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The Engineering Explorations Newsletter

Harmonics

What is biomedical engineering?

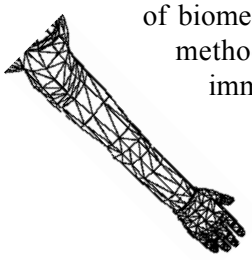
To remain healthy you must take care of your whole being - your intellectual, spiritual, emotional and physical self. Each of these aspects is interrelated and depends on the others. So, when you are sick or just not feeling well, there are many people who can help you get better . Members of your family, traditional healers and friends, as well as doctors, nurses and other medical practitioners all play a role in helping to heal you. Believe it or not engineers can also play a role in keeping people healthy.

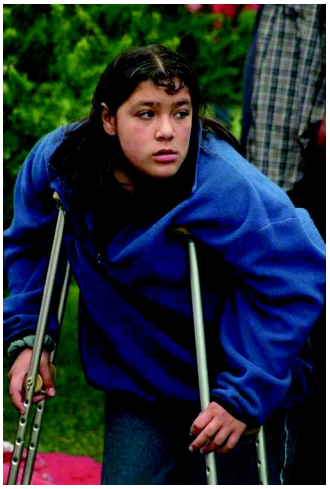
People have been bioengineers for thousands of years. Some bioengineering technologies have withstood the test of time, like splints for immobolizing injured bones ...

Biomedical engineers look at peoples' bodies as if they were machines. Think about it. Your body has a pump - the heart; it has a structure - skin and bones; it has a central processing unit - the brain; and, to run it all your body needs fuel - food, water and air . Biomedical engineers combine the discipline of mechanical engineering with medicine, human anatomy and physiology. They design prostheses (artificial limbs), develop movement systems for people with spinal injuries, refine equipment for athletes in high-performance sports and build machines which help keep people alive like glucose meters, pacemakers, incubators and heart-lung machines.

How many people in your community have diabetes? How many children are alive today because of the incubators they were put in after birth? Biomedical engineers really have an impact on peoples' lives. By looking at the body as a machine, they directly heal the physical part of a person. However; by providing people with artificial limbs and pacemakers, and by creating incubators that allow children to survive and grow up, biomedical engineers also contribute to the emotional, intellectual and spiritual well-being of individuals and communities.

There aren't many Aboriginal people in the field of biomedical engineering. If you stayed in school and learned to combine knowledge of biomedical engineering with western and traditional healing methods, your contributions to your community would be immeasurable.





... and crutches for helping people walk with leg injuries.

Native Engineers & Scientists

A place to meet people from your community.

Name: Lillian Eva Dyck
Nations: Gordon First Nation, Cree & Chinese
Schools Attended: Swift Current Collegiate Institute
University of Saskatchewan
Degrees: B.A. Honours, Master of Science, Ph.D.
Job Title: Professor
Favourite thing about job: "Figuring out what the results of our experiments mean and deciding what the next experiment should be."

Lillian Dyck is a Neurochemist - one of the few women in Canada, and the only Aboriginal person, to work in the field. She currently teaches in the Neuropsychiatry Research Unit at the University of Saskatchewan. Neurochemistry is a branch of medicine. It looks at the body's nervous system and how it' s chemical composition and function impacts mental, emotional and behavioural well-being.

In high school, Lillian would have never dreamt that she would become a professor and researcher , she thought she would probably be a housewife or a lab technician. But, she always liked science, especially chemistry and biology, and had a high school chemistry teacher , Mr. John Dryer, who encouraged both Lillian and her brother to excel in school and pursue a university education. With hard work and a lot of determination, she obtained her bachelor's degree in 1966 and a Ph.D. from the University of Saskatchewan in 1981. While she recognizes that university is very "challenging intellectually" she firmly believes "a post-secondary education is the key to a better life."

As a researcher, Lillian's most significant project so far has been a study of alcohol metabolising enzymes in Cree Indians and others. She felt "compelled to undertake [this research] in order to dispel some of the myths surrounding Indians and alcoholism." In all of her work, Lillian is committed to "helping to improve the lives of those with mental illnesses by figuring out how the brain works or how psychotherapeutic drugs work." In this sense, she feels that her research will contribute to the healing of First Nations communities.

Lillian's contributions to neurochemistry and Aboriginal communities were recognized in 1999 when she received a National Aboriginal Achievement Award for Science and Technology. These awards are presented each year to celebrate outstanding career achievements by Aboriginal people of First Nations, Métis and Inuit ancestry in a wide range of fields.

Lillian hopes her own example will encourage young Aboriginal people to go to university. "In order to be self-sufficient as Aboriginal people, we must have our own engineers and scientists. Our Elders tell us that education is our buffalo. Just as our ancestors needed buffalo to survive, we now need education not only to survive but to excel."

Hockey gold supported by stainless steel and polymer plastic

During the 2002 Winter Olympic Games in Salt Lake City, Canadian hockey players won gold three times. You probably knew about the medals in men's and women's hockey, but Canada also won gold in the demonstration sport of men's upright hockey.

Men's upright hockey is played by people who are missing one - or more - of their limbs. These players wear specially designed artificial limbs (also called prostheses) that let them skate like Sheldon Souray, Theo Fleury and Chris Simon or block shots like Dominic Hasek and Dan Cloutier.

Photo courtesy IPRLS, Tufts Medical School

Brent Clemens, Captain of the Canadian Men's Upright Hockey Team and engineer. Brent lost the lower part of his left leg after a motor vehicle accident in 1989.

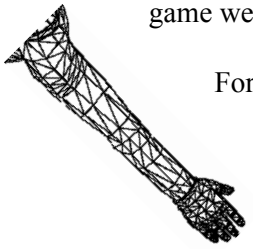
There are lots of different reasons people need protheses. Sometimes a person is born without an arm or leg. Sometimes they lose a limb in accident. Other times, they lose a limb because of infection or disease.

One disease which often causes people to lose a limb is diabetes. When not carefully monitored, diabetes can restrict blood flow to the body's extremities causing tissue to be more easily infected. If left untreated, the damage can spread so much that the only way to save a person's life is by removing the diseased arm or leg.

Artificial arms and legs are designed by biomedical engineers. They work with medical specialists called prothesists, and people who are missing limbs. Together, they look at what the arm or leg is supposed to do and use the right combination of steel, plastic and sometimes electronics to help people who have lost limbs remain active. In some ways these prostheses are even better than real arms and legs: they can be made to be really good for a specific activity - like hockey, running or golf.

You know how Nike redesigns running shoes for high level athletes like Michael Jordan? Imagine what would happen if they could totally redesign his foot or arms. That's essentially what biomedical engineers and prosthetists do for athletes who are missing limbs. These scientists use light weight materials, specialized joints and complex computer programs to make sure the athletes can perform at the top of their game.

Because athletic prostheses are so specialized - and expensive - most athletes only wear them while playing and competing. So, the Olympic players of upright hockey probably won the championship game wearing one prostheses, but accepted their medals wearing another.



For more information on amputee hockey check out http://www.canadianamputeehockey.ca/.

Community Profile

Long Point First Nations, Winneway, Quebec

Where do you live? What do you do when you need to see a doctor? What if there was no doctor in your community? What if the closest doctor was 100 kilometers away or more? For many people in rural and remote communities, getting to see a doctor can be really difficult.

The people of Long Point First Nation in Winneway, Quebec have this problem. The 600 members of the Long Point First Nation are Algonquin. About half of them live in Winneway, a small community in the Abitibi-Temiscamingue region of Quebec.

While their community has a nursing station, the closest hospital - and doctor - is 100 kilometres away in the town of Ville-Marie. That's pretty far to travel for a regular appointment, and a really long way to travel in an emergency. The people of Winneway are hoping at least some of their medical needs will be more easily met through a new telemedicine project sponsored by Health Canada.

Telemedicine is also known as distance medicine. It can take many forms, but at the most basic level telemedicine is medical treatment offered through the use of telecommunications technologies such as the Internet, the telephone, and satellite. In Winneway, the telemedicine project will be set up in the nursing station. Using special cameras and a microphone attached to a computer, a doctor in Ville Marie will be able to see and hear a patient in Winneway. If the doctor needs to take a closer look at a rash or somthing stuck in a patient's eye, the cameras will be able to zoom in and send the images to the computer in Ville Marie. The telemedicine project won't work for all treatments, but to start it will help in treating asthma attacks, blood irregularities, rashes and eye problems. Over time, the doctors hope technological advances in telemedicine will allow them to perform minor surgeries via the computer. They, and the people of Winneway, may have to wait a while though, biomedical engineers are still working on ways to make telemedicine as effective as seeing a doctor in person.

In the meantime, telemedicine will make seeing a doctor much easier for the people of Long Point First Nation. Instead of driving all the way to Ville Marie, the doctor will only be a mouse click away.

Fun facts and things to think about

Did you know ... ... artificial limbs have been around for at least 2300 years? The oldest surviving specimen is a copper and wood leg made around 300 BCE.

Tiny, tiny, tiny machines

The next breakthrough in biomedical engineering will probably be nanomachines. Nanomachines are microscopic robots smaller than our blood cells. Scientists say one day the tiny machines may prolong human life. They will be able to clear blockages in arteries, deliver medicine to specific parts of the body and even clean our teeth!

Health is not simply the absence of sickness.
- Hannah Green

Do you know the signs of Diabetes?

Excessive thirst or hunger
Frequent urination
Hunger accompanied by weight loss
Fatigue
Dry, itchy skin
Wounds slow to heal

Before synthetic materials were available, wood from the Ohio Buckeye (*Aeculus glabra*) was often used to make artificial limbs. Aboriginal people who lived in areas where Buckeye trees grow, used to boil the nuts from the tree and grind them into a flour-like substance.

Incubators -they're hot!

You've got a couple of cardboard boxes, a pane of plexiglass, a light bulb, and a thermometer. What can you make? Well, with a few hours, and a little biomedical know-how , you could make a very simple incubator. An incubator is an enclosed, box-shaped, machine in which the internal conditions - especially temperature - can be controlled. Incubators are used to keep things warm.

As far as we know, the very first incubators were used by Chinese farmers to hatch eggs.Their incubators were small houses made from two layers of mud. Inside each house was a fire which provided enough heat to eventually hatch the eggs. By using incubators farmers could produce more livestock and more food for their families.

On today's large scale farms, farmers still use incubators for hatching eggs. But the incubators are a little more high-tech than mud houses heated by fire.They contain electronic sensors and are controlled by computer . The sensors constantly measure temperature, humidity and other variables and send the information to the computer . The computer can then adjust internal conditions so that they are perfect for whatever is inside the incubators.

Precise temperature control is especially important, for premature babies, who often spend their first weeks inside incubators. Because they are born early, the bodies of premature babies haven't developed enough. One of the most common problems is that they don't have enough fat to keep themselves warm. By placing premature babies inside incubators, they are kept warm and healthy until they develop enough fat for their bodies to maintain a constant temperature. Before incubators became widely used in hospitals, many premature babies would die soon after birth.

Incubators are used for lots of other applications too. For instance, scientists use them to help grow mold and viruses they need for research on diseases and the development of medicines. So, you could say that even though incubators are hot, they're also pretty cool.

All about us

Native Access provides culturally relevant learning opportunities in science, math, engineering and technology to Aboriginal students and their teachers across Ca nada.

Established in 1993, the projects ultimate goal was to increase the representation ofAboriginal peoples among the the ranks of practicing engineers and scientists in Canada.

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