

Breaking Through the Ice of Neurosurgery

2007 Congress of Neurological Surgeons Presidential Address

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Over the last decade, I have had the privilege of serving on the Executive Committee of the Congress of Neurological Surgeons. I have learned much from the leadership, volunteer efforts, and spirit of Presidents Bill Friedman, Hunt Batjer, Dan Barrow, Issam Awad, Steve Papadopoulos, Mark Hadley, Vincent Traynelis, Nelson Oyesiku, and Richard Ellenbogen. The Congress of Neurological Surgeons has a legacy of innovation, and its mission has been defined by its dedication to education and a concern with a mission dedicated to education, and concern with the global issues of neurosurgery since its inception in 1951. To serve the organization is a privilege for which I must thank my wife, Susan, our two sons, Alex and Max, our parents, and friends who have traveled to be with us here today. I must also thank my friends and colleagues at the University of Toronto where I studied and trained, and the University of Pittsburgh where I found an exciting and productive venue for practice and research. This year's Congress of Neurological Surgeons Executive Committee and staff is the heart of the organization and the reason we are here today.

The theme of the 2007 address is "Breaking Through the Ice of Neurosurgery." To address this topic, I will use two of my own personal interests—contrarian thinking and polar exploration—to critically evaluate what we do and who we are as neurosurgeons. How shall we break through the barriers that limit progress? Do we dare explore neurosurgery as the great explorers tackled their challenges? We have been given a tremendous gift, but a gift that is riddled with conflict, frequent change, redefinition, and a tide of progress that may not flow with how we have been trained. Across the span of a career, we can expect much to happen. Last year at this meeting, the director and producer, George Lucas, spoke on the topic of creativity. He challenged us to ask about the status quo, question authority, and to innovate, which, of course, sometimes may go in an unexpected or wrong direction. Clearly, there are many things in neurosurgery that are difficult. Sometimes we seem to find an easier way to do things, but frequently we just put up with our difficulties.

Thus, if we are going to radically change neurosurgery, not just eventually for the better, but quickly, we will have to evaluate how we think and the way that we address new ideas and tackle problems.

Do we change things just because we have the courage to do so or because it leads to career advancement? For some neurosurgeons, the current solution may seem quite adequate: comfort with the status quo. Dr. Thomas Starzl at the University of Pittsburgh radically changed the culture of organ transplantation so what was deemed crazy and impossible became mainstream within 2 decades. The problem now is not that organ transplantation will not work, it is that we have an organ shortage, a medical problem replaced by a societal problem.

Of course, the public wants to know what we are doing about their devastating neurological problems. They know the research when it hits the mainstream media. On the topic of cellular repair, if rats are getting better, then why not people? Of course, our answer might include a discussion of the complexity of stem cell research, but the important question may be, "Why not?" Tremendous advances in neuromodulation concepts, both for the brain and peripheral nervous system, are occurring every year. Functional imaging studies are localizing areas activated in patients for pain, seizures, depression, schizophrenia, anger, humor, and even decision-making. Indeed, one recent study showed that the insular cortex may be important for addiction. Thus, we are identifying the more focal anatomy of depression and obsessive-compulsive illness as well as other neurodegenerative diseases. The potential benefits of transcutaneous stimulation are now being tested by neurosurgeons placing epidural electrodes over the left frontal cortex: new thinking for behavioral disease (*Fig. 1.1*). Even the concept of reversing the vegetative state is now being addressed with neuromodulation. Can we envision an era where neuroimaging shows us the anatomy of intense romantic love and might an electrode be placed there someday?

Certainly, the greatest challenges to both neurosurgery and those in other realms will require not just a revamping of old thinking, but new thinking. Meetings such as our own must not just continue to update and tinker with what we

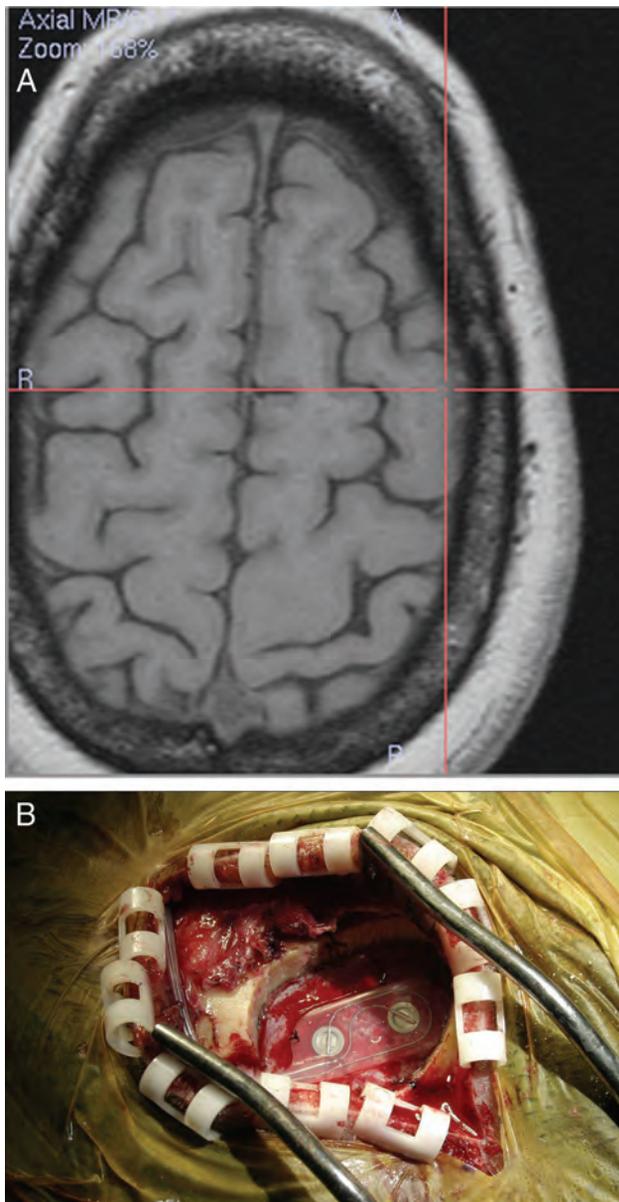


FIGURE 1.1 *A*, axial magnetic resonance image showing the targeting for placement of a cortical stimulation electrode over the left dorsolateral frontal cortex in an experimental trial of major depression. *B*, The epidural electrode placed at craniotomy (not Food and Drug Administration-approved).

already know, but provide us with new avenues for thought. World-renowned oceanographer, Robert Ballard, who will speak at this meeting, has chronicled the cycle of exploration which begins with the vision, and continues with instituting the journey, overcoming the obstacles (which frequently include the inaccurate conventional wisdom that surrounds us), discovering and sharing the truth, and fostering new vision (Fig. 1.2). General Patton once said that “if everyone

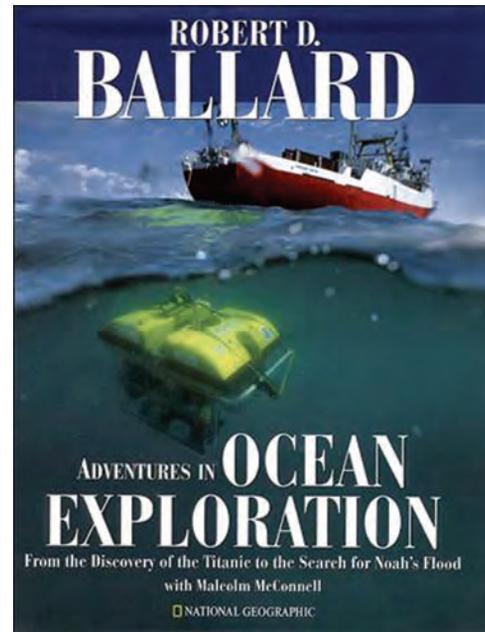


FIGURE 1.2. Robert Ballard, Special Lecturer at the 2007 Congress of Neurological Surgeons meeting.

is thinking the same thing, then no one is thinking.” Should we look at neurosurgical data and draw contrarian conclusions? After decades of trying to preserve hearing with acoustic neuroma resection and achieving a hearing preservation rate often between 15 and 30%, is the answer simply, “it’s impossible and we just accept defeat with the translabyrinthine approach,” or “we need to try harder,” or is it to try something else? In the business world, such a result would be considered a failure. Perhaps the company would have been sold a long time ago.

Contrarian thinking is all around us, affecting both society and neurosurgery—for example, television. Initially, it was enough that television was an entertaining but passive environment. Change created an active environment. Was television created to provide an audiovisual stimulus as we lie on the couch or was it to facilitate interaction between the viewer and the image? When *Pong* came out as the first available video game for home use, it was a revolutionary concept. Now we have *World of Warcraft* with over nine million players worldwide, tremendous graphics, virtual reality, and what seems to be a game without an end. The Nintendo *Wii* system gets people off the couch. When this paradigm shift occurred for the television screen, there was rapid acceptance. How quickly do we accept change?

In the world of personal audio, for decades, people seemed to be quite happy with the transistor radio. When the Sony Walkman was created, carrying around your own songs seemed revolutionary. When the concept became digital,

there was rapid change. Not too long ago, the “old” concept when I was a teenager was to buy record albums. At one point, I could proudly claim that I had several hundred of them. Now that concept is considered ridiculous. People do not need a certain number of albums. They need access to every song ever recorded. A new level of access (podcasts) is now even provided for our own journal, *Neurosurgery*.

In neurosurgery, we are faced with conflicting concepts all the time. Do we fuse the spine or do we preserve motion? Both were contrarian ideas at the time they were proposed, and yet they conflict with each other. When we look at our own clinical outcomes, what should be our goal? Does our care need to be perfect, just okay, or really dependent on the disease that we treat? Or should our care reflect a goal rather than an individual patient result? Should surgical outcomes be much more generic with attempts to reach a certain “standard”? Should we have “acetaminophen” for acoustic neuromas like we have acetaminophen for a fever? It works just about the same for everybody no matter where you are in the world. Would this be an acceptable concept for neurosurgery? Alas, but it lies in contrast to the concept of the master surgeon.

The master surgeon concept is fostered in residency as a goal for individual trainees. We train people to do everything, but what actually happens in practice? Do they, in fact, do everything? If we were to plot the global skill of neurosurgeons to provide worldwide care, and how that changes over time, where would we be on this curve? Based on where we are now, if our care was systematized, would we regress or progress to the mean?

After the first 100 years of neurosurgery, as we look back, we are indeed improving, and we certainly know in which areas we have made gains. However, as we look forward, are we doing as much as we can and at the velocity both we and our patients expect? In the world of personal finance, we are told to sell stocks when others are buying and buy when others are selling. How many people actually do this? If we are to truly make real progress and again, quickly, we will need real change in our thinking. For example, remove the plaque or push it out of the way? Should we look at an aneurysm from the inside or from the outside? Should we leave the tumor in or should we take it out? Should we fuse the motion segment or should we preserve it? If you look at the concept of the deathly transition from a benign to a malignant meningioma, often identified in the setting of multiple subsequent surgeries, we may believe that there is some genetic predisposition for this to occur. However, from a contrarian perspective, was it our surgery that actually caused cancer? Is that possible? We know that some causes of cancer include radiation, heat, inflammation, and infection, or could it be cautery, leading to abnormal repair of injury with a change in the rate of tumor cell division? That is, in many

instances, why a cancer forms. Could the observer of the event be a part of the process?

If we want to rapidly improve neurosurgery, we should start with an evaluation of its definition. We could look up the American Board of Neurological Surgery definition, but I would propose that neurosurgery is what each of you thinks it is or perhaps what each of you does. Is it something that is static, passive, or active? Is your neurosurgery visionary or reactionary? I would submit that the neurosurgeon is an explorer and that our practice requires us to constantly break the ice.

I have had a longstanding interest in polar exploration and would like to evaluate neurosurgery in its first 100 years, to the 100 years that came before it, 100 years of polar exploration^{4,5} (Fig. 1.3). In 1907, when Cushing was writing “The Pituitary Body,” Peary was sailing toward the North Pole¹⁶ (Figs. 1.4 and 1.5). Although the current map of the arctic regions is detailed with every bit of shoreline understood, at the beginning of the 19th century, much of these territories were unmapped. Polar exploration, like neurosurgery a century ago, was a blank slate (Fig. 1.6).

So if neurosurgeons are explorers... then what is exploration? Is it doing something risky or not done before, something that increases our understanding... doing something because it is there, like climbing a mountain or chasing a dream? Exploration is the directed pursuit of knowledge in an area where little is known. Modern polar exploration ended in 1920 in the era of the airplane. It took only 66 more years for a modified airplane to land on the moon. As the

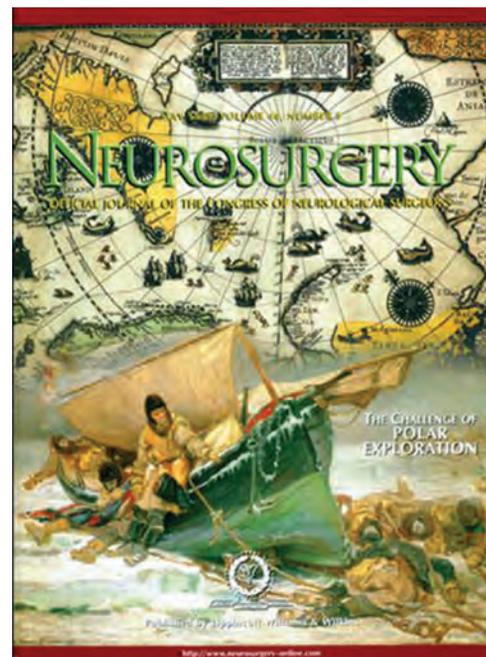


FIGURE 1.3. The May 1999 cover of *Neurosurgery*.



FIGURE 1.4. A, Harvey Cushing at his desk in 1907. B, Robert Peary sailing toward the North Pole in 1907.

neurosurgical story begins with Cushing, Macewen, and others, the polar story starts with Alexander MacKenzie, the first Caucasian to map an overland route to both the Arctic and Pacific Oceans.¹³ This book spurred Thomas Jefferson to create the Lewis and Clark expedition (*Fig. 1.7*).

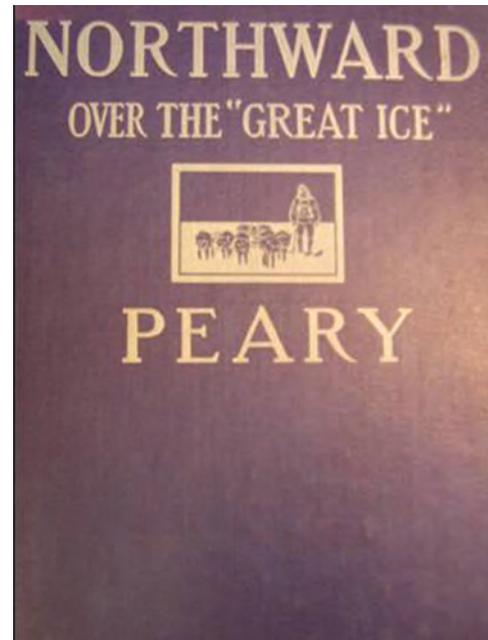


FIGURE 1.5. Robert Peary's "Northward Over the Great Ice."

What does an explorer look like? Do his or her garments prepare them for the environment in which they work? Ernest Shackleton went to Antarctica wearing Burberry cloth. Both the polar world and neurosurgery offer some of the most extreme environments on the planet. Is our garb and our tools enough to allow real progress. . . the microscope, endoscope, loupes, neuroimaging, and radiosurgery devices, or are they simply in evolution?

There were two main goals of polar exploration. One was to discover a Northwest passage from Europe to Asia rather than having to circumvent South America, and the second was to get to the North Pole. The first century of neurosurgery had two main goals. One was to operate on disease safely, and one was to learn about the function of the nervous system. It is still unclear what will be our airplane, that transforming technological paradigm that will radically change the entire approach to what we do. So over these two 100-year eras, what did explorers learn along the way and was their learning fast or slow? How did people respond to the severe challenges they faced?

Now in the polar world, some of the lessons may seem somewhat pedestrian. In fact, it took 60 years to simply figure out that the Arctic Ocean was frozen solid. For many, the concept existed of an open polar sea. The open polar sea concept, supported by many, including the American physician-explorer, Dr. Isaac Hayes, contended that the further north you went, the ice would eventually break up as a result of the warming rays of 24 hours of sunlight⁹ (*Fig. 1.8*) so that if you eventually got through

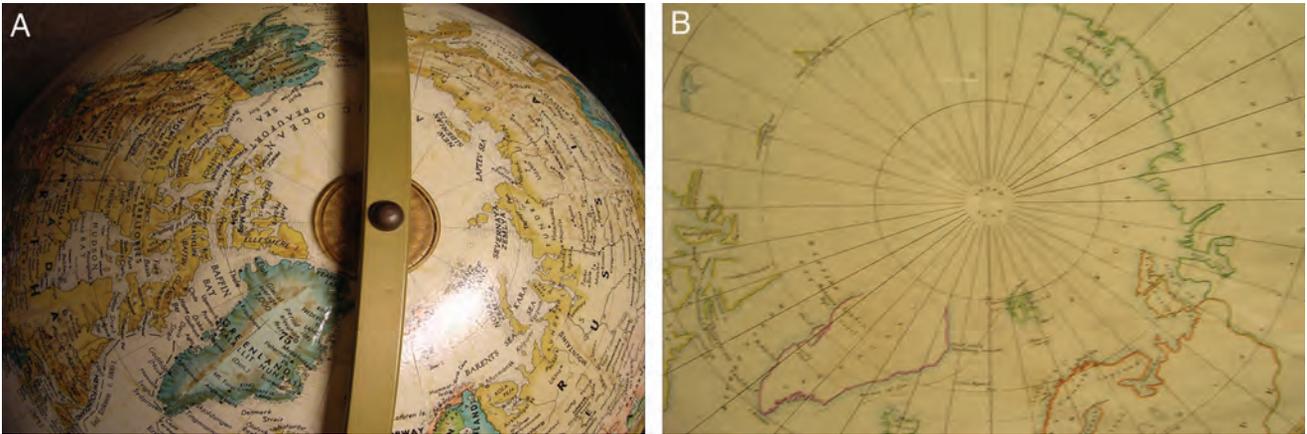


FIGURE 1.6. A, The top of the world as we know it. B, The Arctic map in 1818 with vast unknown territories.

the ice, it would be clear sailing all the way to the pole. Of course, this was 60 years of silliness, and many died because of it. After being stuck in the ice, explorers learned not so quickly that some problems could not simply be overcome by increasing manpower. On the Shackleton expedition, after the *Endurance* was stuck in the ice, it would not have mattered if there were a million

men with pick axes out there chopping the ice bit by bit to free the ship; this was a hopeless problem. Indeed, the biggest problem in polar exploration was the ice, and even their oversized Gigli saws were not the solution. Did these people really hope to advance their journey southward or simply to free the ship from its shackles and head for home?

Interestingly, there may be some value in being stuck in the ice or stuck in an investigation. That is the value of serendipity—that we eventually do learn something. When John Ross was stuck in the ice for 5 years (and of course, nobody knew where he was because there was no form of communication), he and his officers eventually got off the ship, walked around, and discovered the North Magnetic Pole¹⁷ (Fig. 1.9). The solution to the ice problem took 130 years. The solution was not to break up the ice or to create stronger ships or more powerful engines. For over a century, all the technology in the world was useless. The

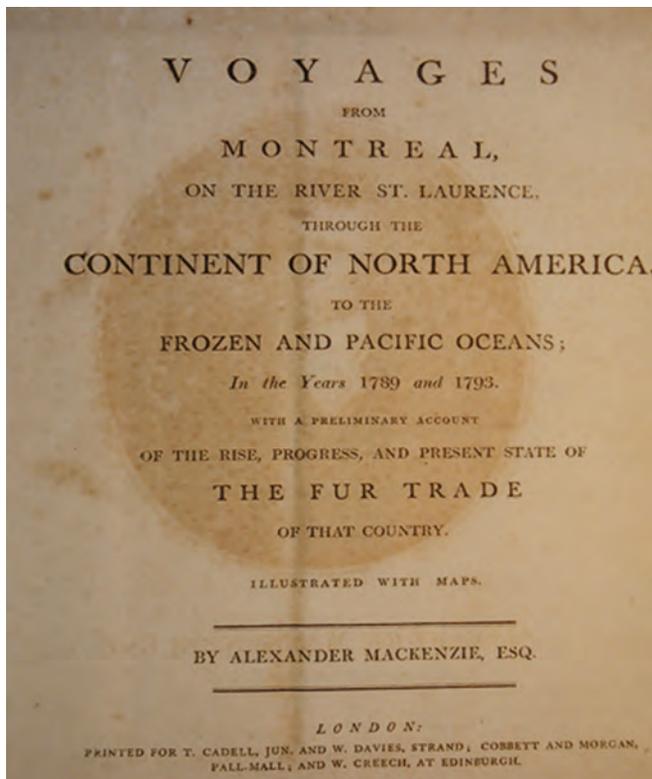


FIGURE 1.7. Alexander Mackenzie’s book was the impetus for the Lewis and Clarke expedition.

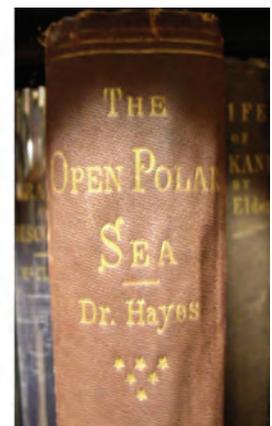


FIGURE 1.8. Dr. Isaac Hayes (A) and his opinion in the Open Polar Sea (B).

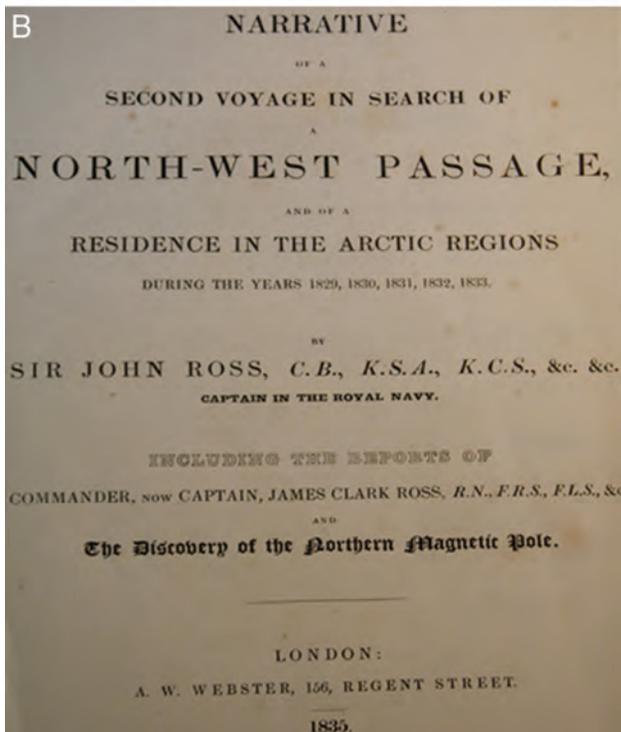
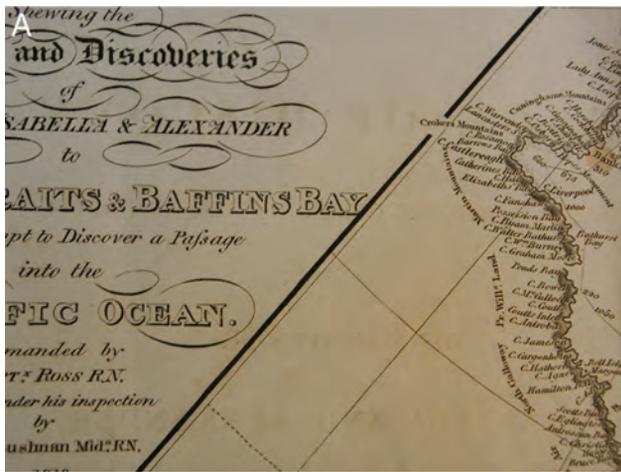


FIGURE 1.9. A, John Ross’s incorrect map showing solid land where open water should have been. The open water was the opening to the Northwest Passage. This map proved the downfall of Ross’s career with the British Admiralty. B, Ross later returned with the backing of private money and discovered the North Magnetic Pole.

problem of the ice was the solution. A device was developed that would simply land on the ice. From that moment on, explorers did not want open water to sail through. They wanted ice they could land on. In fact, even now, when one flies to the pole, oil and gasoline drums are placed at strategic locations on the ice where a plane must land and refuel. The solution to the problem was contrarian. How-

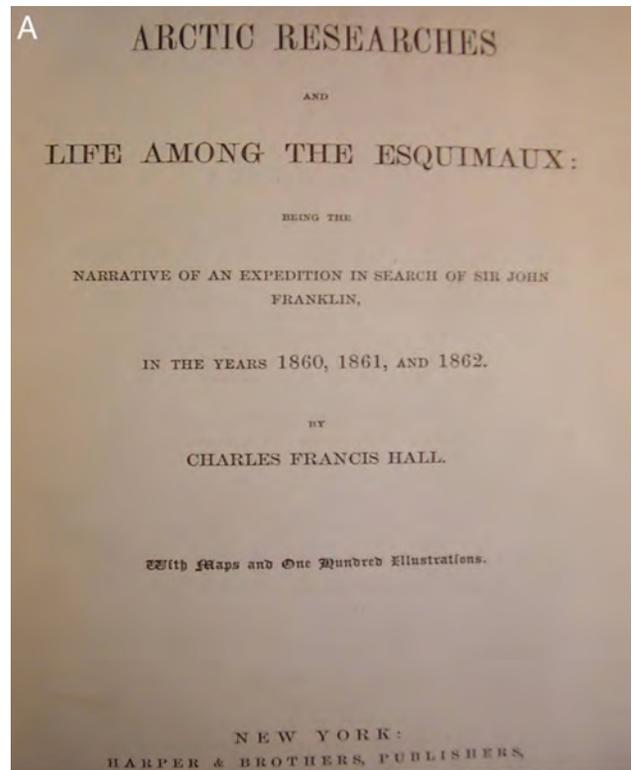


FIGURE 1.10. Charles Francis Hall was the first American polar explorer to live among the Inuit natives (A). On his second expedition, mutiny led to his poisoning with arsenic. The burial of Hall is depicted (B).

ever, with the recent reduction in the polar ice cap presumed resulting from global warming, the “open polar sea” may become a reality at certain times of the year.

Explorers learned that fur rather than wool provided better material for clothing in the Arctic. This took approximately 70 years to figure out. Why would a European explorer want to dress like an Inuit? His appearance was considered savage. The whole point was to change him. . . not be like him. After 60 years of polar exploration, it was a Cincinnati newspaperman turned Arctic explorer, Charles Francis

Hall, who was the first to live among the Eskimos, dressed like an Eskimo, and with his leadership set the record for the furthest north exploration at the time⁸ (Fig. 1.10). In fact, he got so far north that his men were scared that they would never return, mutinied, and poisoned him with arsenic.³ So although fur was better, his life ended as a tragic figure. His willingness to change, and gain ground beyond all prior explorers, eventually led to his death.

Explorers also learned that something in fresh meat and vegetables prevented the deadly disease of scurvy. For many decades, clean living alone was thought to be the way to prevent scurvy. Interestingly, the “savage” Eskimos rarely got scurvy, but of course, their diet was considered unacceptable. This seminal problem took over 200 years to decipher. Of course, all someone had to do was observe what the Eskimos were eating and notice that they did not seem to contract this disease. The unpalatable Inuit diet allowed them to do incredible things in a hostile environment, but explorers watching the construction of an igloo, despite their envy and interest in the technique, did not draw the logical conclusion that the person doing this was healthy and active. Why was their mind so closed?

When John Franklin was first sent to search for a Northwest Passage to China with the help of French voyagers in 1819, the result was starvation, murder, and cannibalism.⁶ One of his lieutenants, Dr. John Richardson, managed the starvation of the entire group and served as judge, jury, and executioner over the murder of the voyageur Michel. Michel had killed one of the other officers and brought forth his meat, claiming it was from a wolf that he had killed. Richardson dealt with the problem expeditiously. Fortunately, Franklin returned home but without half his crew. For weeks, they had existed on *tripe de roche*, a mossy covering of exposed rocks that provided little sustenance. On the other hand, the “redo operation” several years later was so successful that over 1000 miles of new Arctic coastline was charted.⁷ Both Franklin and Richardson were knighted (Fig. 1.11). They had figured out what to eat. Together with the trials of Ross and Parry, the Arctic map began to fill in.

Based on that success, John Franklin was sent in 1847 to solve the final puzzle of the Northwest Passage on an expedition that was the technological equivalent of our initial voyages to the moon. However, without communication and with events that remained unsolved for over a century, he was lost. The British, French, and eventually Americans went to search for Franklin. Elisha Kent Kane, another bored American physician with aspirations of finding the pole, wrote his book, which became the second best-selling book during the Civil War, second only to the Bible^{11,12} (Fig. 1.12). Over the next 2 decades, other Franklin search expeditions, rarely successful in finding clues, mapped out increasingly more Arctic geography.



FIGURE 1.11. Sir John Franklin, leader of the ill-fated 1847 expedition to solve the Northwest Passage.

Interestingly, the people who knew more about the Arctic than anyone, the whaling captains, were rarely asked for their opinion. How often do we ask for advice from those



FIGURE 1.12. A, Dr. Elisha Kent Kane, an American, is one of many sent to search for Franklin. His book becomes a best-seller. B, Other Franklin search expeditions continued for 20 years.

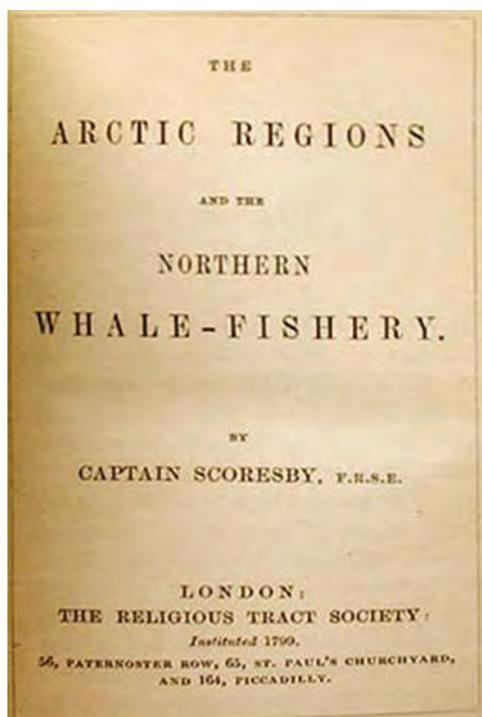


FIGURE 1.13. The great whaler William Scoresby probably knew more about life in the Arctic than any other British seaman. He became a great friend of Jane Franklin.

on the outskirts of our field in our evolving world? Jane Franklin, the bold wife of Sir John, befriended one of the great whalers, William Scoresby, asking for his help to find her husband¹⁸ (Fig. 1.13). When remains and letters of the lost Franklin expedition were found by McClintock, the fate of the expedition was known, but the reason for failure remained unclear. Do we often know why our properly performed operation has a negative outcome? It was not until a book published just 7 years ago, digging deep into investigation records, that the cause was found, and of course it was food.² In a rush to get the expedition underway, the meals had been prepared in canisters too big to allow heat to adequately penetrate and cook their contents. Botulism and lead poisoning occurred. Explorers, like neurosurgeons, travel on their stomachs. In contrast, Stefansson, the great explorer of the early 20th century who mapped the most northerly of Arctic islands, truly learned how to live in this hostile region and was known to come out of the Arctic after a 6-month expedition actually having gained weight^{19,20} (Fig. 1.14).

Another lesson that explorers eventually learned was that dogs should pull sleds, and not men. Although we might think that this is obvious, it took 95 years to figure out. When Parry was sent to sled to the North Pole from the islands north of Norway in 1827, 12 men were asked to pull sleds, each weighing 3700 pounds. Within 2 months, they had turned

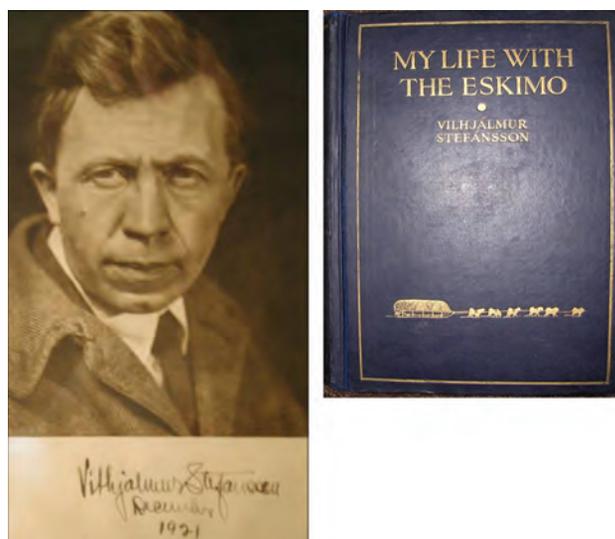


FIGURE 1.14. Stefansson learned to live and travel in the arctic like no non-Inuit before him. He mapped out the most distant and desolate of the Arctic regions. Photo courtesy of a gift from the Baker Library, Dartmouth, NH.

around. The British finally gave up on their attempts to reach the North Pole in 1876, still having men pull sleds. The concept of having “man’s best friend” do the work was untenable, although the “savages” around them seemed to glide over the ice with an alternative source of energy to solve their transportation needs. In neurosurgery, it similarly took 95 years for an alternative energy concept, radiation rather than mechanical surgical energy, to become acceptable to tackle some of the complex problems of the nervous system, and yet in the earlier years of radiosurgery, it was considered somewhat “unmanly.”

Without a transforming concept, progress moves slowly. Over the last 4 decades, despite the tremendous efforts of many, we have improved the average survival of patients with glioblastoma by only 6 months. One month every 7 years must be considered a disappointment. Unfortunately, our investigations along traditional routes that include surgical resection, irradiation, or drug delivery have not been enough. We must strive to develop and evaluate radical new concepts. A similar rate of progress was made over a century in trying to get to the top of the world; from 80° to 90° latitude (Fig. 1.15).

One might think that it was probably important to learn the language of the people in the region being explored.²¹ For example, what could the native people possibly have of any value to tell a European or American explorer? Although there was some attempt to speak their language after 30 years, it was never really a priority. As we consider the nervous system, what is the language of brain function that we study? The voice of the brain such as the cells of the subthalamic

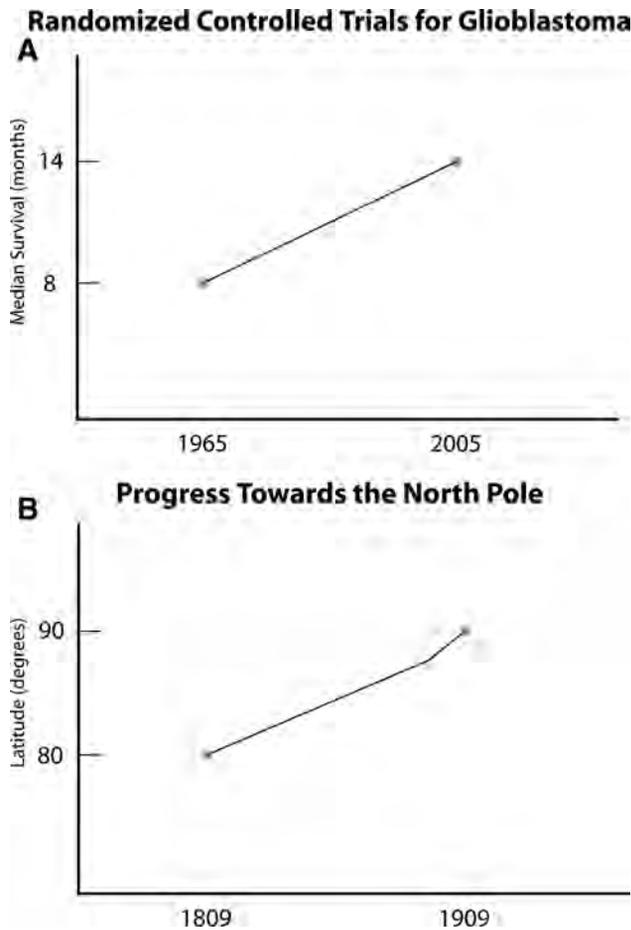


FIGURE 1.15. Progress in the median survival of patients with glioblastoma over the last 40 years (A) compared with progress to travel from 80° to 90° north latitude (B). Without a transforming concept that accelerates change, progress takes time.

nucleus has much to tell us. How few of us have studied cortical mapping or the recordings of brain cells and fiber activity. I submit that this will be the key to the discovery of the major technological change that transforms neurosurgery.

We also know that our own language, the language of publication, is limiting. Why do we focus solely on English when so many of the minds of the world do not understand this language? To broaden the scope of our published words, we had the abstracts of the September 2007 issue of *Neurosurgery* translated into Japanese, including the creation of a hybrid English/Japanese cover (Fig. 1.16). Hopefully this will have been of benefit to the thousands of Japanese neurosurgeons. Future avenues for multilingual publication are planned.

Nansen, the famed Norwegian explorer, the first person to ski across Greenland and to set the furthest north record, was a neurobiologist whose Ph.D. thesis described the concept of a neuron even before Ramon y Cajal.^{5,15} Unfortunately, his doctoral thesis was published in Norwegian, so of



FIGURE 1.16. A, The September 2007 cover of *Neurosurgery* in English and Japanese. B, For the first time, the journal provided scientific content in multiple languages.

course, who read it? Fortunately, Nansen later won a Nobel prize anyway, a Peace prize for creating the concept of refugee status.¹⁰ However, all explorers knew that publication of results was crucial. We all know the adage, “Either publish or perish.” This was certainly true, and it had nothing to do with academic promotion. Indeed, this was the classic example of pay for performance. The only money an explorer ever saw other than his small government wage was from his book publication.

How do our neurosurgical explorers publish? Of course, we have journals and textbooks, but who actually is doing the writing? What proportion of the world's neuroscience minds are contributing to our total knowledge base? How long does it take to bring an idea to print? Does everyone who needs access to information actually have it? Most of the textbooks created by neurosurgeons are superb, but all include a limited number of authors. They take years to create and years to update. Many minds now use alternative sources of information such as Wikipedia. This online, current, interactive, global encyclopedia contains almost two million articles in the English language and countless others in other languages. The Japanese read Wikipedia in Japanese. Early in 2007, we began the Congress of Neurological Surgeons Wiki project, entitled *Congress of Neurological Surgeons NeuroWiki* (Fig. 1.17). We have created a global, current, interactive information environment open to the contributions of any interested party. There are already over 1200 entries, and we have not even launched it for general use. Today we will do so. You can go to NeuroWiki at the Congress of Neurological Surgeons home page and participate in this radical concept in information access. We will need volunteer oversight, responsible contributions, and recognition for good content. Our goal is to tap not into a limited subset of contributors, but into the brightest minds in neuroscience from all over the world. We should have information access for us and for our patients from any computer not just using generic internet search engines, but our own neurosurgical engine. Neurosurgery needs to be immediately responsive to both threats from other rapidly disseminated media sources and to make our opinions known broadly and in a timely fashion. At present, the Presidents of the

Congress of Neurological Surgeons and American Association of Neurological Surgeons can write letters to the editor of Journal of the American Medical Association hoping that they publish our comments, and such a format is important, but we need to do better. We need to be faster.

Explorers learned that a big expensive approach often yielded the least impressive results. Often it was the work of an individual or a small group that usually achieved more. Amundsen, the great Norwegian explorer who was the first to sail through the Northwest Passage, the first to get to the South Pole, and the first to fly to the North Pole, did something else that was special (Fig. 1.18). He never brought a doctor on any of his expeditions. Having other seemingly intelligent minds often led to more problems than they were worth.⁴ It is often the investigations of a small focused group—nimble and innovative—that yield the most impressive results, gliding across the terrain in question, poised for discovery. Asking the right questions was something eventually learned after almost 8 decades. In 1883, the first International Polar Year was dedicated so that countries would address questions of polar science and exploration. Since that time, polar research has provided answers to many perplexing questions.¹⁴ Similarly, neurosurgery, after a century, has truly entered an era, somewhat reluctantly, of evidence-based medicine. By coincidence, the fourth International Polar Year is 2007, in which interested parties are focusing on many key questions relating to these important regions.

How many of our procedures have lofty goals but otherwise gain little? Every operation we do is an opportunity to learn something new, to share our discovery with others through some form of data collection. However, 99% of our surgical findings are never used for anything. That culture will have to change as we begin a systematic study of our individual outcomes. When John Franklin was asked to simply go to the North Pole in 1818, the directions were somewhat similar to telling a young neurosurgery resident to completely remove the glioblastoma, have no deficits, and make sure that tumor never comes back. The North Pole was eventually reached a century later by Robert Peary, and during the same year, success was also claimed by Dr. Frederick Cook.^{1,16} These claims were the most well-known media stories of that era, Peary being backed by the *New York Times* and Cook being backed by the *New York Herald* (Fig. 1.19). Their claims to being the first to place the American flag over the Pole led to vicious personal attacks in the press.

The era of polar exploration ended with air flight and, before the airplane, the hot air balloon. The hope was that one wind current would blow toward the pole and then the wind would suddenly change and bring you home again—what I call the “Wizard of Oz” approach to polar exploration. Later, Amundsen even reached the Pole by Zeppelin. Air flight ended the golden era of Arctic exploration. We all are the explorers of the golden era of neurosurgery.

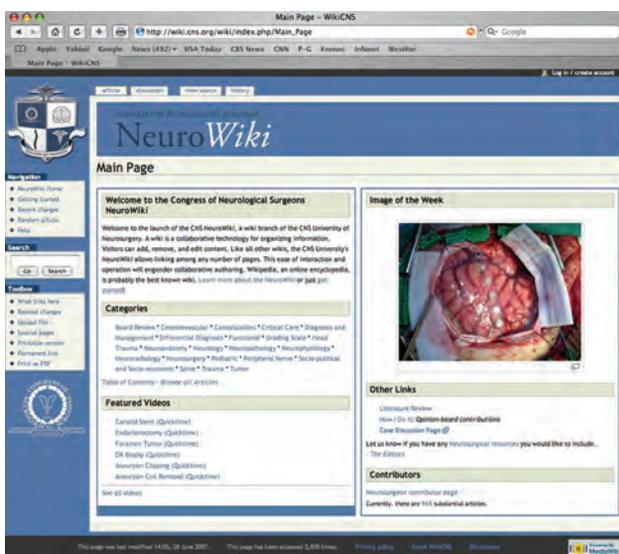


FIGURE 1.17. The Congress of Neurological Surgeons NeuroWiki.



FIGURE 1.18. Roald Amundsen (A) is the first to sail through the Northwest Passage in his small sloop, the *Gjoa*, now on display in Oslo (B).

Yes, neurosurgeons can stand in the face of a challenge whether it is the insula or an iceberg. We can illuminate the deep recesses of the brain as we can explore lands where the sun never sets. We can come close to the great perils of nature and neuroscience. We have colleagues who can help us deal with those perils (Fig. 1.20). We can go boldly into uncharted



FIGURE 1.19. Robert Peary claims the North Pole, but not before Dr. Frederick Cook also lays claim. Their battles were vicious and public and well known to the readers.

territory and develop new methods for guiding our travels as our space program now studies the outer reaches of our solar system and navigates the surface of Mars (Fig. 1.21). The world will gain much from the discoveries of neurosurgeons if we dare to dream, dare to question, dare to create, dare to prove ourselves correct, dare to change the world and the



FIGURE 1.20. The author hiking with a guide during the 2002 Arctic Stereotactic Conference in Svalbard, Norway.



FIGURE 1.21. Spaced a century apart, Peary writes about the discovery of the North Pole (A), and others report their findings from Saturn (B).

world of neurosurgery. The human brain, spinal cord, nerves, and their coverings are a beautiful landscape of difficult challenges, and yet when the sun is shining, this hostile environment can be ours for the taking.

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