Indigenous Perspectives in Science: Education Materials

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In collaboration with the UBC Indigenous Strategic Initiative Fund and the Michael Smith Laboratories at UBC, these materials were produce to provide a series of articles, comics, to celebrate the intersection of Indigenous and Western views of science. We invite you to view and share these documents widely, as they highlight the impact science has in our lives and our understanding of the world.

For more information about the Indigenous Strategic Initiative Fund, please visit https://isp.ubc.ca/isi-fund/

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Cultural Wisdom and Scientific Progress: Harnessing the Power of Indigenous Views

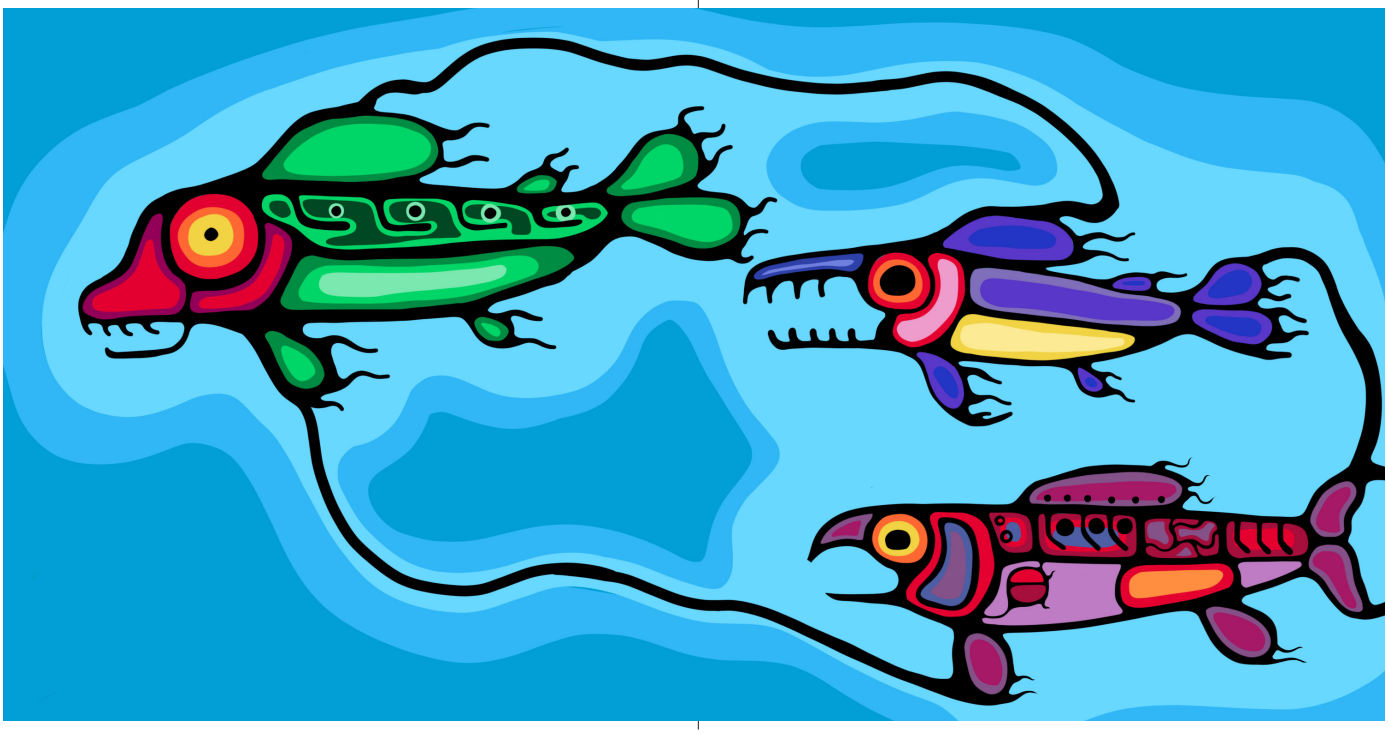
While a Western approach is useful, it can leave out important details about science. It can also make things unfair and hurt Indigenous communities. This is where Indigenous views can play an important role.

Written by Maia Burgess
Art by Oliver Moss

Science, as a cornerstone of human progress, has shaped our understanding of the natural world and fueled remarkable advancements in many areas of life. However, science has predominantly followed "Western" practices in its pursuit of understanding the world around us. This largely focuses on a scientific methodology that emphasizes objective observation, experimentation, and quantitative analysis. While this approach has yielded significant progress in the Western community, it often overlooks essential nuances and intricacies that can enhance scientific inquiry. It is in this void that the perspectives of Indigenous cultures can play a pivotal role, offering valuable insights and fostering a more comprehensive understanding of the natural world. This essay explores the significance of Indigenous views in science, acknowledging their capacity to complement and enrich the existing Western system.

The limitations of Western science

In our conventional education system, the foundations of science are often presented through the perspective of "Western" thinkers and methodol-



ogies. While these principles have demonstrated their value, they have intentionally and unintentionally marginalized the wealth of Indigenous knowledge systems. These are systems that have been developed and refined over generations through close connections with the land, community, and ancestral wisdom.

Put another way, Indigenous knowledge systems acknowledge that science cannot be isolated from other aspects of human existence, a perspective that suggests that key insight can be found in the *connections* between humans and nature. Through this lens, Indigenous cultures possess a deep understanding of local ecosystems that have sustained their communities for centuries. Furthermore, for Indigenous communities, connections are not limited to empirical data but are also rooted in spiritual beliefs, cultural practices, and a sacred relationship with the natural world. This holistic approach, which allows for reverence and wisdom from cultural knowledge, leads to a more comprehensive understanding of the phenomena under investigation.

The understanding and response to the impact of environmental changes on species is crucial for effective management of fish and wildlife. This is especially so in remote and rapidly changing regions like the Arctic–Yukon–Kuskokwim (AYK) area. Here, the region is experiencing significant climate-induced changes that affect Chinook Salmon populations, which are vital to local communities and Indigenous peoples.

A workshop held in 2022 brought together diverse stakeholders, including Tribes, First Nations, government agencies, nonprofits, and universities, to discuss the factors contributing to Chinook Salmon declines in AYK watersheds. Despite the absence of large-scale human infrastructure, salmon populations are declining, and climate change is suspected to be a major driver. The workshop aimed to address data limitations, analyze environmental drivers, and foster collaboration between different knowledge holders.

The event underscored the importance of combining traditional knowledge, local perspectives, and scientific research to develop strategies for Chinook Salmon conservation and recovery.

Indigenous perspectives: traditional medicines and sustainable resource practices.

For example, this can be seen in the realm of traditional medicines, where Indigenous people have a rich understanding of the healing properties of various plant remedies. Here, elders and traditional healers possess extensive knowledge of the local flora, acquiring this knowledge through close observation, experimentation, and intergenerational teachings. These healers understand the intricate relationships between plants, humans, the environment, as well as engage in rituals that recognize the holistic nature of health. Given this, collaborative and culturally sensitive efforts between Indigenous knowledge holders and scientists have demonstrated the benefits of integrating traditional knowledge with Western scientific methodologies. By recognizing and incorporating this knowledge, our understanding of the natural world is enhanced, and real-life health outcomes can be improved.

Furthermore, Indigenous *traditional ecological knowledge* (TEK) has been especially fruitful in offering other perspectives in sustainable practices, and shown to provide alternative ways for humans to look after the land. Indeed, many of these valuable insights have been used to shape policies and practices that promote ecological resilience and social justice. For example, many Indigenous traditions are closely akin to sophisticated agricultural techniques that are inherently sustainable and adapted to local ecosystems. These include practices such as intercropping, agroforestry, and crop rotation resulting in enhanced soil fertility, minimized water usage, and biodiversity promotion.

Overall, many researchers see modern agriculture adopting these traditional practices as potential solutions to enhancing food security and mitigating the negative environmental impacts associated with industrialized agriculture. More generally, these Indigenous views of environmental science

have provided a boon of insight as humanity tackles larger scale global issues like climate change. Importantly, this collaborative approach and its demonstrated success, also fosters greater respect for Indigenous cultures and recognizes their valuable contributions to scientific research.

The Spirit is found in everything

Another First Nations' perspective, upheld by Indigenous communities for millennia, is to acknowledge that *spirit* can be found in both *living* and *nonliving* components of the land. Recognizing this relationship between living and non-living, further challenges the traditional approach of studying things in isolation. As such, spirit enhances the idea of everything being connected, and viewing ecosystems with these relationships has been gaining more prominence in Western science.

The Cree and Dene, have actively informed and shaped the development of sustainable land management strategies in boreal forests. These strategies recognize that maintaining the health and resilience of the entire ecosystem requires an understanding of the connections and the spirit found in living organisms, landscapes, and in the environmental processes themselves. Today, disciplines such as ecology, environmental science, and conservation biology value the understanding of the interconnectedness of ecosystems and embrace a more integrated approach to research.

Two-Eyed Seeing: where knowledge systems can connect

Mi'kmaq or etuaptmumk, or "Two-Eyed Seeing" is a concept that emphasizes the value of combining Indigenous and Western perspectives in Canada. It serves as a tool to bridge the strengths of both knowledge systems, fostering a greater understanding of complex issues, promoting culturally

appropriate solutions, and recognizing the inherent value of Indigenous knowledge in scientific research. There are many current Indigenous and Western collaborations in Canadian environmental conservation efforts that exemplify the application of "Two-Eyed Seeing."

One such initiative is the partnership between the *Tla-o-qui-aht* First Nation and Western scientists to restore salmon populations in the Kennedy Flats region of British Columbia. The *Tla-o-qui-aht* First Nation has long-held cultural knowledge and practices related to salmon conservation. They understand the intricate connections between salmon, their habitats, and the overall health of the ecosystem. By integrating Indigenous knowledge with Western scientific methodologies, the *Tla-o-qui-aht* First Nation and Western scientists can develop comprehensive strategies to restore salmon populations.

This collaboration enables knowledge sharing between Indigenous and Western scientists. Western scientists gain insights into the local ecosystem from the *Tla-o-qui-aht*'s traditional knowledge, which may include information about migration patterns, habitat preferences, and the impact of climate change on salmon populations. In turn, the *Tla-o-qui-aht* community benefits from the Western scientific expertise and resources that Western scientists bring, enhancing their capacity to address conservation challenges. The example of Indigenous and Western collaboration in salmon conservation demonstrates the power of "Two-Eyed Seeing" in promoting a greater understanding of complex issues.

In conclusion, science has played a significant role in advancing our understanding of the natural world, but it has predominantly followed Western practices. While this reductionist approach has yielded remarkable progress, it often overlooks essential nuances and intricacies that can enhance scientific inquiry. Here, Indigenous perspectives offer profound insights and a more holistic approach that complements and enriches the existing Western paradigm. By embracing Indigenous views in science, we can bridge the gaps in our understanding, foster cultural appreciation, and develop more comprehensive, sustainable and culturally dignified approaches to scientific inquiry.

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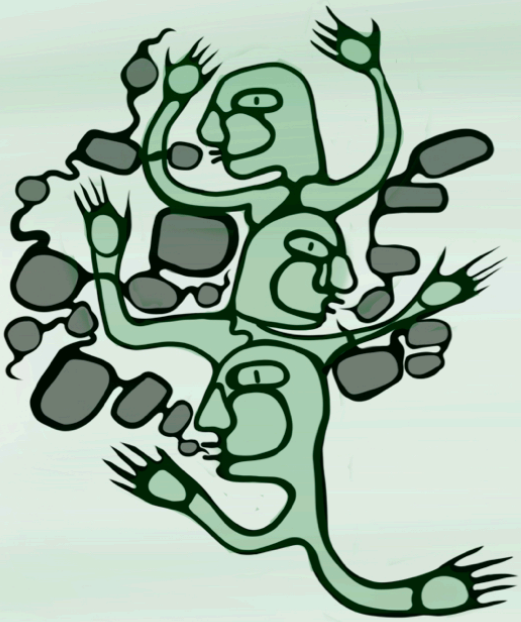
Indigenous Views of Science



For example, First Nations hold cultural knowledge with high respect.

Stories and ceremonies highlight the amazing biodiversity and their uses.

Intimate relationships with the land provide a powerful way to observe and remember environmental changes.

As well, Indigenous views acknowledge that spirit can be found in the living and nonliving components of the land, and that they are *all* connected. Such holistic views have even seen more recent prominence in Western science, despite traditionally studying things in isolation.

Indigenous and Western views.

The Mi'kmaq concept of etuaptmumk, or "Two-Eyed Seeing" is a tool used to combine the strengths of both perspectives

It promotes a greater understanding of complex issues, culturally appropriate solutions, and recognizes the value of Indigenous knowledge in science.

The Deep Relationships Between Indigenous Culture, Environment, and Health

For Indigenous Peoples, *everything* is connected - their culture, their health, and the very land around them. This means that being "healthy" is more than just our usual ideas of medicine. It's recognizing the effects when communities are separated from the customs and places they hold dear.

Written by Caitlin Mayo
Art by Jasper Berehulke

Cultural Environmental Health is a term that recognizes the way in which Indigenous Peoples view the world. That is, a person's well-being is based on complex relationships and connections between all things. And although there may be specific differences to these worldviews between specific traditional lands, something common around the world is how Indigenous Peoples believe that everything - from people, animals, plants, land, water, and the air – can be seen as a living entity with spirit and knowledge [1].

Importantly, Indigenous cultures believe that all these living things are connected, related, and dependent on one another [1]. This interdependency is important to sustain all life and everything is seen as equal, and therefore all elements share responsibility and respect [1].

Furthermore, Indigenous knowledge is strongly rooted in ancestral relationships having been accumulated over thousands of years from a variety

of experiences. This might be by learning from Indigenous Elders or through observation of the environment itself [1]. As well, oral stories have been used as a way to share knowledge and teach important cultural values [1]. Sacred locations become places of healing and ceremonies, and therefore add to this knowledge [1]. All of this, passed on from generation to generation, creates a caring way of understanding and interacting with the world as a whole [1]..

For each Indigenous culture, there are also many rules and acceptable behaviours (known as protocols) for relationships with the land. For example, for some, a person would need to ask permission to hunt or harvest. Or perhaps, there is an offering like tobacco that is presented to the land. There may be a ritual that show thanks for the life being sacrificed [1]. Sacred medicines like sage could be used in smudges by some First Nations cultures to cleanse negative energy [1]. A protocol may also dictate rigid harvesting times, specific to a season, time of year, or even a certain day. Fundamentally, part of this relationship and respect for the land results in the understanding that preservation of the environment is key - one only harvests or hunts what is needed: never too much [1].

Because of the above, Indigenous health is deeply connected to the land and culture. Here, Indigenous Peoples view health as holistic, meaning that health is made up of many different parts – a medicine wheel comprising of the spiritual, physical, emotional, cognitive/mental, and the social [1,2,3]. In order to maintain that person's well-being, these need to be treated together as a whole and in relation to the land [1,2]. This is much different from Western views of health which tend to focus on the body and mind and through empirical statistics [2].

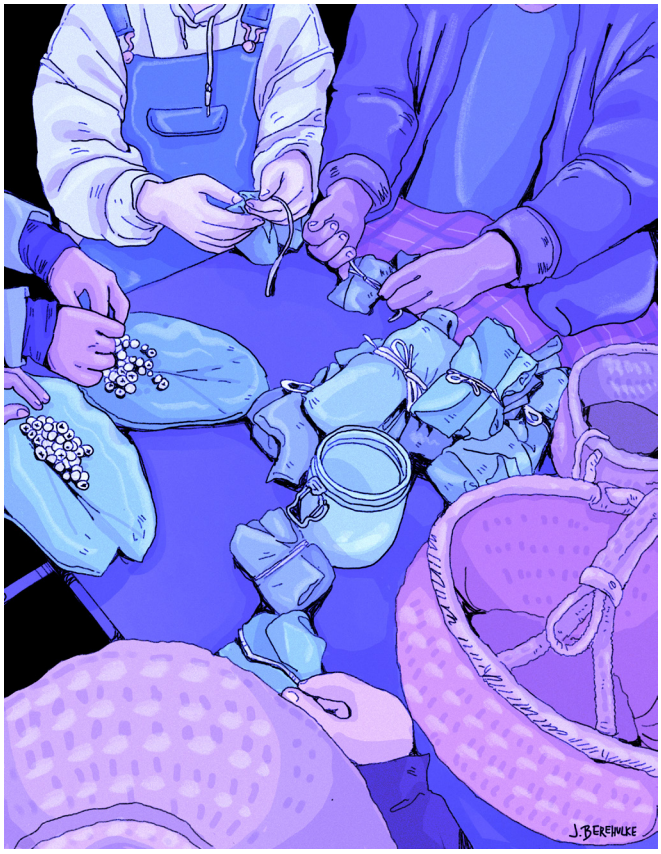
The Kangaqlugaapik (Clyde River) Inuit in Nunavut, Canada, is a great example of what practicing holistic health looks like for an Indigenous community [3]. Seals and the practice of hunting seals have great value to Inuit cultural identity and are believed to hold the power of keeping people holistically healthy [3]. Beyond the physical nutrition of eating seal, seals are culturally believed to energize the body, and medicinally heal both the soul and body of illnesses [3]. As such, seal meat and products like broth, oil, and skin are used to help treat illness, prevent it, and help maintain both individual and community social wellbeing [3].

As the Kangaqlugaapik Inuit believe that the body and soul of a person are connected, both body and soul must be kept well or else one would cause illness to both [3]. As such, a person is only healthy if both body and soul are nourished and at peace with the environment and living things [3]. For the Kangaqlugaapik, the soul and body are kept well by eating seal and practicing hunting rituals and traditional sharing of food with the community [3]. Store bought foods are believed not to be nourishing for the soul and body because they do not hold the same medicinal power as the traditional food of seal [3].

One important way these connections can be seen is maintaining Indigenous health through traditional foods that are harvested, gathered, and hunted on the land [1,2]. This nourishes Indigenous Peoples holistically, because these traditional food systems are embedded with the complex relationships between spiritual, emotional, physical, and intellectual areas [2] – in a way, traditional foods can be seen as powerful because they are able to nurture the mind, body, and spirit [2].. Furthermore, many of these foods, plants in particular, also hold medicinal properties that can heal the body physically [1]. As a result, healers and Knowledge holders have strong relationships with many different types of medicinal plants [1].

Beyond the hunting, harvesting and preparation of traditional foods, there are many other cultural practices that can be seen as healing medicine [1]. This might take the form of participating in Indigenous traditional dances, music, and the speaking of one's language [1]. Many of these activities happen to be important components of ceremonies and celebrations. In general, healing comes in many forms and by continuing these cultural practices and fostering these relationships, Indigenous identity, culture, and holistic health can be protected [1].

With Indigenous health so closely entwined with the land and the rituals of your Nation, one should consider the harm entailed if you were a young child and taken away from your family, community, and land. Imagine being forced to give up your culture and everything important that made you you? How might this affect the rest of your life, and how you would grow as a person? How would the culture and identity of you and your community be impacted? How would this affect your



health? Sadly, this horrifying situation happened to many Indigenous children in Canada [4,5,6].

Here, as a form of control, European colonizers forcibly removed and disconnected Indigenous Peoples from their cultures, traditional territories, and ways of life. These settlers imposed their own European culture, laws, and ways of living on Indigenous Peoples, deliberately destroying their modes of existence [5].

This was done in many different ways: one of which involved the Canadian government taking Indigenous children away from their homes to be put in residential schools and later, the child welfare system [5,6]. It's important to stress that these institutions were not schools in the conventional sense, as they did not aim to give Indigenous children a successful academic education. Attendance at these institutions was involuntary, obligatory and resulted in children being far away from their families, with little to no communication with their loved ones [5]. At its core, the government wrongly saw Indigenous Peoples and cultures as lesser than their own and created this system as a way to "educate" Indigenous children and assimilate them into white Canadian society [5].

The residential school system ran from the 1880s to as recent as the 1990s, where churches carried out the goals of the Canadian government. Children were forcibly taught Christian Canadian culture and ways of living, in an attempt to minimize if not erase their Indigenous identities [5]. In addition to failing to provide an academic education, these institutions and their figures of authority treated the children in horrible ways and subjected them to many indignities [5]. Among many strict rules, children were forbidden to speak their languages (for many the only language they knew) or to acknowledge their Indigenous culture in any way or severe punishments would be given [5]. Since boys and girls were kept separate, brothers and sisters could not see each other [5]. The institutions themselves had very poor food and sanitation, and were extremely overcrowded [5]. Emotional, physical, psychological, and sexual abuse were commonly experienced by Indigenous children, resulting in lasting trauma and devastating impacts to many lives and First Nations cultures in general [5]. Tragically, of the over 150,000 children forced to attend, many Indigenous children did not make it back home, dying at residential schools [7]. The deep effects of this history continue through families and generations up to today.

Similar to the impacts of the residential school system, what has become known as the "Sixties Scoop," also saw the forced removal of Indigenous children from their families, communities, and cultures [6]. However, instead of placing children in schools, this time the government put Indigenous children into the child welfare system (or foster care system), a system intended to help children they viewed as "in need." However, this also worked to assimilate them into Canadian society and destroy their Indigenous identities [6]. This becomes insidious when looking at the child welfare system in the 1960s, where the very large numbers of Indigenous children, especially compared to non-Indigenous children, in the system was obvious [6]. Indigenous children at this time

were essentially being "scooped" up by authorities from their families without consent and then put into the child welfare system at a very high rate [6]. Many Indigenous children were placed with middle-class, white families where for many, their Indigenous identities were denied [6]. To this day, Indigenous children are still overrepresented in this system and are being placed in foster homes outside of their Indigenous families and communities, continuing to cause many harmful consequences [6].

Consequently, it is crucial to emphasize that these horrendous programs were not only harmful because one was separated from family, but also devastating because the separation included being taken away from their land. In other words, these government policies had and continue to have a large impact on Indigenous cultures, in part because of the deep holistic connections Indigenous cultures have with the land [1].

One significant result of Indigenous children being disconnected from their families and communities is that cultural knowledge and traditional teachings could not be passed down from their community and from their Elders. Additionally, for those that survived, these government policies taught them to be ashamed of their Indigenous identities, and many choose to ignore their identity to protect them from the pain they experienced [8]. Because of this and other factors, Indigenous communities experience challenges in sustaining their cultures and many face losing parts of their cultures, ceremonies, and languages outright. Removal from and unfamiliarity to their traditional lands, meant that many Indigenous children lost this connection, affecting their culture and health. For example, these children never learnt to hunt and prepare traditional foods, which eventually impacts a community's access to these traditional foods, culminating in loss of traditional ways of staying healthy.

In Saskatchewan, Birch Narrows Dene Nation at Turnor Lake have created a program that teaches its youth community traditional hunting, fishing, and harvesting practices like hunting moose [9]. Further the program teaches knowledge around preparing, cooking, and using these foods [9]. Programs like this one are valuable to Indigenous identity and community health by allowing people access to nutritional, traditional foods and connecting with each other, culture, traditions, and ancestral knowledge [9].

There are so many more amazing initiatives that are being done by Indigenous communities like Land Back [10] and Water Protectors [11], and we encourage you to learn more about and support the ones in your area! There is a very bright future for advancing Indigenous Cultural Environmental Health.

However, despite the goals of colonizers and the Canadian government, Indigenous Peoples, cultures, and ways of living were never destroyed. Through all the challenges that Indigenous Peoples have faced, incredible community strength and perseverance have always sustained Indigenous cultures and identities. Consequently, it is very important to highlight the amazing work that Indigenous Peoples are doing together to heal and rebuild from devastating government policies, and fight for positive change against continuing colonialism.

Because of the deep connection between Indigenous culture, health, and land, there are many communities which are focused on teaching Indigenous youth their traditional practices and cultural knowledges through something called land-based education. By connecting and building relationships with the land through hunting and harvesting traditional foods from the land, important knowledge is passed on to the next generation of Indigenous youth who will help strengthen Indigenous cultures, communities, and health [9].

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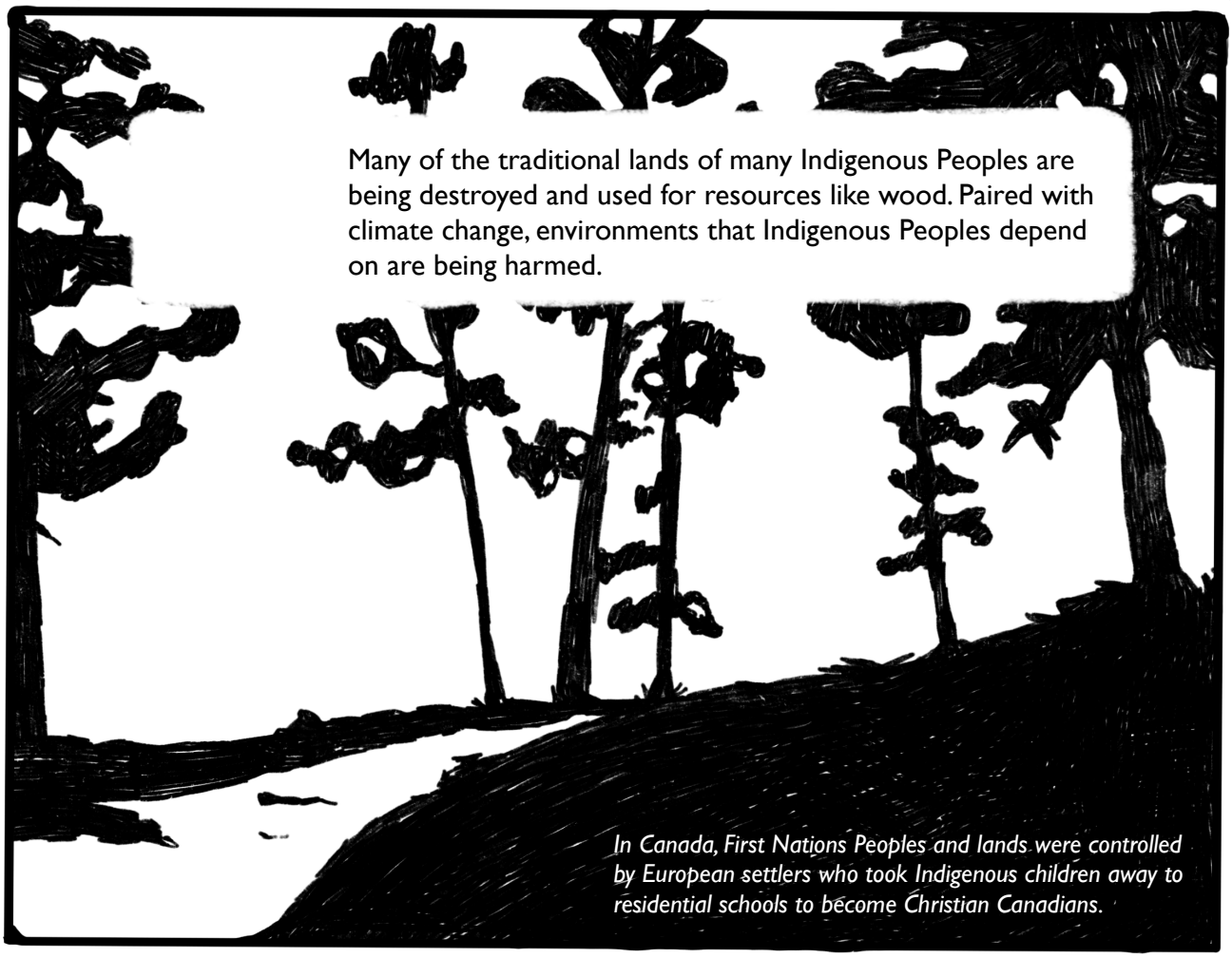
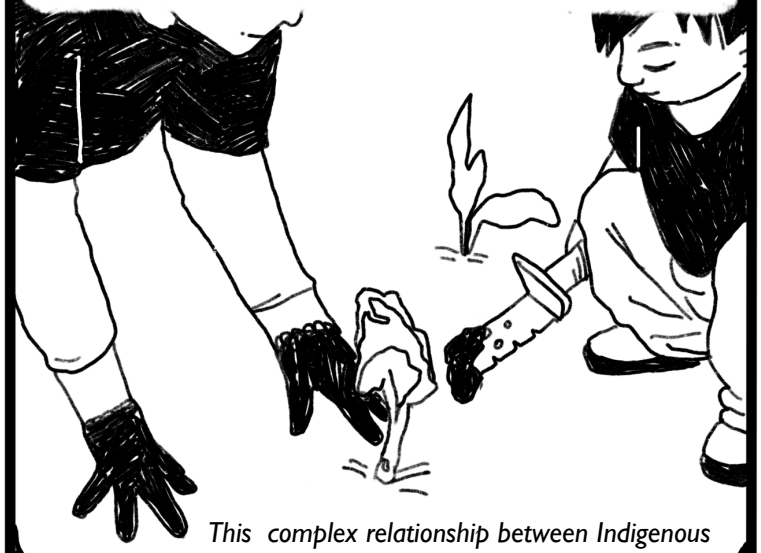
Indigenous Cultural Environmental Health

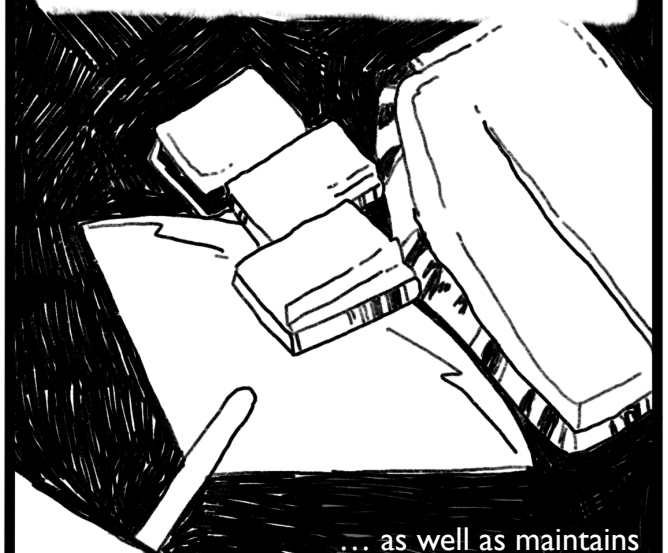


Indigenous Peoples' cultures, and ways of knowing are created through their relationships and interactions with their traditional lands. First Nations Peoples' health includes a balance of mental, *spiritual,* and physical health.

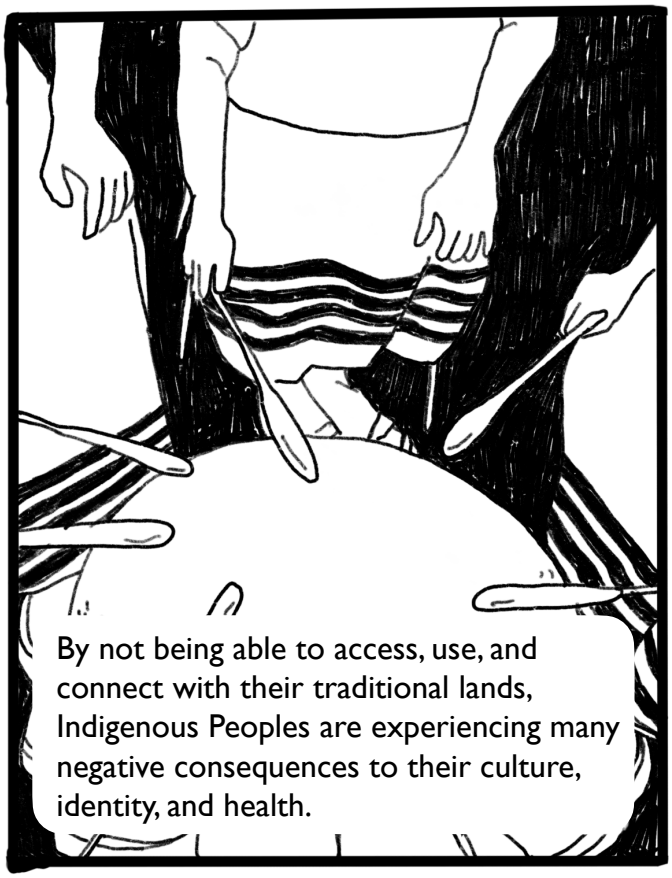


This complex relationship between Indigenous culture, health, and the environment is called Cultural Environmental Health.

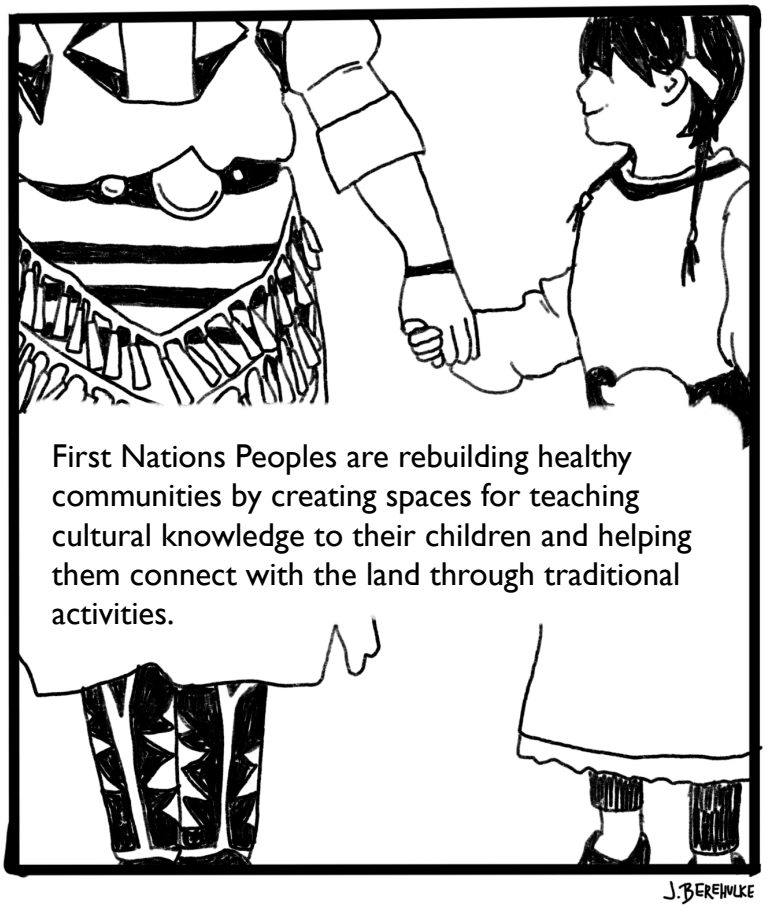
For example, having access to, hunting, sharing, and eating seal is a very important part of Inuit health. This traditional activity supports nutritious food and physically healing medicines for people…



… as well as maintains their mental and spiritual wellbeing.



By not being able to access, use, and connect with their traditional lands, Indigenous Peoples are experiencing many negative consequences to their culture, identity, and health.



First Nations Peoples are rebuilding healthy communities by creating spaces for teaching cultural knowledge to their children and helping them connect with the land through traditional activities.

J.BEREHULKE

What's in a Name? Indigenous Naming Conventions

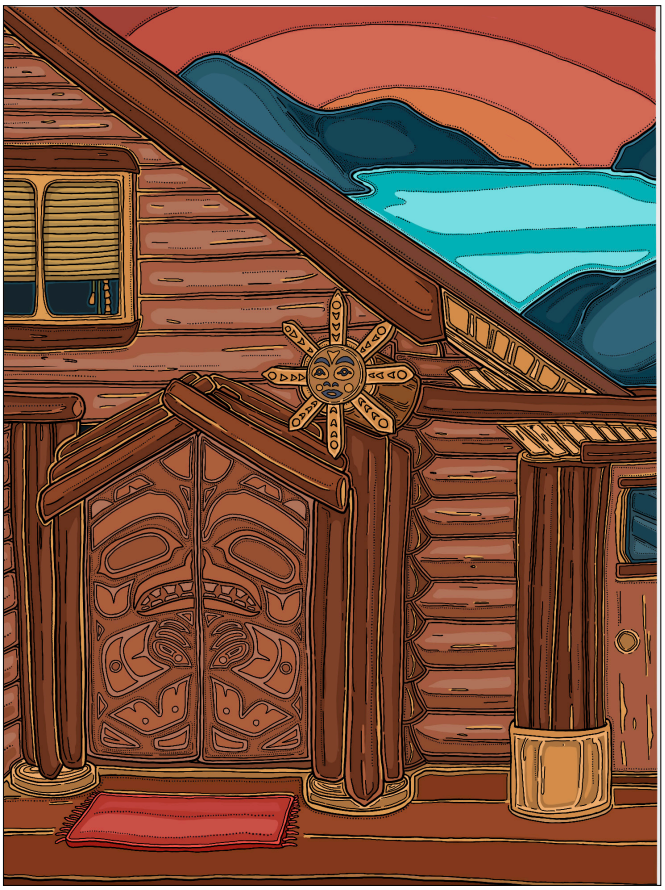
Colonization often resulted in the erasure of Indigenous place and wildlife names, which are descriptive of their use or spiritual significance.

Written by Ayasha Abdalla
Art by Koyah Morganbanke

What's in a name? For Indigenous Peoples, a name holds a lot of information and value. Not only are they descriptive of environmental and ecological knowledge, but they can also reflect historical and cultural teachings. They can be useful for wayfinding and even for emergency responses. They often carry details of the relationship between the land and its inhabitants, by indicating places of danger, beauty, or gathering [1]. As well, many Indigenous names for living things and their places communicate how they are used. They may even hold spiritual significance and showcase connections to creation stories.

For example, take the official tree of British Columbia, the Western Red Cedar. This tree has several terms in Indigenous languages that describe its different parts. The Quw'utsun' name is *xpeyʔ-əɬp*, which uses *xpeyʔ*, meaning "cedar wood," and the suffix *-əɬp*, meaning "plant or tree." If you want to refer to the inner bark, the Quw'utsun' will say *sl̓áwəy*, which is derived from the early term *ləw* or *ləʕw*, meaning "to come off (as skin or bark)"[2].

Here, the utility of the name for the Red Cedar showcases how important it is in the lives of West Coast First Nations, with all parts being used to make canoes, clothes, tools, and medicines. And since *xpeyʔ-əɬp* is an integral part of their lives, this tree also holds spiritual significance with a sacred creation story - for many Indigenous communities, it is even referred to as the tree of life [3,4, 5, 6].



On Indigenous names and biodiversity.

Indeed, Indigenous cultures have many names and stories that describe plants and animals of spiritual importance. As you can imagine, much like your own name holds significance for your story, Indigenous names are an incredibly important reflection of Indigenous culture and heritage and are often viewed with reverence.

Now, imagine such a name being stripped from your community, and replaced with something else. Imagine everything and everyone familiar with it is suddenly forced to see things under this new foreign name. Unfortunately, this type of jar-

ring and alienating experience is a common reality for Indigenous populations subjected to colonization.

This type of intrusion is particularly evident in ecology and biology, where the current names of many species were designated by European biologists, ignoring longstanding Indigenous names. Indeed, these names often reflected the name of a biologist that wrongly claimed "discovery" of the species. They tend to convey no morphological or ecological information, and by ignoring the Indigenous names, they can be insensitive and offensive given the historical context of the words [7].

In an attempt, to change this practice, many taxonomists are currently engaging with Indigenous Peoples and using their languages for newly described species. As well, many academics propose that Indigenous names should and can be incorporated within the current Linnean (scientific) naming system, without affecting the evolutionary relationships conveyed by the colonized name. In fact, using First Nation identifiers could even provide more information than before.

For example, a change in the name of two New Zealand tree species from *Nothofagus menziesii* and *Nothofagus fusca* to *Nothofagus tawhai* and *Nothofagus tawhairaunui*, incorporated the Indigenous Māori names. Not only that, the name still shows that these two species are part of the same family, but the similarity between *tawhai* and *tawhairaunui* (unlike the original names *menziesii* and *fusca*) add context that these species are closely related. Overall, these efforts to restore and use Indigenous names are encouraging and will be essential to help preserve and strengthen Indigenous languages and culture [8].

Indigenous naming principles for places.

When settlers came to Indigenous lands, they often claimed possession of territory through a declaration of discovery and replaced local names with new ones that reflected European culture and history [7]. This renaming was deliberate and was done to erase the languages, cultures and social structures of Indigenous Peoples.

Today, there is a recognition of the harm this has done, and as a result, across Canada, traditional Indigenous names are now being recognized and reinstated for many landmarks. An example of this is the Mackenzie river in the North West Territories, which has now adopted five Indigenous names: *Deho* (North Slave - Hare), *Dehcho* (South Slave), *Nagwichoonjik* (Kutchin-Gwich'in - Loucheux), *Kuukpak* (Inuktitut, Western Canadian), and *Grande Rivière* (Michif) [7].

By some measures, at least 30,000 official place names in Canada are of First Nation origin, with ongoing efforts to restore many more to their original Indigenous names [8]. This process is guided by the *Geographical Names Board of Canada* (GNBC), which are federal, provincial and territorial naming authorities. The GNBC regularly consults with Indigenous communities, cultural associations and heritage groups to collect traditional names and information on their meaning and origin [1,8,9].

From this dialogue, the GNBC has published a document titled the *Best Practices for Indigenous Place Naming*. This suggests a framework that considers a set of core principles to use when addressing geographical names with origins in Indigenous languages, and determining if such names exist for a particular geographical feature or place [1,9].

Overall, these principles focus on the recognition of Indigenous languages and their historical significance. In essence, the reconciliation of Indigenous names prioritizes the open communication with Indigenous communities, as this consultation on the topic of traditional naming is imperative to preserve the cultural significance.

A local example highlighting the importance of engagement is the naming of the Totem Park residence houses at the University of British Columbia. The first six houses built in the 1960s were named Haida, Salish, Nootka, Dene, Kwakiutl and Shuswap.

While the university was trying to recognize and acknowledge Indigenous communities, no Indigenous communities were actually consulted or asked permission to use these names. As such, they are inaccurate and do not represent Indigenous place names. In fact, if named correctly and according to the Indigenous Peoples they were trying to honour, these houses should be named Nuu-chah-nulth (Nootka), Kwakwɑ̓kɑ̓'wakw (Kwakiutl), and Secwepemc (Shuswap).

Later, recognising that the University is situated on the traditional, ancestral, and unceded territory of the Musqueam People, Student Housing and Community Services collaborated with the Musqueam Nation to come up with names for new buildings built in the 2010's. Here, with the knowledge and counsel of the Musqueam People, accurate and educational place names were gifted to the University. These new houses have traditional names that carry Indigenous stories and are known as həm̓ləsəm̓, q̓ələχən and c̓əsnaʔəm [10].

This shows the significance of open communication, as it can raise awareness of the existence of Indigenous names, their language, meaning, pronunciation, history, scope and significance.

When your own name is changed.

The degradation and subsequent reclamation of Indigenous names extends much further than only biodiversity and place names. In fact, many Indigenous Peoples themsleves were renamed through admittance into residential "schools", largely through the process of their mass apprehension when they were children (a process that was sometimes called the Sixties Scoop or the Millennial Scoop). Losing their original names effectively disconnected individuals from their culture and community, and with this loss of identity and dignity, essentially ensured that many Indigenous legacies faded into history. Traditional names were no longer passed down to children, with many of them becoming lost [11].

Many Indigenous survivors speak about how they do not connect with their legal Christian name, because it is not who they are - it is not the culture and history they identify with. However, the path to officially and legally reclaim Indigenous names is not easy. Many individuals who have reclaimed their names, had to go through a long and laborious journey [12, 13,14]. Moreover, it was only recently, in 2021, were Indigenous Peoples able to legally reclaim their traditional name without any fees, a result of one of many calls to action made by the Truth and Reconciliation Commission of Canada [5, 15].

The challenge for the future.

While these efforts to restore Indigenous biodiversity, geographical, individual and family names are a step in the right direction, the reality is that there is still significant residual trauma and reconciliation required for Indigenous Peoples. The reality is that there are many names that have not been recovered, and many names that have died out through generations of erasure.

As alluded to earlier, the issue is also pressing because many Indigenous languages themselves are in danger of becoming extinct. In 2021 within Canada, only about one in eight Indigenous Peoples were able to converse in their own language

[16]. More striking, a 2021 Statistics Canada survey showed that for about 30 of these Indigenous languages, there were a less than 500 speakers [16].

These trends are troubling, but they also demonstrate the importance of reinstating, using and protecting traditional Indigenous names. Not only are these names sacred to Indigenous culture, history, and identity, but they may also hopefully provide some of the awareness that is essential to restoring the sanctity of Indigenous languages themselves.

November 2024

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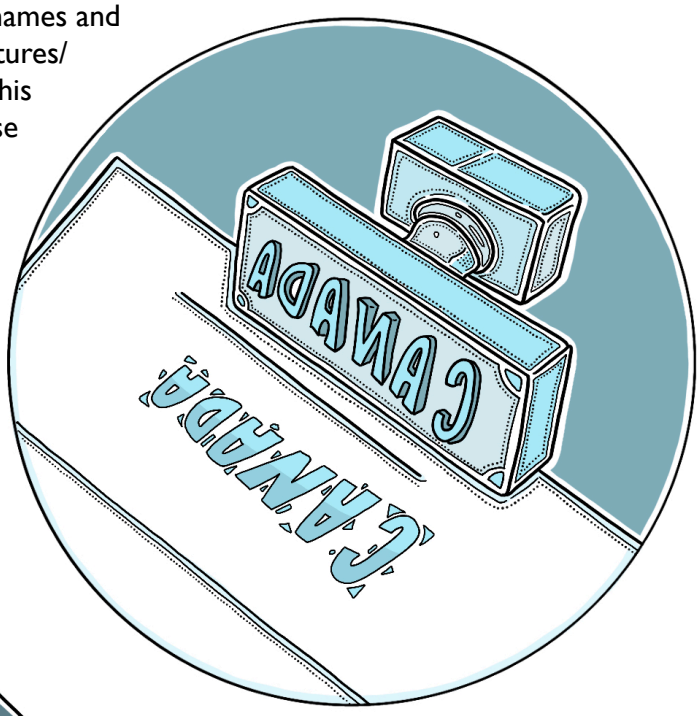
[16] Statistics Canada. Table 98-10-0294-01 Knowledge of Indigenous languages by single and multiple knowledge of languages responses and Indigenous language acquisition: Canada, provinces and territories

Indigenous Naming Conventions

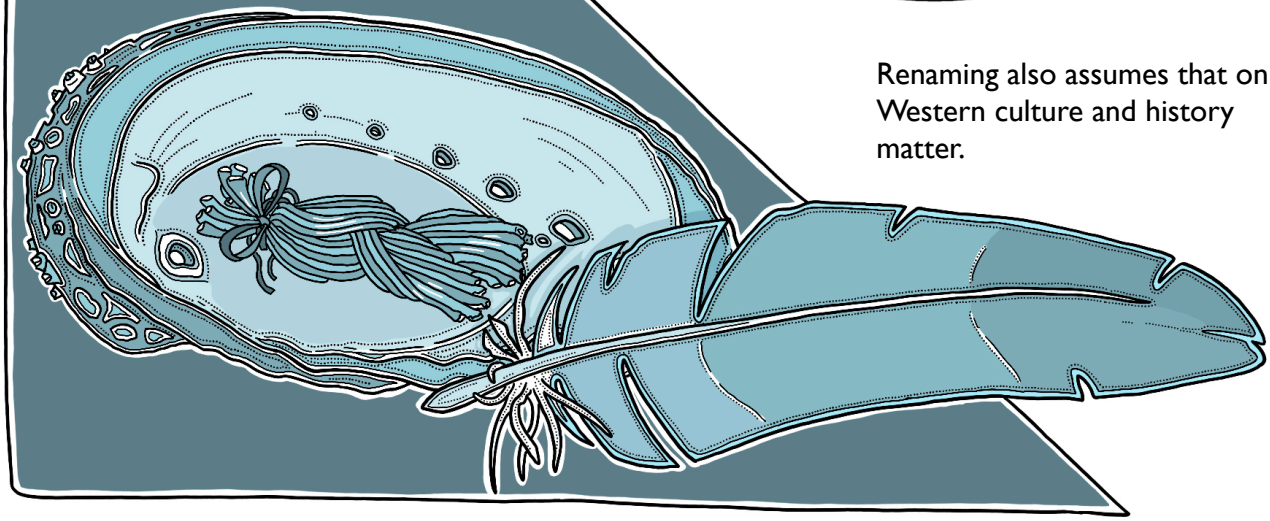
Indigenous place and wildlife names are descriptive of their use or spiritual significance. For example, the Western Red Cedar in its Quw'utsun name (xpey?-əɬp) means cedar wood (xpey?) plus tree/plant (əɬp), and Coast Salish people have a creation story for the origins of this tree.

Colonization resulted in the erasure of Indigenous names and degradation of their cultures/ language in many ways. This includes prohibiting the use of traditional names, actively misspelling and renaming things, and even assigning Christian surnames to people.



All of this can be insensitive, if not offensive.

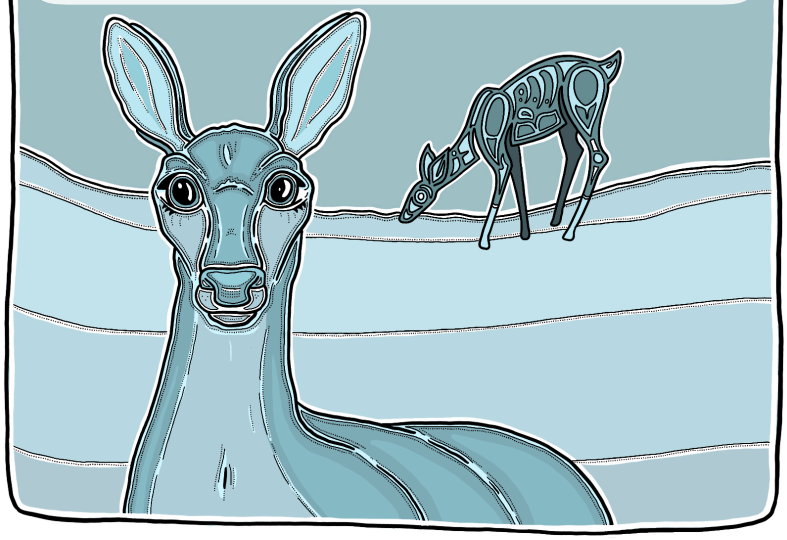
Furthermore, when compared to Indigenous names these colonial changes hold less ecological and cultural information.



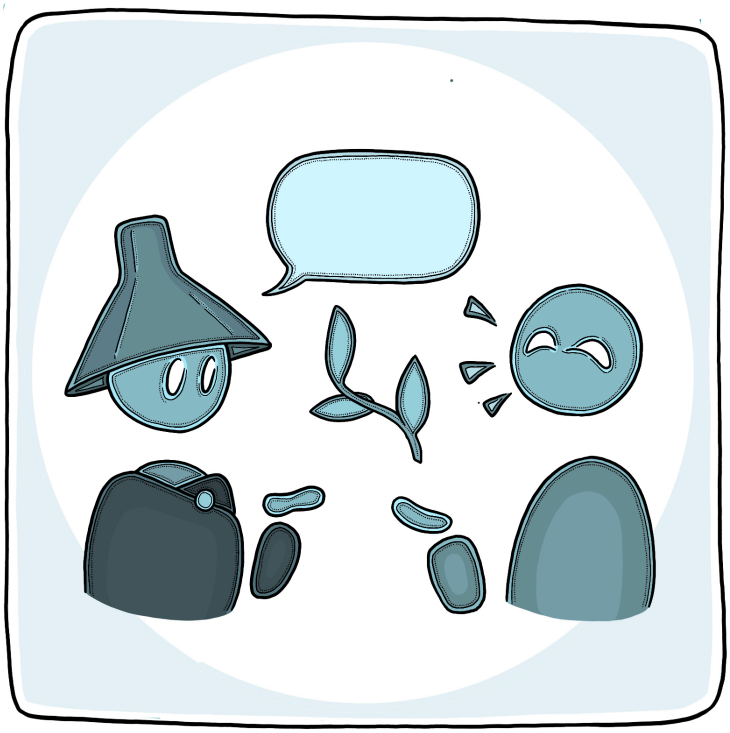
Renaming also assumes that only Western culture and history matter.

Words by Ayasha Abdalla, Art by Koyah Morganbanke

Because the use of traditional Indigenous names helps preserve the language and culture, many countries are reinstating Indigenous place names. This includes many Canadian provinces which have begun to add traditional names alongside the non-Indigenous name.



Open communication and consultation with Indigenous communities on this topic is imperative. It can increase the general public's awareness of the importance of Indigenous names, highlighting their language, meaning, pronunciation, history, scope, and significance.



Here, the GNBC* Canadian naming authorities have published core principles to consider: These include: recognizing and prioritizing Indigenous languages, with a mind to understand their historical significance; as well as following and enacting naming conventions by raising awareness and engaging with Indigenous communities.

** Geographical Names Board of Canada*

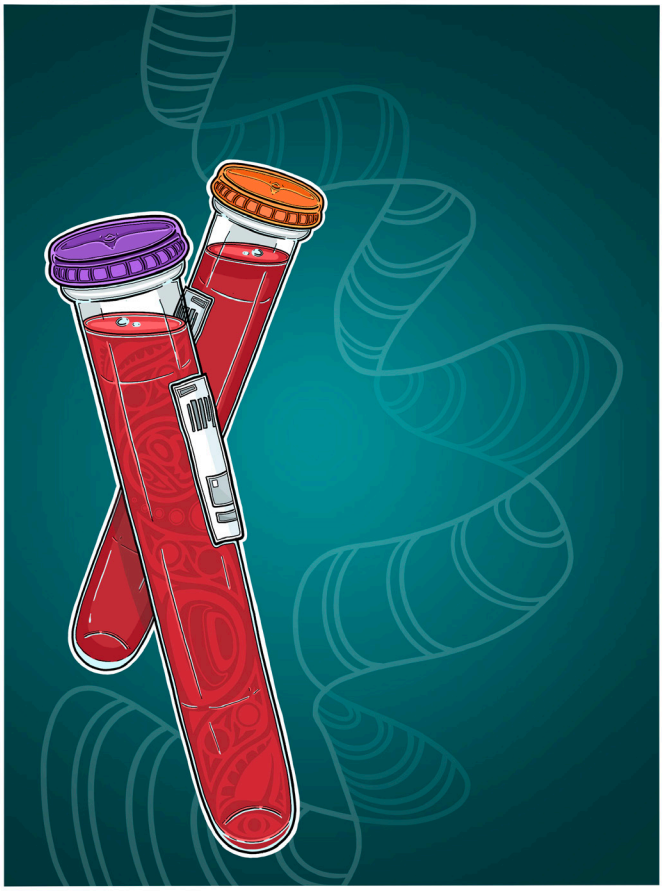
Indigenous Data Sovereignty: Empowering Indigenous Peoples in Western Science

How would you feel if you gave samples of your blood to researchers thinking that this would help your community, but then later discover that they were being used for other purposes without your knowledge or permission? And what if the scientific data gathered from studying your blood not only benefited the researchers, but actually hurt your community?

Written by Caitlin Mayo
Art by Koyah Morganbanke and Ogechi Anumba

In 1989, The Havasupai Tribe in the United States of America experienced this horrifying situation when they approached researchers from Arizona State University to better understand why diabetes was ravaging their community [1]. Here, the Tribe was misled to believe that their blood would only be used to perform research to help improve their diabetes[1]. Instead, the Tribe's blood samples were also used to study other medical diseases like schizophrenia [1]. In an even further breach in consent and confidentiality, the Tribe's blood samples were further shared with other researchers within the university, who used them to study alcoholism, inbreeding, and the Havasupai Tribe's migration and origin [1]. This violated many of the Havasupai Tribe's civil rights and as you can imagine, inflicted profound, irreparable emotional harm to the community [1].

Locally, almost the exact same situation happened in the early 1980s to the Nuu-chah-nulth First Nations on Vancouver Island, Canada [2]. With



high rates of rheumatoid arthritis affecting their community, 883 members of the Nation agreed to donate blood to scientist Ryk Ward at the University of British Columbia (UBC). As before, assurances were made that these samples would be used only for research to understand rheumatoid arthritis better, with the hope of finding possible treatments [2,3].

However, fifteen years later [3], the Nuu-chah-nulth First Nations discovered that their blood was also being used for other research projects without

their further consent [2]. Indeed, after leaving UBC, Ward took the Nuu-chah-nulth First Nations blood samples with him to various other academic institutions, continuing to share data with researchers around the world [3], and published half a dozen unrelated articles [2,3].

Understandably, any trust for western science practice from these Nations was broken. And tragically, throughout history, whether intentionally or by negligence [1], this pattern of Indigenous People being taken advantaged of and made victims of western (settler) science practices, was not uncommon. First Nations Peoples were often used solely as the subjects of studies carried out by non-Indigenous researchers [4,5], as opposed to being active collaborators and research partners.

When treated this way, Indigenous Peoples typically had little to no involvement in forming the research project, determining how or who could use their data,9 or deciding the goals and who would benefit from the project. Further, data collected typically belonged to the researcher and not the First Nations Peoples participating in the study [6]. Unfortunately, First Nations ways of knowing, traditional knowledge, and Indigenous data were often not recognized or even considered as valid in Western science studies which rely heavily on quantitative data [4,5].

As highlighted by the Havasupai Tribe's and Nuu-chah-nulth First Nations' experiences being "subjects" in a research study [1-3], Indigenous Peoples were not always fully informed about the research before the study and consent to use Indigenous data further was often not sought [4]. Considering past wrongdoings Indigenous Peoples have faced and their devastating impacts, First Nations communities fully understand the need to be careful about sharing their science data and participating in research studies. Importantly, these experiences have played an important role in shaping current collaborative practices.

Indigenous Data Sovereignty is one way First Nations Peoples are actively resisting and challenging the oppression, racial discrimination, and exploitation experienced in Western science today. Slowly, over the last 50 years, advancements in Indigenous rights and self-determination - such as the formation of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) - has aided in the formation of this concept [6]. Although this term may appear complex, it is important to first understand what Indigenous data is and who creates it.

Basically, *Indigenous Data* is considered to be any data that relates to Indigenous Peoples, their cultures, communities, ways of life, lands, and resources [4]. This data could be created by Indigenous Peoples or by non-Indigenous people if the data is about Indigenous Peoples [6]. Furthermore, Indigenous data can take any form, including for example, traditional knowledges and stories [7].

Here, Indigenous Data Sovereignty responds to harmful data practices by affirming Indigenous Peoples' rights to control their own data. This means Indigenous Peoples' have the right to determine all aspects of their own data including its collection, analysis, access, interpretation, dissemination, management, and re-use [4,5]. Moreover, Indigenous Data Sovereignty ensures the usage of data that supports and furthers the well-being of Indigenous Peoples [4], as well as ending unequal treatment of Indigenous Peoples in Western science. Specifically, Indigenous Data Sovereignty

One prevalent example of how Indigenous data is misused in Western science is how most uses of data focuses on problems such as Indigenous disparity and disadvantage instead of addressing Indigenous needs and priorities [4]. Known as deficit framing, data used in this way casts harmful stereotypes on Indigenous Peoples, painting First Nations Peoples as "in need" and "problematic" [4], rather than framing the challenges more accurately as a product of past exploitations. Another way Indigenous communities are hurt is when their data is interpreted scientifically without using traditional, contextual or cultural knowledges [5]. For instance, the Havasupai Tribe in Arizona felt this when researchers published data which contradicted the Tribe's cultural and sacred beliefs of their origin [1].

makes sure that data created is empowering to and benefits Indigenous communities, and is kept within context [4]. It also ensures that data stays culturally and geographically specific to an Indigenous community [4], preserving the large diversity across and within Nations [8]. Additionally, the data produced is to be relevant and protective of Indigenous Peoples' interests [4]. Basically, data reflects Indigenous values and priorities [4].

Although, great progress has been made, there is still a ways to go before full Indigenous self-governance is realized [7,9]. One challenge is the tension created by the emergence of large amounts of data in modern science and the push toward opening data, making it freely available to use, share, and re-use [4]. Through sharing, open practices promises to allow more effective collaborative use of data in order to solve complex issues otherwise unsolvable when data is unconnected and inaccessible [4].

Although open data can be greatly beneficial to science, it also is a cause of concern for Indigenous communities who fear risking the protection of Indigenous knowledges and rights. If Indigenous data is made open for anyone to share and use without ensuring the proper protections for Indigenous Peoples, it could be easier for harmful data practices, like those described earlier, to occur. Considering open data and past wrongdoings Indigenous Peoples have faced, special concern must be held to ensure the protection of Indigenous knowledges [4].

Fortunately, some principles, or rules, have been created that can be followed to help protect Indigenous rights and perspectives in science. One of these principles is called OCAP® which stands for data Ownership, Control, Access, and Possession [8]. Supporting strong Indigenous governance of information, "OCAP® asserts that First Nations alone have control over data collection processes in their communities, and that they own and control how this information can be stored, interpreted, used, or shared" [8]. Importantly, these principles "will be expressed and asserted in line with a Nation's perspective, worldview, traditional knowledge, and protocols" [8]. Anyone working with Indigenous communities should apply these OCAP® principles to ensure that their interactions with Indigenous Peoples' data is respectful and follows proper protocols. Using this framework, outcomes of scientific research can become more equitable and benefit First Nations Peoples, supporting the growth of Indigenous communities and cultures. Ultimately, we can all work to help support Indigenous Data Sovereignty by building positive relationships and practicing respectful, ethical, and careful science!

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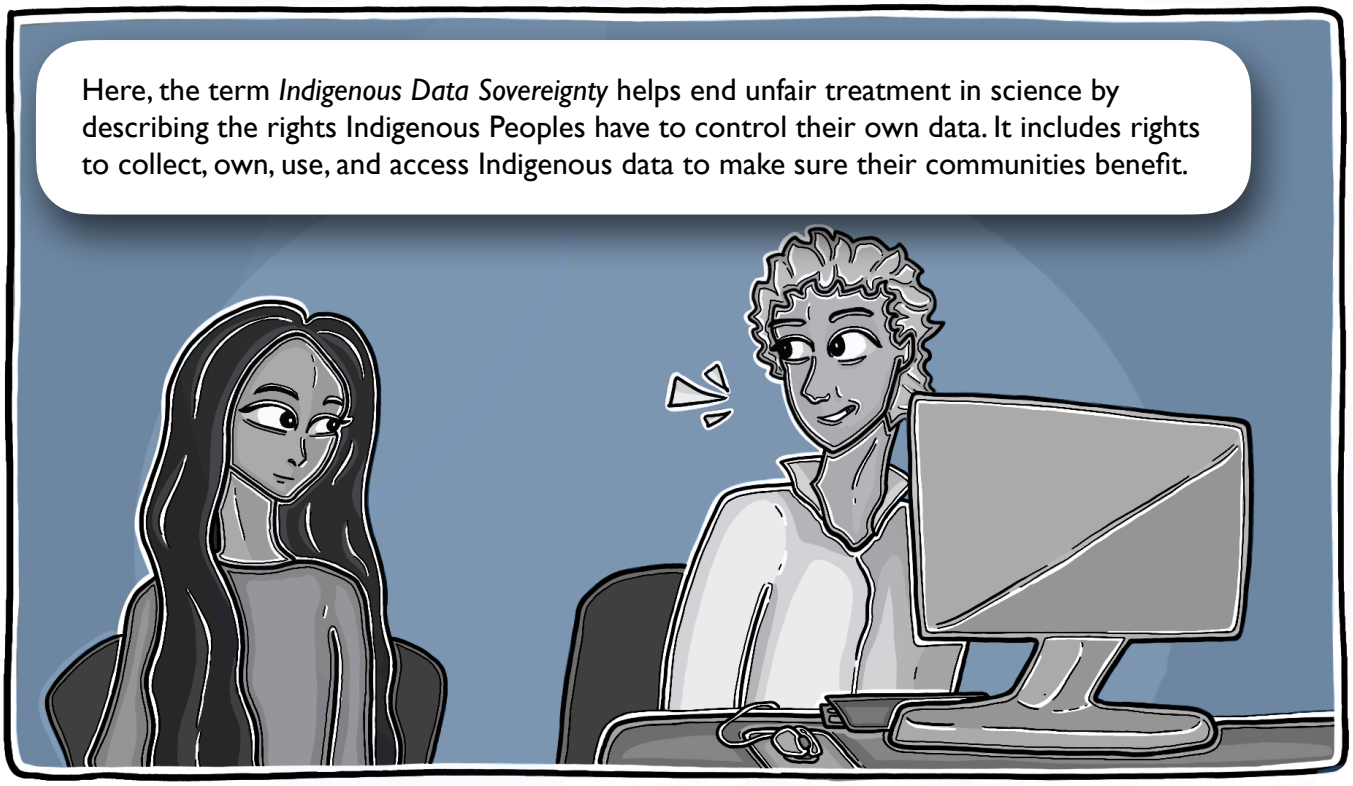
Indigenous Data Sovereignty

How would you feel if you gave a sample of your blood to researchers and later found out that it was being used without your permission? And what if scientific data gathered from your blood benefited these researchers instead of your community?

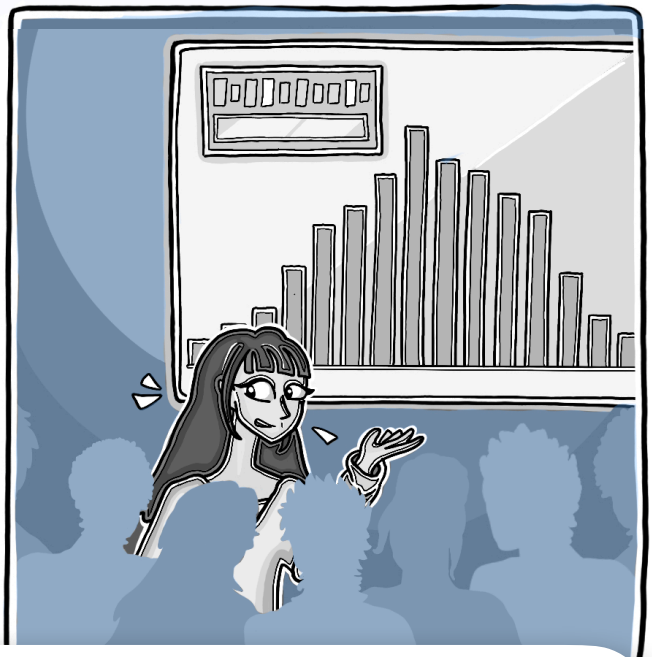
This has actually happened to a number of communities, including the Nuu-chah-nulth First Nations on Vancouver Island and the Havasupai Tribe in the U.S

Indigenous Peoples were and are often victims of such situations where they are taken advantage of in scientific research. Because of this, First Nations communities are careful about sharing their data and participating in research studies.

But what *is* Indigenous data? It refers to all data about Indigenous individuals, communities, cultures, traditional knowledges, lands, and ways of life. Indigenous data is any data created by or about Indigenous Peoples.



One challenge Indigenous Data Sovereignty faces today is the free sharing of data online for anyone to see and use. Indigenous communities want to support sharing their data but because of wrongdoings they must also make sure their rights and needs are protected.



Four rules that help to protect Indigenous Data Sovereignty are described by *OCAP®* which stands for data **O**wnership, **C**ontrol, **A**ccess, and **P**ossession. When scientific data is made following these rules it supports the growth of Indigenous communities and cultures.

OCAP® is a registered trademark of the First Nations Information Governance Centre (FNIGC). See https://fnigc.ca/ocap-training/ for a full definition.

Reconnecting with the Land: The Transformative Power of Indigenous Land Based Education.

Imagine stepping into a classroom like no other, where the land itself becomes the teacher, and every footfall upon its sacred grounds imparts profound lessons in connection, resilience, and respect. This transformative approach lies at the heart of Indigenous land-based education, an ancient and holistic philosophy that embraces the wisdom of the natural world as the ultimate guide to understanding life and the human experience.

Written by Maia Burgess
Art by Jasper Berehulke

The Power of Stories

Often, this wisdom is channeled through the art of storytelling. This not only serves as a powerful tool for passing down ancestral knowledge and healing within Indigenous communities in Canada, but also has the potential to contribute significantly to scientific research and knowledge. Indigenous communities in Canada have developed intricate understandings of the environment through generations of living in harmony with nature. These traditional ecological knowledge systems encompass a vast array of insights into ecosystems, wildlife behavior, plant properties, and sustainable resource management practices.

The Ojibwe community in Ontario has passed down stories and teachings about the migration patterns of animals, which has proven crucial in contemporary wildlife research. Integrating this traditional knowledge with modern scientific methods has led to a deeper understanding of the behavior and conservation needs of various species.

Through storytelling, elders and knowledge keepers can share these invaluable insights, contributing to the preservation of unique ecological knowledge that is often complementary to modern scientific understanding. Therefore, storytelling strongly facilitates cross-generational communica-

tion and collaboration, enabling Indigenous researchers to work closely with elders and community members. This collaboration offers a distinct approach to Western scientific research, where one can maintain academic rigor but also recognize the importance of cultural wisdom.

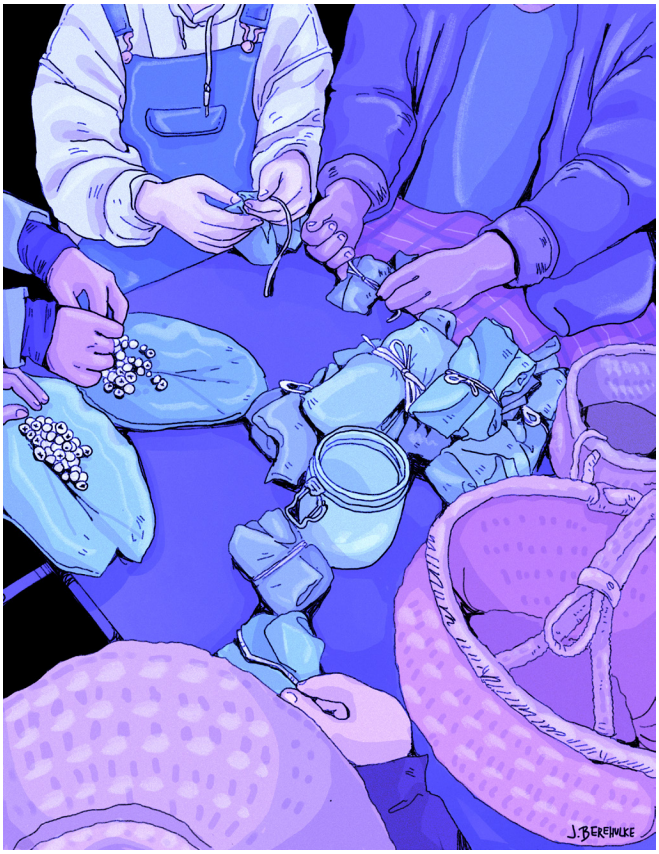
Interestingly, storytelling also has the power to ignite scientific curiosity and interest in younger generations. When scientific concepts are interwoven into traditional narratives, they become more relatable and accessible to children and youth. This approach fosters a desire to explore the natural world, encouraging Indigenous students to pursue scientific education and careers. A great example is where Indigenous educators in Manitoba have incorporated scientific explanations into stories about the life cycle of animals. This approach has led to increased engagement in science-related subjects and a greater interest in environmental stewardship.

It's all about the place, the local

Place-based learning, another form of land-based education, utilizes the local environment and community as a foundation for learning. By focusing on the local, this approach empowers Indigenous students to embrace their own heritage and wisdom, strengthening their sense of identity and belonging.

Place-based learning in Canada often centers on Indigenous traditional ecological knowledge (TEK), which is deeply rooted in the relationship between Indigenous peoples and the land. As in storytelling, Elders and knowledge keepers play a vital role in sharing this wisdom, passing down

The Mi'kmaq community in Nova Scotia participates in place-based learning that emphasizes traditional land management practices. Through projects focused on ecosystem restoration and species monitoring, students contribute to ecological research and management, fostering a symbiotic relationship between Indigenous wisdom and scientific inquiry.



valuable insights about local ecosystems, plant and animal behavior, and sustainable resource management.

As well by instilling a sense of responsibility and connection to the land, place-based learning encourages environmental stewardship. Students become actively involved in environmental conservation efforts and scientific research within their local communities.

The power of the ceremonial

In Canada, Indigenous communities also intertwine ceremonies and rituals with their environment, as another way to enhance holistic and sustainable approaches to education and ecological stewardship. Indigenous ceremonies are sacred gatherings that uphold ancient traditions and teachings, passed down from generation to generation. Through ceremonies, Indigenous communities are able to maintain a strong connection and therefore foster a profound relationship with their ancestral lands. As well, rituals are also often

deeply tied to the natural world, reflecting the Indigenous peoples' reverence for the land and its resources. All of this offers a sense of identity, belonging, and continuity, reinforcing the importance of preserving cultural heritage.

In their way, these ceremonies and rituals serve as powerful tools for imparting and categorizing knowledge about the environment, the cosmos, and human interconnectedness with nature. Through this, Indigenous peoples have long observed ecological patterns, animal behavior, and weather changes, and therefore these trends become analogous to a form of scientific insight. Furthermore, the essence of many of these ceremonies and rituals ultimately emphasize sustainability, respect for ecosystems, and interdependence. As a result, science is essentially embedded into the core of Indigenous knowledge, and therefore enriches the land-based education experience.

To immerse oneself and to learn the language

Cultural immersion programs are another transformative educational approach embraced by some Indigenous communities in Canada. These initiatives offer a unique opportunity for participants to fully immerse themselves in the traditional ways of life, language, and spiritual beliefs tied to the environment. Through living on the land and engaging in day-to-day activities with community members, participants gain a profound understanding of Indigenous cultures and their deep connection to nature.

Examples of Indigenous ceremonies in Canada include the Powwow, a vibrant gathering that celebrates culture through dance, music, and storytelling. The Sundance, a powerful spiritual event practiced by some Plains Indigenous groups, demonstrates a profound connection to the land as participants engage in fasting, dancing, and prayer for the well-being of the community and the environment. The potlatch, practiced by various First Nations, is a ceremony that involves the redistribution of wealth and reinforces communal ties while emphasizing respect for the environment.

the Haida Nation in British Columbia has been actively engaged in language revitalization efforts, reclaiming and teaching their endangered Haida language to younger generations. By using Haida to describe their land and its resources, the community not only imparts traditional ecological knowledge but also reinforces the intrinsic link between language, culture, and the environment, ensuring the survival of their unique heritage for generations to come.

This might also include language revitalization which is seen as another critical component of land-based education. The preservation and revitalization of Indigenous languages can play a pivotal role in strengthening the connection between the people and their ancestral lands, as these languages are structured in descriptive ways that can deepen the understanding of the environment. Through the revival of their native tongues, Indigenous communities can describe and comprehend the natural world with depth and nuance, fostering a more profound relationship with the land and their cultural heritage.

A Harmonious Integration

In conclusion, Indigenous land-based education embodies the harmonious integration of ancient wisdom and contemporary knowledge, offering a holistic and sustainable approach to understanding the environment and the human experience.

Furthermore, Indigenous education research recognizes and values alternative ways of knowing and understanding the land and the world at large. This includes help from western science to keep things accurate and evidence based. However, western science also tends to value transparency, but many Indigenous stories are sacred and private. Consequently, it is important for Western and Indigenous perspectives in science and education to work together to establish trust, build respectful relationships, and honor Indigenous protocols throughout the relationship.

Ultimately, as Canada continues to foster edu-

cational inclusivity and cultural appreciation, it is crucial to recognize and celebrate the value of Indigenous land-based education, acknowledging the wisdom of the land as the ultimate guide to understanding life and fostering a deep sense of interconnectedness between all living beings.

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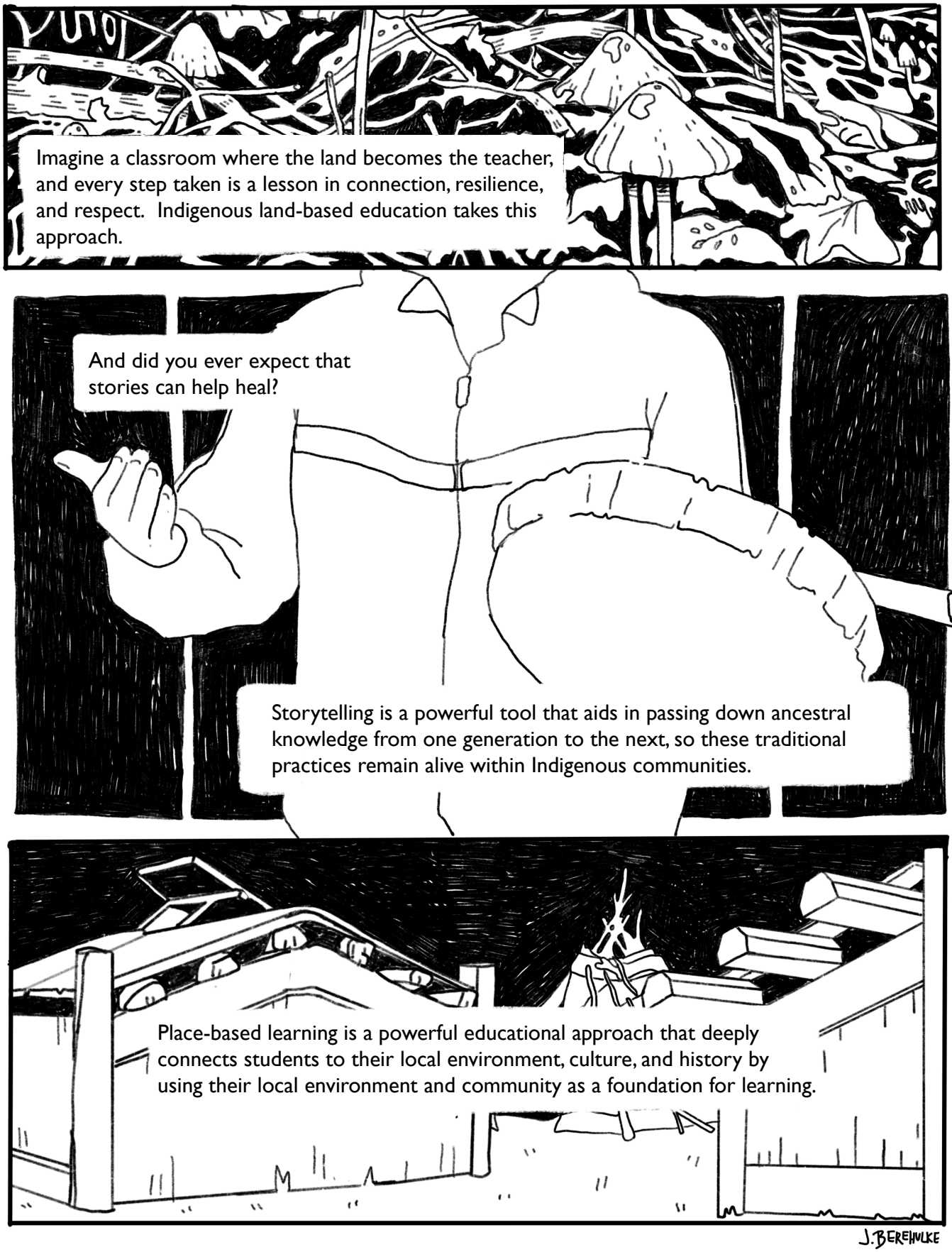
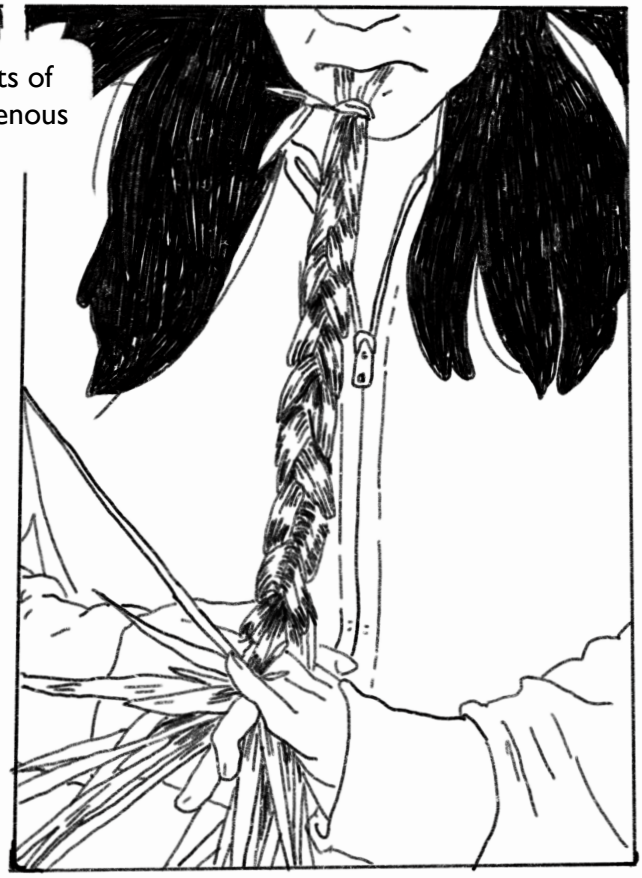
Indigenous Land Based Education



Here, ceremonies and rituals are essential aspects of land-based education, as they also connect Indigenous people to their spiritual and cultural roots.



Indigenous education research recognizes and values alternative ways of knowing and understanding the land and the world at large. This includes help from western science to keep things accurate and evidence based. However, western science also tends to value transparency, but many Indigenous stories are sacred and private.

Therefore, it is important for Western and Indigenous perspectives in science and education to work together to establish trust, respect, and to honor Indigenous protocols throughout the relationship.

J. BEREHULKE

Indigenous Health Disparities: A View from the Past, Present and Future

Like Western medicine, current views of Indigenous health considers physical, mental, and social/emotional wellbeing. However, it also emphasizes the importance of connection to the land, as well as First Nations culture, community, spirituality and ancestry.

Written by Ayasha Abdalla
Art by Ogechi Anumba and Koyah Morganbanke

A case of nutritional experimentation

In the 1940s, Canada published its very first *Food Guide*, a standard for nutritional advice. These infographics ("*Eating well with Canada's Food Guide*") were plastered all over schools and even on our home fridges. To this day, a rainbow of green, yellow, blue and red colours provide details on the four main food groups and their suggested serving sizes. However, while this might seem like a harmless blueprint for healthy eating, this guide actually has a dark history: a history that began during the Second World War.

Here, the Canadian government, in an effort to keep their troops strong, wanted to encourage healthy eating for their soldiers. At the time, however, scientific knowledge about nutrition was minimal - so there was a desire to learn more about how to eat healthy. As it happened, this was also during a time when Indigenous children were routinely separated from their parents and trapped within the notorious residential school system, a system where parents often made it clear that many children were not being fed properly.

It was in these poor conditions, that the Canadian government, led by scientist Lionel Pett saw an opportunity to perform nutritional experiments. In fact, nearly 1000 Indigenous children became test subjects. Rather than simply provide more food to these children, experiments were set up so that some would receive experimental nutritional supplements, whereas others would be subjected to *intentional and sustained malnutrition* and starvation [1-4]. The trauma created by this horrific situation cannot be overstated, and many of these children, as adults, recount troubling memories and recollections. It was common for these children to risk punishment and sneak away from school to find fruits or veggies to eat [2].

The stark truth is that the abhorrent treatment of these children was built on a system of racism, where scientists and bureaucrats simply believed that Indigenous Peoples were inferior. Remarkably, it was even suggested that this inferiority was caused by the malnutrition itself, somehow ignoring how racialized colonial practices were at the root of the malnutrition in the first place.

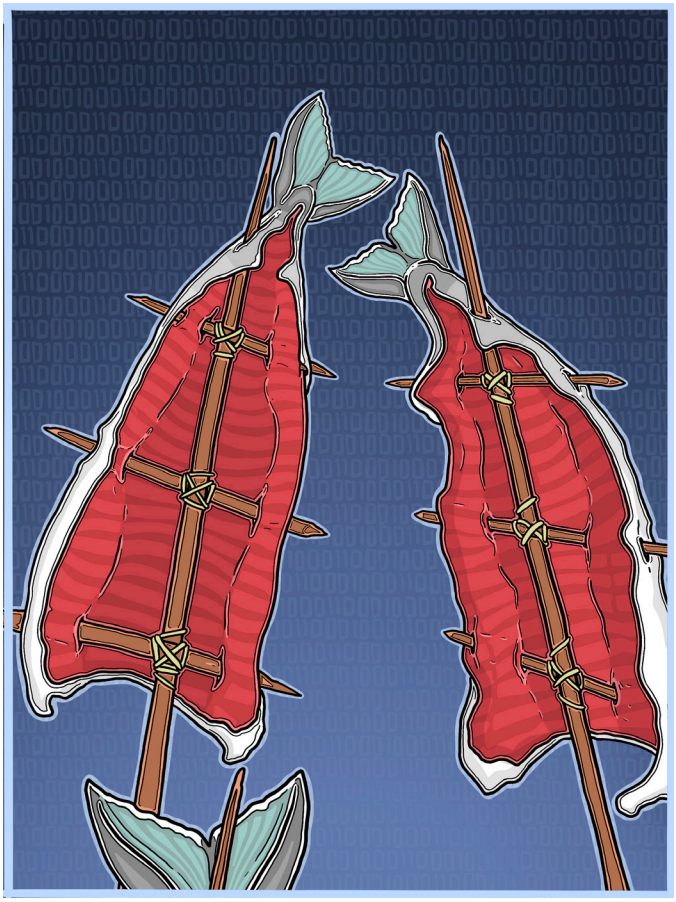
On *Mno bmaadis* and the challenge of being alive and well

As ugly as the above incident was, it should be noted that this harm was evident from the very first arrival of the Europeans to the "new" Canadian land. As early as the late 1400's, settlers began treating the land as their own, stealing it in fact, and aggressively moved to build up their own culture and traditions. Settlers would systematically suppress Indigenous language and culture, and would even use more nuanced forms of colonialism, such as setting up unfair regulations on hunting which directly impacted the diets of many Indigenous Peoples. Devastatingly, many settlers also inadvertently brought with them unknown diseases, ripe for large scale and deadly infections in communities whose immune systems were unprotected from such pathogens. Ultimately, it was through pathways such as these, that colonization impacted various aspects of Indigenous health, leading to outcomes that in many ways still persist to this day.

To better understand the intergenerational effect, one must recognize that for Indigenous populations, the idea of health goes beyond just simple physical wellbeing. For example, an idea of this can be seen in the *Mno bmaadis*, an Ojibway term used by Anishnaabe Indigenous Peoples, meaning being alive and well [5,10]. More specifically, such Indigenous perspectives describe a person's health as encompassing a holistic balance between physical, mental, spiritual and social/emotional wellbeing. They emphasize the importance of connection to the land, as well as Indigenous culture, community, family and ancestry [6]. Under this framework, it's not surprising that the effects of colonialism, where Indigenous concepts of land, culture and ancestry were systematically destroyed, were so disruptive.

As such, these disruptions contributed to the poor health outcomes seen throughout history in Indigenous communities, and this disparity persists today. They manifest in several ways, starting at birth, carrying on throughout life, and, as alluded to earlier, may be transferred over generations. In stark terms, data clearly shows that Indigenous populations show poorer life expectancies, abnormal birth weights, higher malnutrition rates, higher incidence of obesity, and more. Disease burden is also higher: prevalent and notable current examples include tuberculosis, an airborne bacterial disease, as well as several mental illnesses, such as depression, anxiety, and substance abuse.

Indeed, many of these disparities are also due to modern socioeconomic factors, many of which result from historical influence. These socioeconomic factors can augment disparities, and include elements such as access to employment and



Tuberculosis was not prevalent in North America until European settlers came, spreading rapidly and infecting Indigenous populations [7,8]. With little knowledge of the newly introduced disease, no support from European medicines and healthcare, and having their bodies and immune systems unaccustomed to the bacteria, Indigenous populations got caught in a brutal epidemic. Even today, tuberculosis is still a major problem with some Indigenous communities. One can especially see this in Inuit populations, where the infection rate is nearly 300 times higher when compared to non-Indigenous populations (a rate of 0.6 per 100 000 non-Indigenous Canadians compared to 170.1 per 100 000 Inuit Canadians [9]).

education, poor living conditions, food insecurity, precarious healthcare and social support. In fact, together, these add further fuel to alight disproportionate impact on Indigenous communities.

Take the incidence of mental illnesses in Indigenous populations: Recent research has been looking at the generational effect of the trauma endured by Indigenous populations, particularly those who survived life at residential schools. Unsurprisingly, the abuse inflicted on these children extended much further than the nutrition experiments mentioned earlier. Indeed, this abuse would have severe psychological impacts on survivors, which has been seen to be long-term, both at the individual and generational levels. Imagine struggling because of your experiences, and then imagine being a child of that struggling abuse victim - the likelihood of a healthy upbringing would be challenged, and this can cause a cycle of intergenerational trauma that may be difficult to break out of. Indeed, several studies have shown various psychological and biological impacts on children and even grandchildren of residential school survivors [10-12].

Western Science and Indigenous Perpectives combine

Because of the lasting effects of colonization and the current state of socioeconomic realities, it makes sense to use science and research to learn more about these health disparities. This information can potentially reveal what causes (and maintains) them, and more importantly, provide solutions on how to combat them. However, because traditional science has a long history of exploitation and unethical treatment of Indigenous populations, there is naturally a strong reluctance for these communities to engage in this type of westernized science. Given past actions, it is completely understandable for Indigenous populations to be wary of sharing their biological data.

Consequently, there is currently a general lack of medical data available on Indigenous patients. This gap in scientific knowledge combined with the fact that the majority of Western scientific research over-represents European data [17], has had a significant impact on the success of Indigenous healthcare. In other words, if you only have data about certain populations, then the medicines that are developed may only have limited use on those underrepresented populations.

A prominent example of this are studies using genetic information, specifically the ability to study the genomes of patients (a genome being the entire DNA code of a person). Being able to do this with Indigenous Peoples could be extremely beneficial to understand, identify and prevent diseases. However, with the natural hesitancy for Indigenous Peoples to participate (and for good reason), there is a "genomic divide" of data, resulting in significantly poorer risk prediction and disease prevention within these populations.

This is why there are attempts to address this divide. A great example is the BCCHR *Silent Genomes Project*, led by Nadine Caron and Laura Arbour. The idea here is to create a DNA project that would collaborate wholeheartedly with First Nations' communities to collect this valuable genetic data, and to do so in a culturally sensitive and appropriate manner. Furthermore, mechanisms are in place so that ownership of data is clearly defined and in favour of the Indigenous Peoples involved. As the first Indigenous (Sagamok Anishnawbek First Nation) woman to become a general surgeon in Canada, Nadine Caron was

Many studies looking at intergenerational trauma have shown that damage can be passed on in biological ways. One example of this is something known as epigenetics [13]. Briefly, this is where the accessibility of the genetic DNA code of a person is influenced by the environment (stress, trauma, poor nutrition, alcoholism), such that access to certain parts of the DNA code is blocked. This in turn can lead to poor outcomes for a person (physical or psychological)[14,15], as the code may be important for healthy biological functions. More strikingly, these stressed induced changes in accessibility can appear to be inherited, and therefore seen to be passed on from mother to child [16]. In fact, epigenetic studies in families with residential school histories are shedding light on this phenomenon, and it is hoped that understanding its biology can provide a starting point to explore interventions that could help to break the cycle of this form of intergenerational trauma.

especially sensitive to First Nations' needs, having encountered constant ignorant actions and comments during her career as a healthcare professional. Indeed, this type of behaviour is exactly why more Indigenous perspectives need to be involved in research, and why Nadine founded the Silent Genomes Project. She says, "Academic qualifications and years spent in a scientific role can never replace actual lived experience in one of these communities" [18].

Ultimately, there is a growing recognition that there needs to be continual efforts to improve Indigenous relations in health research. In this way, Indigenous healthcare can be more data driven, targeted and improved, but also with Indigenous perspectives front and centre. Health is one of the most critical aspects of life, so it is absolutely imperative that the health disparity across Indigenous communities is taken seriously. By recognizing the historical and social determinants driving the poor health outcomes for Indigenous Peoples, we come closer to understanding what can be done to improve these outcomes. In the end, more attention in responsible Indigenous healthcare research should be directed to restoring the balance of *mno bmaadis* so that it has a chance to recover.

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Indigenous Health Disparities

Like Western medicine, current views of Indigenous health considers physical, mental, and social/emotional wellbeing. However, it also emphasizes the importance of connection to the land, as well as First Nations culture, community, spirituality and ancestry.

However, Indigenous health also has many challenges. Historically (and contemporarily), it was brutally impacted by colonization, where foreigners both inadvertently and deliberately brought new diseases to Indigenous communities.

With their traditional medicines and immune systems not exposed to such pathogens, this often led to many deaths.

Furthermore, historical trauma within Indigenous populations can be passed through generations and cause lasting health effects. This has been seen with children of residential "school" survivors showing signs of depression, anger, and even PTSD, likely due to the trauma endured by their parents.

Words by Ayasha Abdalla, Art by Ogechi Anumba

There is also a long and condemnable legacy of poor relations and distrust between Indigenous patients and Western medical science, as historical experimentation was often unethical and purposefully exploited Indigenous Peoples.

Even today in Canada, there is a significant institutionalized health gap in Indigenous communities, resulting in a wide range of poor health outcomes and increased disease susceptibility. These include, but are not limited to, reduced life expectancy, maternal and infant mortality, malnutrition, and high rates of physical and mental illnesses.

Much of this is due to *social determinants of health*, a term that highlights how health is impacted by the conditions of the person's environment, past and present.

This includes things like income, education, living conditions, racism, and loss of connection to the land and culture.

Therefore, this reinforces the importance of providing social support systems to achieve good Indigenous health outcomes.