular world, I abandoned the study of Artificial Intelligence, which seemed to be reaching a dead end at the time, possibly because its mechanistic approach was just too simpleminded to approach something as complex as the human mind, and took up mathematics, which is what I seemed to do best and which always seemed fun and natural to me. I studied mathematics at the University of Toronto for twelve years, ultimately earning a PhD in pure mathematics under Peter Greiner; my dissertation was on the topic of hypoelliptic partial differential operators. Peter is like a father to me in a certain sense. He is also a great mathematician, and wise in his own way and in his own tradition. He is my mathematical father, connecting me to another strong lineage which includes Solomon Lefschetz and Carl Neumann. My two fathers have never met.

One of my major life goals is to resolve the apparent incompatibility between the two aspects of my identity, being a mathematician and being an Indigenous person. To that end, I would like to explore various interfaces between mathematics and Indigenous thought. At this point I am more interested in searching for possibilities than organizing my thoughts in any particular way. I have tried to identify the main sources for my thinking, but I have neglected making exact references to the literature. I hope that you will forgive my poor scholarship, but the need for references is reduced because of the availability of such information in this modern age. In any case, I don't always remember things the way they were said or written, but I remember the impression they made on me.

Perhaps the most common, most straightforward, and simplest interface between mathematics and Indigenous people is the proposal that mathematics is a requirement for Indigenous people to succeed in the job market. The problem is often stated in terms of the desperate state of education of Aboriginal people in terms of math and science. Many researchers have attempted to quantify or otherwise justify that assessment and then conclude that we must find ways to improve outcomes and achievement indicators for the benefit of the students.

I am skeptical of that approach. For one thing, we have heard such talk before, in connection with residential schooling for example. I don't doubt the sincerity and desire to do good of those who take that point of view, but the concern that I have, partly from history, partly from personal experience, is that as something is gained, something might be lost too. We have some idea of the benefit, but do we know anything at all about the cost?

The complexity of the situation seems to expand endlessly the more it is examined. It is tempting to search for simple solutions to complex problems and to offer simple responses to complex situations; that is what Western thought (mathematics included) teaches us to do. However, such responses have not been adequate as we can see from the continuing nature of the problem (whatever that problem really is).

As examples of the surprising and complex nature of Indigenous mathematics education, I would like to offer some impressions taken from a paper by William Leap on the mathematics education of the Ute Indians.

Q: If he gets four dollars a day, how many is he going to have in two days?

A: Six.

Q: Let's imagine you have 72 pennies right here in a pile, and there's one boy sitting here, one boy there, one boy there, and one boy there. What would you do to make certain everybody got the same number of pennies?

A: Pass them out until they are all gone.

Q: If your brother took his truck to Salt Lake City, how much would he have to spend on gas?

A: My brother doesn't have a truck.

Another approach to the apparent incompatibility between Indigenous thought and mathematics is ethnomathematics. Roughly speaking, ethnomathematics expands the meaning of "mathematics" to include very general notions of counting, measuring, locating, designing, playing, and explaining. From the perspective of mathematics education, the task is to identify examples of such activities within a culture and use those examples to teach mathematics. Many different examples of Native American ethnomathematics have been discussed by authors such as Marcia Ascher, Michael Closs, and many others. For example, the peach pit bowl game of my people is discussed in Ascher's book *Ethnomathematics*.

Some of the most interesting examples of ethnomathematics in North America, in my opinion, involve the idea of mapping in an extended sense. The feeling I get from Native American maps and diagrams is that they are not static maps of locations and spatial relationships, but maps of processes, like how to get from one place to another, how to make a caribou dinner from scratch, how to give thanks and show respect to everything that's good, or how to mourn.

Ethnomathematics is far more reflective and respectful to Indigenous traditions of thought than the simpler reflex to help Indians succeed at improving their outcomes on standardized tests. However, the danger of oversimplification remains, perhaps more insidious because the motives are put forward as purer. An example of such oversimplification which I have encountered repeatedly in discussions with well-meaning people I call Cone on the Range. "The tipi is a cone," I have heard countless times. But that is surely wrong; the tipi is not a cone. Just look at a tipi with open eyes. It bulges

here, sinks in there, has holes for people and smoke and bugs to pass, a floor made of dirt and grass, various smells and sounds and textures. There is a body of tradition and ceremony attached to the tipi which is completely different from and rivals that of the cone. Similarly, there is a ceremonial and spiritual tradition connected with the peach pit bowl game that is completely lost in Ascher's treatment.

Aside from being wrong, oversimplifications such as calling a tipi a cone or analyzing the peach pit bowl game only in terms of probabilities and odds may have other serious implications in an educational context. My feeling is that Indigenous students who are presented with such oversimplifications feel that their culture has been appropriated by a powerful force for the purpose of leading them away from the culture. The starting point (tipi, game) may be reasonable but the direction is away from the culture and toward some strange and uncomfortable place. Students may, implicitly or explicitly, come to question the motives of teachers who lead them away from the true complexities of their cultures.

There is a more pervasive and insidious example which I call Squaring the Circle. Of course, Squaring the Circle is one of the unsolvable mathematical problems of antiquity, but the term is also used by blues musicians such as Sterling "Satan" Magee for the process of reasoning too much about something that one should be feeling; I believe the term "square" is meant in a pejorative sense in that context.

In modern Indigenous thought, a tool called the medicine wheel is often used to divide complex situations into four simpler categories. Many Indigenous people will staunchly defend the process of dividing wholes into four aspects, such as the person into the physical, emotional, spiritual, and mental. However, I feel, based on personal experience, that such analyses square the circle; they are pale oversimplifications of complex and powerful traditions which have gone underground. One revelatory experience for me took place at a meeting with teachers, an elder, and a number of well-meaning researchers at the University of Saskatchewan. After the presentation of a rather complicated example of the use of the medicine wheel in the theory of science education, Elder Betty McKenna of Moose Jaw was asked what she thought about it. Betty responded: "I have worked on a real medicine wheel."

The implication, of course, is that a geometrical, abstract medicine wheel is not real. But what then, is a real medicine wheel? It is an approximately circular arrangement of stones on the ground, often with spokes radiating from a centre, sometimes with loops of stones occurring at irregular intervals around the perimeter. There are many pictures available on the Web of real medicine wheels such as the Bighorn Medicine Wheel. Note that they blend with the landscape as it rises and falls; they are not regular. The stones used to mark them are of different sizes and shapes and colours; the number of spokes is not necessarily a multiple of four and not clearly meaningful in any way at all. The purpose and meaning of such wheels is to some extent lost, or more likely has gone underground. My belief is that they were used not to divide and analyze, but as "maps" of processes of ceremony, thanksgiving, timekeeping, and communication. Or maybe not.

Notwithstanding the concerns I have about ethnomathematics in math education, I feel that ethnomathematics is a worthwhile pursuit. I would like to propose another example for the body knowledge of the ethnomathematics of Native North America. However, before I do so, I can't resist telling a joke which I first heard from Eber Hampton at a barbecue sponsored by Luther College on the occasion of the opening of First Nations University.

When the astronauts first landed on the moon, they saw a strange sight: a teepee sitting right there on the lunar surface some distance from the landing craft. The astronauts bounced over in their spacesuits to marvel at the sight. Finally, one of them got the nerve to knock on the hide covering the entrance. An old man parted the doorway and looked out, just as surprised to see the astronauts as they were to see him. They stared at each other for a few moments, and then the old man noticed the American flag planted some distance behind the astronauts. Seeing the flag, the old man exclaimed, "Oh no! Not you guys again!"

The capture of Detroit is one of the highlights of Canadian military history. Near the beginning of the War of 1812, the government of Canada and its wartime leader, Isaac Brock, were concerned about its ability to fight a war on three fronts: the Detroit river, the Niagara river, and the St. Lawrence River. Brock decided to try to neutralize the threat in Detroit quickly by launching an immediate, overwhelming attack on the American forces stationed in Fort Lernoult, Detroit. Short of manpower, he gathered as many militia as possible and dressed them in red jackets to make them look like regulars, and recruited as many Indians as he could to the cause. Key to those recruitment efforts was the great chief Tecumseh, who was impressed with Brock and willing to support Brock's fight against the Americans.

In the decisive tactic of the attack on Fort Lernoult, Tecumseh had his Indians march past a point which the Americans could see, change their clothing somewhat, sneak back around to their starting point, and march again and again through the Americans' field of vision. "One little, two little, three little Indians" Several thousand non-existent Indians later the Americans thought they were severely outnumbered and surrendered without firing a shot.

That, I would say, is a fine example of the Native American use of mathematics. It is something which we own, something of which we can be proud. That is what is missing, from most of the examples of ethnomathematics used in education. In ethnomathematics, there is usually a sense that there is something larger behind the scene, let us call it "real mathematics", which is not ours. That perceived lack has the effect of making us feel ashamed rather than proud.

Passion was a major key to Tecumseh's success in the opinion of his biographer John Sugden. In the Indigenous world view, perhaps feelings like passion and pride are more valuable than the knowledge of facts, ideas, rules, regulations, and methods. We need to

follow Tecumseh's example and instill a sense of pride and passion in our students, not shame and apathy.

Apropos are historian William Wood's words on the impact of the death of Brock at Niagara-on-the-Lake shortly after the capture of Detroit: "Genius is a thing apart from mere addition and subtraction." Brock was just one man, but his life and death changed the course of history. Arithmetic is not always the best tool to use.

One good example notwithstanding, we are still left with the question of what we can do to resolve the apparent incompatibilities between Indigenous thought and mathematics. I would like to make two suggestions about how we might be able to proceed from here.

First, I would like to consider the question of how we might be able to pull mathematics into Indigenous culture rather than how mathematics might be pushed onto Indigenous people or how Indigenous culture might be pulled onto mathematics. What might be the difference between thought which is authentic to the culture rather than a simulacrum of an idea from elsewhere?

Let us consider how foreign words and concepts are introduced into the Mohawk. Some words are simply borrowed, in a process familiar to English speakers, from a European language as in *Kabatsya* = garbage, *Ti* = tea, and *Takós* = cat (probably from Dutch *de poes*, i.e., the puss). There are obvious signs that those words are not originally Mohawk words: the presence of strange sounds (the b sound in garbage), single syllable words, or words with stress on the wrong syllable. Some borrowed words have the overall style of Mohawk (e.g., begin with "ra-") but lack the internal structure of Mohawk words, as in *Rasanya* = lasagna which, if it were really a Mohawk word, would mean something like "he sanyaed", whatever sanyaing would be. A similar example is *Rasohs* = sauce, apparently from the French *la sauce*. All of those examples lack the nuance, complexity, and internal structure that Mohawk words typically have. If there is any connotation, it is ridiculous, as in "he sanyaed".

On the other hand, there are new Mohawk words to describe new concepts, words which developed within the Mohawk tradition. For example, we have *kaya'tarha* = television, literally "it has bodies on its surface"; *teyothyatatken* = banana, literally "the fruit that has bent itself"; *kawennokwas* = radio, literally "it throws out songs"; and *kawennarha*, literally "it has words on its surface", a word proposed, but not (yet?) generally accepted, for describing a computer. Those words really mean something and are not just dry tokens the way English nouns are. They are better because they are ours, but it is not simply a matter of pride. Since they are ours, they are consistent and coherent with the rest of the language; they strengthen the language just as the language strengthens them; and they can be modified and built upon to add further complexity and sophistication to the language.

New words are coined constantly within the Mohawk tradition. The spirit of the language is inventive and playful, not acquisitive like the spirit of English. I myself have coined a few new words, for example *kahnekahontsi* = cola drink, literally "black water"

or “black drink”, and *Kwiskwis nikawahràsas* = bacon bits, literally “little pig meats”. The latter made Kahnekotsyentha kenha laugh and is now regularly used by a small group in Six Nations. Some day it may come into general use.

Second, I would say we need to recognize that mathematics is an essentially simple (not complex, although often complicated) way of thinking. Mathematics is all about simplifying, clarifying, analyzing, and breaking down. On the other hand, Indigenous thought is all about developing and building up sophisticated, complex responses to complex phenomena such as the weather, animal migratory patterns, healing, and human behaviour. A colleague at First Nations House at the University of Toronto told me about one occasion on which her grandmother held a baby. “There’s something wrong with this baby,” said the grandmother. It turned out that the child had a serious illness, but the child’s parents and doctor had all missed the problem until the grandmother felt that something was wrong. We can weigh and measure and test, but true complexity cannot be handled by simple means.

Time for another joke. This one I heard at the Sakewewak Storytelling Festival in Regina several years ago. I’m afraid I can’t remember the name of the storyteller; if anyone out there knows, please tell me so I can credit him properly in the future.

In a town in a certain reserve in Saskatchewan, some young boys were breaking into houses. The RCMP investigated. They came into town and asked the first person they see, an old man sitting in front of his house, whether he knew anything about the break-ins. “Yup,” said the old man. “Do you know who’s been doing it?” asked the police. “Yup,” said the old man, “those four boys.” “Would you be prepared to testify in court?” asked the police. “Yup,” said the old man. So the RCMP arrested the boys and charged them with break and enter.

Court day arrived, and the old man took the stand. The prosecutor asked him, “Do you know who’s being doing those break-ins?” “Yes,” said the old man. The prosecutor asked, “Can you point to the individuals in question?” “Yes,” said the old man, “it’s those four boys sitting over there.” “Thank you,” said the prosecutor, “those are all the questions I have.”

Then the defence lawyer began his cross-examination. “Have you actually seen those boys breaking in to a house?” “No,” said the old man, “I haven’t actually seen it myself.” “Then how do you know it’s them?” asked the defence lawyer. “I have my ways of knowing,” said the old man. “I’m sorry, your evidence is hearsay. We can’t accept it,” the defence lawyer said. The judge agreed, and dismissed the witness.

Well, the old man was not too happy about being dismissed like that, so as he walked past the judge on the way back to his seat, he let out a fart. A long, loud one. A big one. The judge banged on his gavel and said, “I could have you charged with contempt of court for that!”

The old man turned to face the judge and asked, “Did you see anything?”

Given the apparent incompatibilities between Indigenous thought and mathematics, I suggest that instead of asking “What is Indigenous mathematics,” it may be helpful to start with the following question instead: “What are the Indigenous analogues to mathematics?”

For example, we might ask what the role of mathematics is in non-Indigenous culture. I believe that one function mathematics plays is as a source of power, which is one reason people are so concerned about learning it or seeing that it is taught to their children. Power is also an important concept in my culture. In fact, the core message of the *Kayanerekowa*, the Great Good Way, is *Skennen, Kahsha'sten'tshera, Ka'nikonhriyo* = Peace, Power, and Good Mind. (The word “righteousness” is often seen in place of “good mind”, but the latter is a better translation.) Power is central to our understanding of following a good way.

Seeing me in my patched-up, faded shirt, my down-at-heels cowboy boots, the hearing aid whistling in my ear, looking at the flimsy shack with its bad-smelling outhouse—it all doesn't add up to a white man's idea of a holy man. You've seen me drunk and broke. You've heard me curse and tell a sexy joke. You know I'm no better or wiser than other men. But I've been up on the hilltop, got my vision and my power, the rest is just trimmings. That vision never leaves me. —Lame Deer

All this talk about power tends to make some people nervous. However, *kahsha'sten'tshera* in this context is not power in isolation, rather power within a strong ethical tradition, if “ethical” is the right word. Another aspect of the tradition in which power sits is humility. As Black Elk said,

I cured with the power that came through me. Of course, it was not I who cured, it was the power from the Outer World, the visions and the ceremonies had only made me like a hole through which the power could come to the two leggeds. If I thought that I was doing it myself, the hole would close up and no power could come through. Then everything I could do would be foolish.

Black Elk’s reference to power coming through him reminds me of Ramanujan, a great inspiration to me, one of the finest mathematical minds of the 20th century. Ramanujan could not describe the source of his mathematical insight, but believed it did not come from him personally; instead it came through him in dreams from his family goddess, Namakkal. Ramanujan had a morning ritual of writing down the thoughts that came to him in dreams shortly after awakening.

Indigenous spiritual traditions and mathematics are perhaps not really so far apart after all. Perhaps. Perhaps we can think of mathematics as a kind of medicine, a healing power. But can it make our lives better as a people, or are its benefits restricted to just a few fortunate individuals?

I would like to finish with the Blackfoot horse creation story. This version of the story is taken from Ted Chamberlin's most recent book, *Horse*.

A long time ago there was a poor boy who tried to obtain secret power so that he might be able to get some of the things he wanted but did not have. He went out from his camp and slept alone on the mountains, near great rocks, beside rivers. He wandered until he came to a large lake northeast of the Sweetgrass Hills. By the side of that lake he broke down and cried. The powerful water spirit—an old man—who lived in that lake heard him and told his son to go to the boy and find out why he was crying. The son went to the sorrowing boy and told him that his father wished to see him. 'But how can I go to him?' the lad asked. 'Hold onto my shoulders and close your eyes,' the son replied. 'Don't look until I tell you to do so.' They started into the water. As they moved along the son told the boy, 'My father will offer you your choice of animals in this lake. Be sure to choose the old mallard and its little ones.'

When they reached his father's lodge on the bottom of the lake, the son told the boy to open his eyes. They entered the lodge, and the old man said, 'Come sit over here.' Then he asked, 'My boy, what did you come for?' The boy explained, 'I have been a very poor boy. I left my camp to look for secret power so that I may be able to start out for myself.' The old man then said, 'Now, son, you are going to become the leader of your tribe. You will have plenty of everything. Do you see all the animals in this lake? They are all mine.' The boy, remembering the son's advice, said, 'I should thank you for giving me as many of them as you can.' Then the old man offered him his choice. The boy asked for the mallard and its young. The old man replied, 'Don't take that one. It is old and of no value.' But the boy insisted. Four times he asked for the mallard. Then the old man said, 'You are a wise boy. When you leave my lodge my son will take you to the edge of the lake, and there in the darkness, he will catch the mallard for you. When you leave the lake don't look back.'

The boy did as he was told. At the edge of the lake the water spirit's son collected some marsh grass and braided it into a rope. With the rope he caught the old mallard and led it ashore. He placed the rope in the boy's hand and told him to walk on, but not to look back until daybreak. As the boy walked along he heard the duck's feathers flapping on the ground. Later he could no longer hear that sound. As he proceeded he heard the sound of heavy feet behind him, and a strange noise, the cry of an animal. The braided marsh grass turned into a rawhide rope in his hand. but he did not look back until dawn.

At daybreak he turned and saw a strange animal at the end of the line—a horse. He mounted it and, using the rawhide rope as a bridle, rode back to camp. Then he found that many horses had followed him.

The people of the camp were afraid of the strange animals. But the boy signed to them not to fear. He dismounted and tied a knot in the tail of his horse. Then he gave everybody horses; there were plenty for everyone and he had quite a herd left over for himself. Five of the older men in camp gave their daughters to him in return for the horses. They gave him a fine lodge also.

Until that time the people had had only dogs. But the boy told them how to handle the strange horses. He showed them how to use them for packing, how to break them for riding and for the travois, and he gave the horse its name, elk dog. One day the men asked him, 'These elk dogs, would they be of any use in hunting buffalo?' 'They are fine for that,' the boy replied. 'Let me show you.' Whereupon he taught his people how to chase the buffalo on horseback. He also showed them how to make whips and other gear for their horses. Once when they came to a river the boy's friends asked him, 'These elk dogs, are they of any use to us in the water?' He replied, 'That is where they are best. I got them from the water.' So they learned how to use horses in crossing streams.

The boy grew older and became a great chief, the leader of his people. Since that time every chief has owned a lot of horses.

Given the frustrations and difficulties of the task facing us, it is reasonable to ask, "Do we really need this stuff anyway?" As a response I offer the completion of the earlier quotation by Chief John Snow: "We have survived, but survival by itself is not enough. A people must also grow and flourish."