THE SCIENCE CREATIVE QUARTERLY ISSUE ONE PART ONE OF SIX APRIL 11TH 2005 GO!

Our masthead is still evolving, although at present we have two Daves, a Bethany, a Caitlin, a Stephen, a Claire, and also an exotic sounding Azar. Want to participate? Email us at **tscq@interchange.ubc.ca**

ABOUT SUBMISSIONS:

Anything will do, but if you like more direction, we are happy to look at:

Things with some link (however weak) to science.

Things in English.
Things in other languages that are more or less readable when translated with Google tools.

Things with many words.
Things with few words.
Things with pictures.

Things that are news worthy.
Things that are not terribly so.

Things that educate.
Things that entertain.
Things that both educate and entertain.

Things that are important to ones well being, or perhaps to the global community at large.
Things that (at the end of the day) are really only there for the sake of being there.

Things from famous people who think that this is a pretty neat thing going on here.
Things from infamous people - they're interesting too.
Things from everyone else.

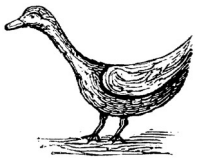
And things whose copyright ultimately remain with the author, although it would be nice to be acknowledged as being involved in presenting it to others.

Submissions are preferred as attached word documents, or text pasted directly into the body of the email. Please send us your good work to **tscq@interchange.ubc.ca**

AND COMMENTS ALWAYS WELCOMED...

A WORTHY CAUSE INDEED

BY DAVID NG



Dear Reader,

On most mornings, somewhere in the landscape of children's television, you can hear Taj Mahal singing and Joan Cusack narrating – not about sharing, or taking turns, or telling the truth, or even potty training for that matter, but actually on (of all things) science. Funded in part by the National Science Foundation, I'm referring to a program called "Peep and the Big Wide World," a quaint animated offering which follows the adventures of Peep, Quack, and Chirp (a chick, a duck, and a robin), as they explore and discover all the things that "go" in their little world.

I know about this show because I happen to be a scientist with a vested interest in acts of science education. And I also know about this show because I happen to have two young children, who find it both amusing and engaging enough to sit still for its entirety.

Of course, my children don't give a rat's ass about it being science and all. And they certainly wouldn't even begin to understand the irony of using characters that, in my circle of colleagues, currently represent reservoirs for both the Avian Flu Virus and the West Nile Virus (the duck, of course, has the funniest lines, possibly because he knows that he alone is the asymptomatic carrier).

But at the end of the day, I think that this is all really beside the point.

And that's because the *point* is this: we should be impressed because the show succeeds in talking effectively to the general public about science. And it does this by being different, creative, charming and yet informative – which believe me is no easy task.

In no small way, we are hoping to do the same here. What you are reading is an experiment of sorts, a web publication that will attempt to be, well... different, creative, charming and yet informative. We're hoping to provide an online (and possibly future print) platform that will accept all types of scientific writing. This will include those that plough through material in a journalistic or review style, or those that skip daintily, poignantly or even angrily into creative writing. I suppose our own little holy grail would be to present an assortment of well written science literature in all of its possible connotations.

To express this somewhat esoteric flavor, we have decided to name this project *The Science Creative Quarterly*. A name that word for word, represents the following: "The" because we do want to engage people who enjoy good writing and, of course, understand the use of words and grammar; "Science" because we are ultimately about expanding the science knowledge in the public consciousness; "Creative" because we are also interested in exploring the uncon-

ventional and literary realms that this project seeks; and "Quarterly" because, well, we really liked the word "Quarterly."

So, if you're willing, I ask that you please give us a minute of your time and take a deeper look. Let us know what you like and what you don't like. Better yet, submit something and allow us the privilege of being impressed and excited with your work. And if you think we need a duck that says funny lines to succeed, please let us know. We are, in reality, pretty clueless about the best way to do this, and it's always good to know these sorts of things sooner rather than later.

GRIZZLY BEARS TAKE NORTHERN VACATION

BY BETHANY LINDSAY
PHOTOGRAPHS BY MARK FURZE

A paw print, a hair, and a photograph are all clues that Canada's grizzly bears are on the move.

Recently, Canadian scientists genetically confirmed the sighting of a grizzly bear more than 1000 kilometers north of the species' known range, proving that Canadians still have a lot to learn about our northern-most animals.

Grizzlies seem to be encroaching on the territory of polar bears, a species already threatened by global warming. The two species previously met only on the sea ice near mainland Canada, where they both hunt seals. Though polar bears are generally larger, grizzlies have been spotted preying on polar bear cubs.

In July of 2003, University of Alberta geologist John England flew to Melville Island, shared by Nunavut and the Northwest Territories and more than 1000 kilometers north of mainland Canada, to begin his field season. His helicopter dropped off a group of biologists to collect mosses at the southern end of the island, and started heading north.

"We took off and had gone about a kilometer away in the main valley leading to the coast, and we saw a bear," said England. "We assumed it was a polar bear, but we wanted to make sure with the helicopter that it was going down the valley towards the sea and not up-valley, to where the people were collecting."

The helicopter's pilot brought the craft closer to the animal, which looked too dark to be a polar bear, England said. "We swung around and went over the bear a couple of times and took some photographs, and it was very apparent that this was not a polar bear, it was definitely a grizzly bear—it had a really distinctive hump on its back, a shorter snout, wider face, and very strong colouration."

Traditionally, grizzly bears were only thought to live as far north as the edge of mainland Canada, but Inuit hunters have spotted them on Banks and Victoria Islands in recent years.

"If you were to look at a map of mainland Canada and the Arctic Islands, Victoria Island is not a long distance from the mainland," said England. "But when you get to the north end of Victoria Island, you've got about 80 to 100 kilometers of ocean or sea ice before you can get to Melville Island. It's not like you can look from Victoria Island and see Melville Island. This bear had to cross over the sea ice, which is a very great distance."

It was a shock to think a grizzly would wander so far. Surely it wouldn't stay.

The Tracks.

The following summer a post-doctoral fellow in England's research group, Jonathon Doupe, returned to Melville Island. Doupe and the pilot of his helicopter stopped at a cabin meant to protect travelers from the high numbers of polar bears in the region. Near the cabin, the pair spotted bear tracks. Doupe assumed that they belonged to one of the many polar bears nearby.

But the pilot was adamant that they couldn't belong to a polar bear because of the long claw marks in front of the toes—only grizzlies have long claws, used for ripping open logs to search for grubs.

The side of the cabin was scratched, and several brown hairs were stuck in the wood. "Bears will go up to a cabin and start rubbing themselves or scratching themselves on it," said Doupe. "It looked like this bear had done that, gone right up to the cabin."

Doupe collected the hairs and delivered them to a wildlife forensics expert in Edmonton, who noticed the hairs were brown with white tips, a characteristic of grizzly bears.

The Cabin

A geneticist able to extract DNA from some dried skin left clinging to one of the hairs. He used a well-developed set of microsatellite DNA markers to conclusively identify the hairs as grizzly bear. In fact, Doupe said, "they were ten million times more likely to be grizzly bear than polar bear."

The Melville Island sightings are the farthest north that grizzly bears have been spotted. In 1991, one was spotted on the sea ice south of Melville Island near several seal pup carcasses. The bear was tranquilized and tattooed before it was released.

Melville Island was surveyed extensively during oil and gas explorations in the 1970s, and no grizzly bears were reported. England and Doupe suggest that the bears they've seen are the first in the area, although they can't be sure if global warming, human development in grizzly habitats or the pluckiness of a single bear is responsible for the move north.

More research is necessary to determine how many grizzlies live on Melville Island, and how they will interact with resident polar bears. England believes that there is a reliable source of food for grizzlies on the island. "This bear was quite healthy from all appearances—it was big, it was very heavy set, and certainly didn't appear to be out of its element at all."

England says that his group's discovery shows how little we know about the North. "The arctic islands have their own surprises, and they're undergoing their own changes, and it's always exciting to come across something that's unexpected. It just reminds you that you shouldn't assume that things are fixed."

SCIENCE GETS ITS FIRST SUPERMODEL.

BY DAVID SECKO

New discoveries that show evolution in action are causing some scientists to say that the first scientific supermodel has arrived.

Biology is normally carried out within isolated specializations. Ecologists study one organism, molecular biologists another, while evolutionary biologists look over hundreds without probing too deeply into any particular one.

But one tiny little fish, the threespine stickleback, proves that a combination of genetics, molecular biology, developmental biology and population studies, can bring insight into the fundamental question of how evolution occurs in nature.

"The sticklebacks are a shining example of what can happen when you put all of these fields together," said Dolph Schluter, a zoologist at the University of British Columbia. "It produces a paper that all of biology can appreciate," he said.

Recently, Schluter, in collaboration with David Kingsley, from Stanford University School of Medicine, and other colleagues, found that a single gene seems to control changes in the armor of sticklebacks in the wild.

Threespine sticklebacks, Gasterosteus aculeatus, are five-cm-long fish that show a great deal of morphological diversity. In the ocean, you'll find them with upwards of 36 bony plates, which run along their sides and are thought to serve as armor against predators. In freshwater lakes, these armor plates have been lost, likely due to a lack of predators.

The loss of bony armor in sticklebacks is a prime example of evolution in action. "It's rather like a military decision, to be either heavily armored and slow, or to be lightly armored and fast," said Kingsley in a press statement. "Now, in countless lakes and streams around the world these low-armored types have evolved over and over again. It's one of the oldest and most characteristic differences between stickleback forms. It's a dramatic change: a row of 35 armor plates turning into a small handful of plates - or even no plates at all."

To better understand how this natural evolution works, Schluter, Kingsley, and their colleagues, crossbred heavily armored marine fish with those containing no armor at all. The offspring of this cross were then used to look for genes controlling the production of armor by a technique called chromosomal walking. Surprisingly, the authors found a single gene, called Ectodysplasin (Eda), which appears to control major changes in stickleback armor. The results of this work are published in the March 25, 2005, issue of Science.

A mutation in the Eda gene controls hair and teeth development in humans, being linked to the disorder ectodermal dysplasia. "This gene also turns out to be responsible for a fairly conspicuous

change in evolution in nature," said Schluter.

The discovery that Eda appears to control the adaptation of stickleback armor sheds light on an old debate about how evolution occurs in nature. Scientists have struggled to discover if evolution occurs by many small changes in numerous genes or significant changes in just a few genes. The findings of Schluter and his colleagues appear to support the latter.

Another big question about how genetics influences natural adaptation is how much evolution relies on new mutations versus variation already present in ancestral populations, said Schluter. The team was able to show that mutations in Eda predate that loss of armor in freshwater sticklebacks, revealing that new mutations may not be required to power some forms of evolution. "In this case, for this one trait [stickleback armor], it appears variation is ancestral," said Schluter.

The discovery of Eda's role could not have been made without the merging of distinct specializations, including gene isolation in Kingsley's lab and the knowledge of developmental evolution in Schluter's lab. "When I read the paper, I was just wowed by the comprehensive nature of it all," said Greg Gibson, from North Carolina State University, who wrote an article in Science that accompanies the research paper.

"[Schluter's paper] elevates the stickleback to the status of supermodel for the study of developmental evolution," writes Gibson, in his accompanying paper.

"They have really put together a huge amount of research and shown the way forward," said Gibson.

References

Dolph Schluter
http://www.zoology.ubc.ca/~schluter/

Colosimo PF, et al. "Widespread parallel evolution in sticklebacks by repeated fixation of Ectodysplasin alleles," Science, 307(5717):1928-33.

Gibson G. "Evolution. The synthesis and evolution of a supermodel," Science, 307(5717):1890-1.

A DIALOGUE WITH SARAH, AGED 3: IN WHICH IT IS SHOWN THAT IF YOUR DAD IS A CHEMISTRY PROFESSOR, ASKING "WHY" CAN BE DANGEROUS

BY W. STEPHEN MCNEIL

SARAH: Daddy, were you in the shower?

DAD: Yes, I was in the shower.

SARAH: Why?

DAD: I was dirty. The shower gets me clean.

SARAH: Why?

DAD: Why does the shower get me clean?

SARAH: Yes.

DAD: Because the water washes the dirt away when I use soap.

SARAH: Why?

DAD: Why do I use soap?

SARAH: Yes.

DAD: Because the soap grabs the dirt and lets the water wash it off.

SARAH: Why?

DAD: Why does the soap grab the dirt?

SARAH: Yes.

DAD: Because soap is a surfactant.

SARAH: Why?

DAD: Why is soap a surfactant?

SARAH: Yes.

DAD: That is an EXCELLENT question. Soap is a surfactant because it forms water-soluble micelles that trap the otherwise insoluble dirt and oil particles.

SARAH: Why?

DAD: Why does soap form micelles?

SARAH: Yes.

DAD: Soap molecules are long chains with a polar, hydrophilic head and a non-polar, hydrophobic tail. Can you say 'hydrophilic'?

SARAH: Aidrofawwic

DAD: And can you say 'hydrophobic'?

SARAH: Aidrofawwic

DAD: Excellent! The word 'hydrophobic' means that it avoids water.

SARAH: Why?

DAD: Why does it mean that?

SARAH: Yes.

DAD: It's Greek! 'Hydro' means water and 'phobic' means 'fear of'. 'Phobos' is fear. So 'hydrophobic' means 'afraid of water'.

SARAH: Like a monster?

DAD: You mean, like being afraid of a monster?

SARAH: Yes.

DAD: A scary monster, sure. If you were afraid of a monster, a Greek person would say you were gorgophobic.

<pause>

SARAH: (rolling her eyes) I thought we were talking about soap.

DAD: We are talking about soap.

<longish pause>

SARAH: Why?

DAD: Why do the molecules have a hydrophilic head and a hydrophobic tail?

SARAH: Yes.

DAD: Because the C-O bonds in the head are highly polar, and the C-H bonds in the tail are effectively non-polar.

SARAH: Why?

DAD: Because while carbon and hydrogen have almost the same electronegativity, oxygen is far more electronegative, thereby polarizing the C-O bonds.

SARAH: Why?

DAD: Why is oxygen more electronegative than carbon and hydrogen?

SARAH: Yes.

DAD: That's complicated. There are different answers to that question, depending on whether you're talking about the Pauling or Mulliken electronegativity scales. The Pauling scale is based on homo- versus heteronuclear bond strength differences, while the Mulliken scale is based on the atomic properties of electron affinity and ionization energy. But it really all comes down to effective nuclear charge. The valence electrons in an oxygen atom have a lower energy than those of a carbon atom, and electrons shared between them are held more tightly to the oxygen, because electrons in an oxygen atom experience a greater nuclear charge and therefore a stronger attraction to the atomic nucleus! Cool, huh?

<pause>

SARAH: I don't get it.

DAD: That's OK. Neither do most of my students.

WHAT IS BIOINFORMATICS?

BY JOANNE FOX

Bioinformatics involves the integration of computers, software tools, and databases in an effort to address biological questions. Bioinformatics approaches are often used for major initiatives that generate large data sets. Two important large-scale activities that use bioinformatics are genomics and proteomics. Genomics refers to the analysis of genomes. A genome can be thought of as the complete set of DNA sequences that codes for the hereditary material that is passed on from generation to generation. These DNA sequences include all of the genes (the functional and physical unit of heredity passed from parent to offspring) and transcripts (the RNA copies that are the initial step in decoding the genetic information) included within the genome. Thus, genomics refers to the sequencing and analysis of all of these genomic entities, including genes and transcripts, in an organism. Proteomics, on the other hand, refers to the analysis of the complete set of proteins or proteome. In addition to genomics and proteomics, there are many more areas of biology where bioinformatics is being applied (i.e., metabolomics, transcriptomics). Each of these important areas in bioinformatics aims to understand complex biological systems.

Many scientists today refer to the next wave in bioinformatics as systems biology. Systems biology is an approach taken by scientists to tackle new and complex biological questions. Systems biology involves the integration of genomics, proteomics, and bioinformatics information to create a whole system view of a biological entity.

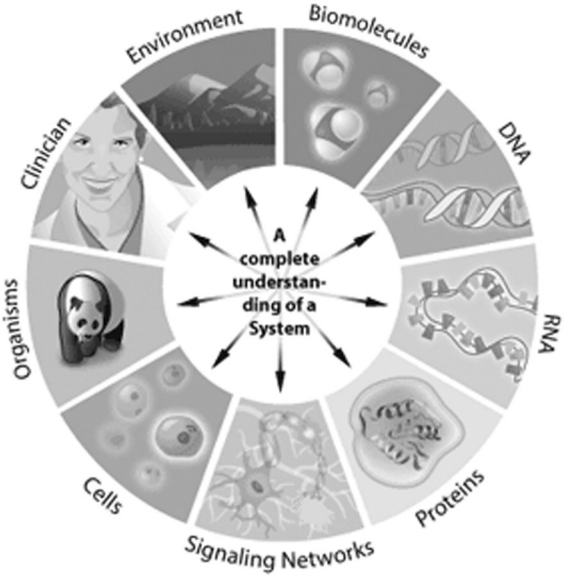


Figure 1. The Wheel of Biological Understanding. System biology strives to understand all aspects of an organism and its environment through the combination of a variety of scientific fields.

For instance, how a signaling pathway works in a cell can be addressed through systems biology. The genes involved in the pathway, how they interact, and how any modifications will change outcomes downstream, can all be modeled using systems biology. Any system where the information can be represented digitally offers a potential application for bioinformatics. Thus bioinformatics can be applied from single cells to whole ecosystems. By understanding the complete list of parts of a genome, scientists are gaining a better understanding of complex biological systems. Understanding the interactions that occur between all of these parts in a genome or proteome represents the next level of complexity in the system. Through these approaches, bioinformatics has the potential to offer key insights into our understanding and modeling of how specific human diseases or healthy states

manifest themselves.

The beginning of bioinformatics can be traced back to Margaret Dayhoff in 1968 and her collection of protein sequences known as the Atlas of Protein Sequence and Structure1. One of the early significant experiments in bioinformatics was the application of a sequence similarity searching program to the identification of the origins of a viral gene2. In this study, scientists used one of the first sequence similarity searching computer programs (called FASTP), to determine that the contents of v-sis, a cancer-causing viral sequence, were most similar to the well-characterized cellular PDGF gene. This surprising result provided important mechanistic insights for biologists working on how this viral sequence causes cancer3. From this first initial application of computers to biology, the field of bioinformatics has exploded. The growth of bioinformatics is parallel to the development of DNA sequencing technology. In the same way that the development of the microscope in the late 1600's revolutionized biological sciences by allowing Anton Van Leeuwenhoek to look at cells for the first time, DNA sequencing technology has revolutionized the field of bioinformatics. The rapid growth of bioinformatics can be illustrated by the growth of DNA sequences contained in the public repository of nucleotide sequences. This database is called GenBank.

Genome sequencing projects have become the flagships of many bioinformatics initiatives. The human genome sequencing project is an example of a successful genome sequencing project but many other genomes have also been sequenced and are being sequenced. In fact, the first genomes to be sequenced were of viruses (i.e., the phage MS2) and bacteria, with the genome of Haemophilus influenzae Rd being the first genome of a free living organism to be deposited into the public sequence databanks4. This accomplishment was received with less fanfare than the completion of the human genome, but it is becoming clear that the sequencing of other genomes is very important for bioinformatics today. A genome sequence by itself provides a limited amount of information. To interpret genomic information, comparative analysis of sequences needs to be done and an important reagent for these analyses are the publicly accessible sequence databases. Without the databases of sequences (such as GenBank), in which biologists have captured information about their sequence of interest, much of the rich information obtained from genome sequencing projects would not be available.

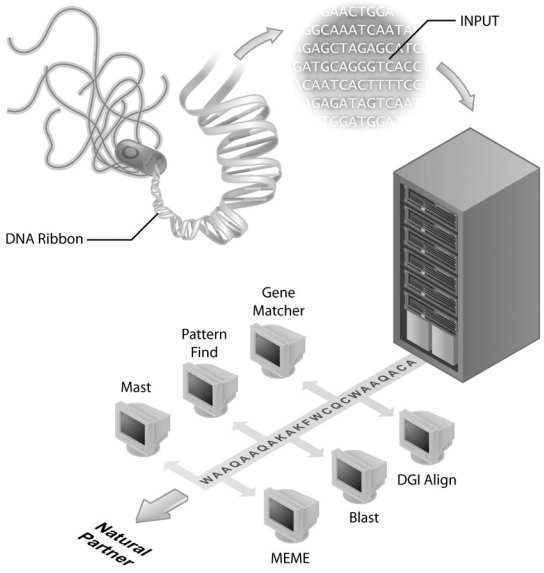


Figure 2. The Use of Computers to Process Biological Information. The wealth of genome sequencing information has required the design of software and the use of computers to process this information.

The same way developments in microscopy foreshadowed discoveries in cell biology, new discoveries in information technology and molecular biology are foreshadowing discoveries in bioinformatics. In fact, an important part of the field of bioinformat-

ics is the development of new technology that enables the science of bioinformatics to proceed at a very fast pace. The Internet, new software developments, new algorithms, and the development of computer cluster technology has enabled bioinformatics to make great leaps in terms of the amount of data that can be efficiently analyzed. On the laboratory side, new technologies and methods such as DNA sequencing, serial analysis of gene expression (SAGE), microarrays, and new mass spectrometry chemistries have developed at an equally blistering pace, enabling scientists to produce data for analyses at an incredible rate. Bioinformatics provides both the platform technologies that allow scientists to deal with the large amounts of data produced through genomics and proteomics initiatives as well as the approach to interpret these data. In many ways, bioinformatics provides the tools for applying the scientific method to large-scale data and should be seen as a scientific approach for asking many new and different types of biological questions.

The word bioinformatics has become a very popular buzz word in science. Many scientists find bioinformatics exciting because it holds the potential to dive into a whole new world of uncharted territory. Bioinformatics is a new science and a new way of thinking that could potentially lead to many relevant biological discoveries. Although technology enables bioinformatics, bioinformatics is still very much about biology. Biological questions drive all bioinformatics experiments. Important biological questions can be addressed by bioinformatics and include understanding the genotype-phenotype connection for human disease, understanding structure to function relationships for proteins, and understanding biological networks. Bioinformaticians often find that the reagents necessary to answer these interesting biological questions do not exist. Thus, a large part of a bioinformatician's job is building tools and technologies as part of the process of asking the question. For many, bioinformatics is very popular because scientists can apply both their biology and computer skills to developing reagents for bioinformatics research. Many scientists are finding that bioinformatics is an exciting new territory of scientific questioning with great potential to benefit human health and society.

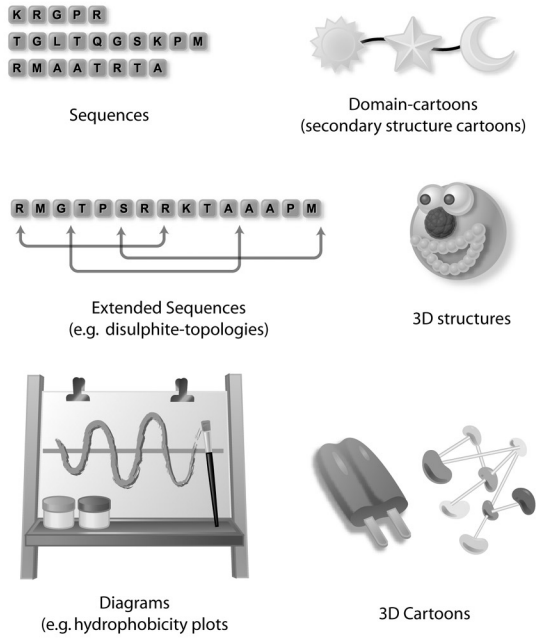


Figure 3. Potential Types of Bioinformatic Data. Computer based databases of biological information enables scientist to generate all sorts of data, from generating protein sequence and predicting protein domains to even producing 3D structures of proteins

The future of bioinformatics is integration. For example, integration of a wide variety of data sources such as clinical and genomic data will allow us to use disease symptoms to predict genetic mutations and vice versa. The integration of GIS data, such as maps, and weather systems, with crop health and genotype data, will allow us to predict successful outcomes of agricultural

experiments. Another future area of research in bioinformatics is large-scale comparative genomics. For example, the development of tools that can do 10-way comparisons of genomes will push forward the discovery rate in this field of bioinformatics. Along these lines, the modeling and visualization of full networks of complex systems could be used in the future to predict how the system (or cell) reacts, to a drug, for example. A technical set of challenges faces bioinformatics and is being addressed by faster computers, technological advances in disk storage space, and increased bandwidth. One of the biggest hurdles facing bioinformatics today,however, is the small number of researchers in the field. This is changing as bioinformatics moves to the forefront of research, but this lag in expertise has lead to real gaps in the knowledge of bioinformatics in the research community. Finally, a key research question for the future of bioinformatics will be how to computationally compare complex biological observations, such as gene expression patterns and protein networks. Bioinformatics is about converting biological observations to a model that a computer will understand. This is a very challenging task since biology can be very complex. This problem of how to digitize phenotypic data such as behavior, electrocardiograms, and crop health into a computer readable form offers exciting challenges for future bioinformaticians.

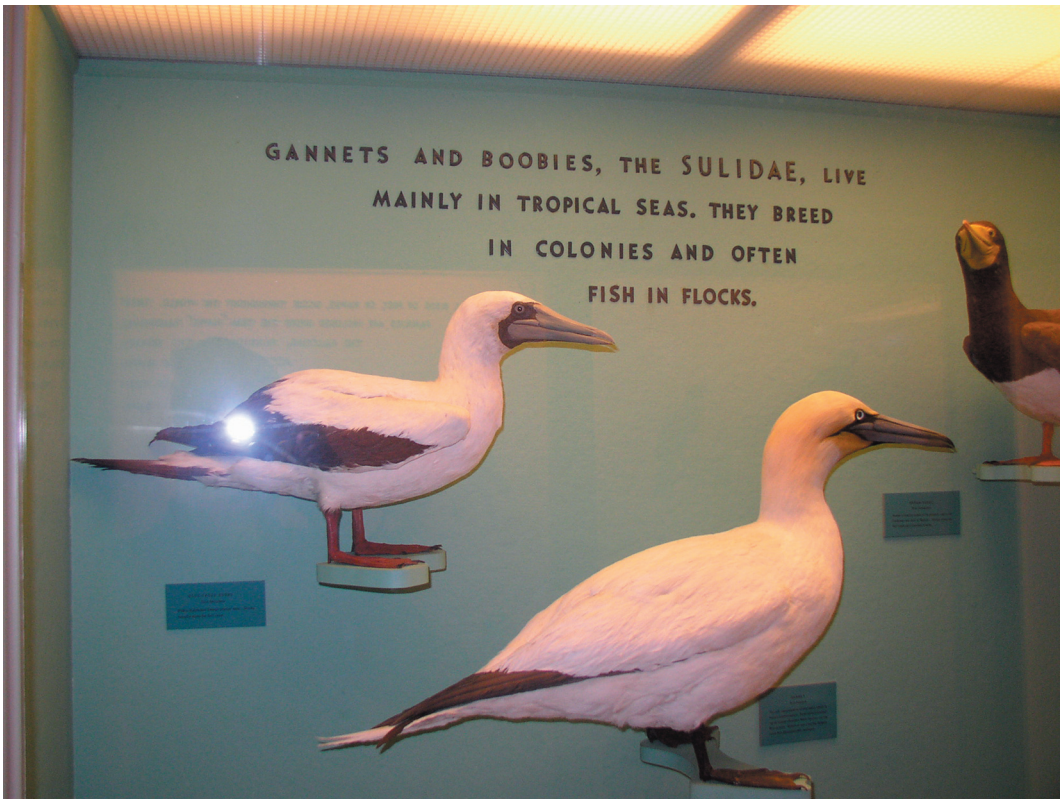
(This article is based upon an interview with Francis Ouellette, Director of the UBC Bioinformatics Centre)

References

1. Sci. Am. 1969 Jul; 221(1):86-95.
2. Science. 1983 Jul 15; 221(4607):275-7.
3. Nature. 1983 Jul 7-13; 304(5921):35-9.
4. Science. 1995 Jul 28; 269(5223):496-512.

A PHOTO OF A NICE SET OF BOOBIES WE SAW AT THE MUSEUM OF NATURAL HISTORY.

BY CHRISTOPHER MONKS



Christopher Monks took science in high school. He lives in Massachusetts with his wife and two sons. Visit his website Utter Wonder (www.utterwonder.com) and fall in love with the Internet all over again.

LOTIC

BY CLAIRE SALVADOR

In electric confrontations, the clouds gather, grow dark, and grumble their dissent. They lumber about like gravid beasts, heavy bellies aimed at the earth below; a slow dance that lasts for days.

Then, like a crescendo, it rains.

Not an unusual phenomenon in this urban area of the west coast trapped between the mountains and the sea. The geometric nature of the city provides a horizon of percussive surfaces in the form of concrete stalagmites that have colonized what once was a temperate rainforest. What trees remain have been landscaped into place. And water batters into the foliage, each leaf a splash, crash. It pounds into itself in tide pools of pavement, flows in tiny streams alongside curbs, gurgles in the subterranean catchments of the sewage system. These sounds weave into me, buffering sensitivities so that I don't notice the distraction. A thousand choral fragments are dampened into a single sigh, a conch cupped to my ear. No one ever seems to notice how loud the rain is.

As a small child, I would lift my face to this rush of water and try to swallow what fell from the sky. Rain would collect in the concavities between my nose and eyelids, overflow like tears. Never enough to quench my thirst.

Everywhere water falls, it is absorbed into the earth. Worms surface to escape flooding tunnels. New corridors are made for slugs to use as dispersal routes to new terrain. Roots draw this water into themselves, which fortifies xylem cell walls and increases turgor on the path to branch apices. Plasmodesmata transpire water back into the sky.

So immersed in this ubiquity, it is no wonder that water has been present in my dreams. I see myself descending into warm pools of trapped water until I look up (and this is the part that always surprises me) and discover that the surface has risen over my head. Layers of curving light bend and shift to the memory of my descent.

Water running in a straight line is an even flow. It owns a calm predictable in its variation, expected, like the next fugal movement. But let it rush downward in a fall and it gains immeasurable turbulence. Or add heat to agitate its already vibrating structure (two hydrogen atoms bonded in a V to an oxygen) and no one can tell you anything about the way milk curves in an upward current in a steaming mug of coffee by itself, mixing spontaneously into an inexplicable solution.

We are made of mostly water. We left the sea behind long ago in exchange for legs and language. It seems significant that we developed systems to preserve it within us. Water rules our balance; it fills the labyrinth of canals inside our ears and tells us if we are indeed aligned with the horizon. But only joy and sorrow recall this; they bring water forth from our eyes. It blurs perception,

distorts sight.

The same evolution that ties us to water also disconnects us. I once read how a man and his son were fooled by the false security of land as the moon drew the water away from the shores of Morecambe, in England. Amid bars of sand, panic insidiously struck with the onset of fog and the steady return of the tide. Despite the connection of a mobile phone and the efforts of search and rescue teams, water continued to swirl between their legs, and rise. The sandbanks shifted, sank and the last call on the mobile telephone (the boy on his father's shoulders) was made less than one hour later. Audio records of the calls indicate they could hear sirens on the shore. Rescue teams heard disembodied voices, so close, magnified by the presence of water in the air. So close.

Does it make me callous to wonder if that connection were not present, if boy and man had had no mobile, would they have paid more attention to the direction of the water beneath them? The tide was going in, rushing past them to fill the reservoir intended for it by the shape of the sand. Would not the current have showed them the way? But perhaps evolution has taken us so far away from the sea that they did not think, in their terror, to listen to the insistent push of the sea.

We swim through our evolution in the waters of the womb. A child breathes liquid for nine months, taking oxygen directly from fluid. It is an umbilicus to ontology that directs us to recapitulate amoeba, fish, tadpole, and finally emerge four-legged, helpless and oblivious to our heritage. Once released from water, we immediately reject it. Our species has so much collective memory in the very bases of its DNA, yet no understanding of how to access the information, so our nascency into sentience came from imperfection, survival, need.

Only beneath layers of self do we recall such depth. A lover once told me that he slept in a room below the waterline of the Atlantic, deep in the belly of a ship while he played in a cruise line orchestra. He fell asleep to the hum of the engine magnified and muffled a hundred fold by a cushion of surrounding water, and every night, dreamt violent red dreams in a windowless room.

So many layers. Even within itself water has layers. Cohesive forces between molecules at the surface push rows of molecules already attracted to each other, closer. They form a regenerative skin easily broken by the slightest pressure. Only an insect can walk across water.

Just below, the water column supports life, a seething blue-green blanket from which complexity secured its elaboration, the foundations of a recursive chain of events Mandelbrot would have been proud of.

Far beneath the surface, and for miles more, water has flesh. A place that is dynamic, living, responding. Sharks feed on fish that feed on molluscs that feed on plankton; knee jerk, funny bone, eye blink. It is both repulsion and attraction. Motor governs flesh; there is no true thought here. But instinct has history, implicit knowledge of the past. Emotion roots itself deeply without rational justification. Remember sorrow, remember joy.

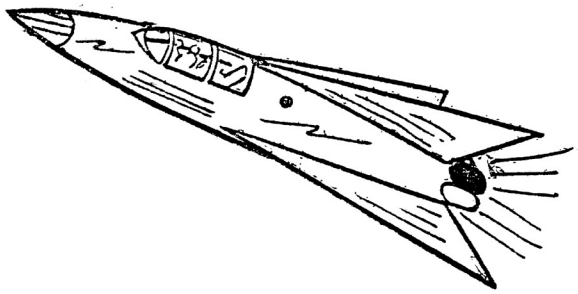
And closest to the earth where water is compressed by carrying itself millions of times over, it loses fleshy duality and becomes heavy with another hydrogen. The current slows into contem-

plation, passivity; weight has its limitations. We spend most of our time believing we live in balance, but in truth, equilibrium may require a lifetime to achieve. We reach towards that ideal with stories, songs, dreams; stretch our fingers, stand on tippy toe.

Not too long ago I discovered that if I light a candle on the other side of the window of clear tiles in the wall that separates my bed from my kitchen in my one roomed home, the imperfections of the glass tiles distort the flickering candlelight. Patterns dance on the ceiling above my bed and I am submerged again, looking up at the reflections of light on the surface. They herald my dreams and freeze the loud rush of my thoughts into the silence of soft midnight snow.

FROM A SATELLITE LOOKING DOWN AT OUR USE OF PATENTS IN THE GREAT PLANETARY SCHEME OF THINGS

BY AZAR MEHRABADI



Patents, by Providing more Research and Development, Benefit the People of the Word. Well, except for…

Patents allow inventors to have unique access to a market for a set period of time, giving the inventors monopoly control and/or market exclusivity on the sale of their innovation. The monopoly control provided by patents not only provides for a return on the relatively high cost of research and development that went into the innovation, but also provides rather high profits as a result of the monopoly and its duration. Excess profits serve to attract capital investors, who then create jobs in the biotechnology industry, increase the rate of research, and cause new innovations in drug treatments, tests and therapies to be undertaken, subsequently benefiting the people of the world. Well, except for... except for the people who comprise the majority of the world's population, that is, the socially and economically underprivileged people of the world, who live for the most part in less-developed countries. Because of this, the challenging question was raised by Solomon Benatar in an article addressing human rights and biotechnology: "If drugs for malaria, tuberculosis, many tropical diseases and HIV/AIDS have not been made available to billions in poor countries is it likely that the poor will benefit from advances in biotechnology?"[1].

Where in the World is the Pharmaceutical/Biotechnology Industry? The Transnational Operation of the Industry.

Pharmaceutical/biotechnology companies cannot be pinpointed to one location as they function as any transnational corporation would; globally. As with any corporation that is transnational in

scope, operations are carried out depending on where labor is cheapest, raw materials are the least expensive, where taxes can be most easily evaded, as well as where market regulations are the least strict. As Bodenheimer describes "…a pharmaceutical company might have its corporate headquarters in the United States, produce its drugs in Ireland, assemble its capsules in Brazil, and sell the products in Bolivia" [2]. In his description, the "core" are the regions of capital accumulation, mainly in the more developed countries, and are where the majority of research and development occurs. The "periphery" are described as the exploited regions of the world, the less-developed countries, whose main functions are production and assembly. Institutions such as the World Bank and the International Monetary Fund (IMF) support these corporations by lending billions of dollars to third world elites, who in turn, because of their large debts, support the profit-making of corporations. Unfortunately, profits from these corporate organizations are achieved through decision-making about policies without public consultation that have historically been achieved by introducing policies that harm human-rights, labor rights and the environment, especially in third world countries [18]. The other concerns regarding this set-up are the same as those for any transnational corporation: the mobility of the pharmaceutical industry compared to the relative immobility of governments means that because the industry is seeking out the cheapest labor and the lowest taxes, governments have few means of maintaining stable employment and collecting required taxes [6].

Not only is the pharmaceutical industry difficult to locate in any single place around the world, it is also difficult to isolate from other transnational capital, a characteristic of its world-wide pervasiveness and strength. Interlocks, mergers and acquisitions, serve to make the industry a force indistinguishable from other transnational capital such as that of oil companies, Coca-Cola, and even the New York Times [2,3]. In this sense, the transnational pharmaceutical industry is, overall, difficult to discuss tangibly and as a separate and distinguishable entity, requiring it instead to be addressed along with other transnational capital. Although it is referred to here as the pharmaceutical industry, it is important to keep in mind this lack of disctinction to better understand how the industry operates.

Patents and Social Responsibility…

The Corporate Struggle to Prevent Antiretroviral Accessibility During an HIV/AIDS Crisis in South Africa.

In many cases, governments themselves may be acting on behalf of the pharmaceutical industry. In the United States during the 1997 to 1998 election campaigns, the pharmaceutical industry spent almost $12 million in soft money, Political Action Committee and individual pharmaceutical company campaign contributions, according to the Centre for Responsible Politics [3]. These large contributions came at a time when the U.S. government was supporting the pharmaceutical firms in abolishing the health initiatives of the South African government that made the antiretroviral drugs more accessible to South Africa's population. Antiretroviral drugs are drugs that target HIV, have the possibility of prolonging infected people's lives indefinitely and as well, have been

shown to drastically reduce the transmission of HIV from mother to child. Drugs that fight HIV/AIDS, although being physically close to the many millions of people living with HIV/AIDS in South Africa (the subsidiaries of international pharmaceutical firms produce these drugs in South Africa), are far from being accessible financially to infected people and their families. This is still true now despite the fact that in April 2001 the 39 pharmaceutical firms suing the South African government for patent violations, finally dropped their case [19]. Bond has published a report and analysis on the situation in South Africa from 1996 to 1999 in the International Journal of Health Services and his report is discussed in this section to highlight the role of globalization on the health of poor people [3]. The "Medicines Act," established in 1996 in South Africa, included an Essential Drug List, based on 90-95% of the most common and detrimental conditions, and contained a clause allowing the importation of generic substitutes for the essential drugs specified. This clause included allowing the importation of some of the antiretroviral drugs, for example AZT, ddI and ddC, that had been developed by the U.S. National Institute of Health, and were produced by some of the large pharmaceutical firms. The clause allowing the importation of these generic substitutes was legal according to the World Trade Organization (WTO) Trade in Intellectual Property Rights (TRIPS) rules, and similar measures have often been used by European nations and the U.S. to attempt to import generic substitutes at times of health emergencies, for example during the potential Anthrax threat in the U.S. [1]. This is due to every government's entitlement to compulsory licenses and parallel imports during times of need. Compulsory licenses allow a product to be manufactured without the inventor's consent and parallel imports allow it to be bought wherever it is sold the cheapest.

Yet at a time when 25.1 million people out of a total 36.1 million living with HIV/AIDS worldwide lived in Sub-Saharan Africa, with at least 2.9 million living with HIV/AIDS in South Africa in 1997, a lawsuit claiming intellectual property rights violation was issued by the pharmaceutical firms, backed by the U.S. government. This lawsuit tied up the law in South African High Court between mid-1997 and April 2001, and impeded South African peoples' access to the drugs during this time. In April 2001, finally, a deteriorating public image, in an industry that spends more money on marketing than on research and development [2,4], and international criticism and protest, finally prompted the firms to drop the case [19]. Yet on top of lawsuits, threats of trade sanctions and trade constraints were used against the South African government as the government attempted to install WTO-legal imports of generic HIV/AIDS drugs [3].

Although funds for research and development were cited by the industry as the reasons they pushed for their monopoly patents, Sanjaya Lall's studies inform us that where there is inelastic demand for a drug, as would be the situation in this case for a drug involved in a life-threatening virus with soaring new infection rates, the profits earned are so great as to be extremely socially irresponsible [6]. To add to the injustice, the funding for the development of some of the drugs implicated came from the U.S. National Institute of Health, and so from the U.S. population's tax dollars.

Is This An Isolated Incident?

The evidence tells us otherwise: previously,

there had been similar U.S. government threats of foreign aid cuts to Bangladesh in the early 1980's when Bangladesh attempted to prohibit import of non-essential drugs; then there were trade pressures on Thailand when they attempted to provide affordable antiretrovirals for people with HIV/AIDS [3]. It is obvious that trade pressure and threats of foreign aid cuts by developed countries on less developed ones, make it difficult for governments of less developed countries to implement policies that would make necessary drugs affordable to populations.

To Consume More Than We Need vs. Balancing Health Resources – How Patents and Marketing Measures Work In Partnership

Drug "dumping," exporting harmful drugs into countries that lack strict drug enforcement, and the excessive marketing of unnecessary or damaging drugs have been heavily documented [4,5] and prompted the World Health Organization to release its list of essential drugs. As the case study of South Africa has shown, it can be nearly impossible for governments to make drugs accessible to their population as a results of patents. While "drug dumping" has been clearly problematic in less developed countries, closer to home, marketing can create a similarly dangerous and/or unnecessary problems of drug over-consumption.

The decision makers in drug purchases are often doctors and not the consumers themselves, so marketing can produce a lack of reliable information or as Lall has put it, "promotion creates powerful monopoly positions, confuses the flow of correct information, may induce inappropriate prescribing and generally leads to considerable social waste" [6]. The reason it is so important that a person's income not be wasted on unnecessary or expensive drugs is that ill people are more likely to be poor, and expensive medications detracts income from food, adequate housing and other such important expenses. Lall has noted that in the countries where there is a governmental health system (i.e. Canada), the consumer's identity may also be separate from the purchaser, the state. In this situation, the best interests of society, to balance health expenditures among pharmaceuticals, testing, screening, hospitals, care staff, and other social expenditures coincides with the interests of the biotechnology industry, which is conversely driven by market forces that call for the maximum usage of commodities that will profit them.

Patents and promotion have a common vision - that of establishing and maintaining a secure position of monopoly control. Technological innovations and monopoly patents have provided a way, during periods of economic crisis, which occur after as a result of economic overproduction and stagnation, to render the pharmaceutical industry, what MacKinlay has termed, "almost crisis proof" [7]. Marketing measures serve to establish a monopoly position long after the patent has expired. Periods of low consumer demand in the world economy are dealt with through promotions and patents to insure that the industry remains profitable and suffers minimal setbacks throughout a crisis.

Overall, Lall has also found that the pharmaceutical industry faces little risk in research and development when compared with other industries, yet its pricing policies are based on the monopolistic principles of "what the market can bear" rather than

on the socially responsible one of lowering prices after recovering research costs [6]. The fact remains that patents reduce competition. For example, smaller firms that cannot afford the high cost and time-consuming process of litigation will simply sell their innovations to the giant firms for a set amount. This reduces competition and so works in turn to keep the price of drugs and therapies high. As far as health goes, pharmaceuticals and biotechnology really only fit into a continuum of health needs, ranging from good nutrition, adequate housing, clean air and water, to education, and qualified health care workers. Just as a person with limited resources may have to divert income for expensive drugs from that spent on food, lifestyle and other social spending, or else go without medication, the state has an allocated budget for social spending and health care and must divert from other necessary endeavors to fund pricey biotechnology. Either way, as a result of the high prices brought on by patents, impoverished people will not receive necessary medication, or will become more impoverished, or else governments will go further into debt and into economic control of unaccountable organizations such as the International Monetary Fund and the World Bank [1].

The Ontario government has so far ignored Myriad Genetics Laboratory's demands regarding breast cancer genetic susceptibility tests. They involve demanding screening for genes only in Myriad's own labs in the U.S. at about five times the current price; in doing so the Canadian government has thereby "taken steps toward charting a path that balances societal and commercial interests in the area of genomics" [12]. It is important to grasp then, that although for society's sake high-costing patented biotechnology should be balanced among many other health and social factors, without continual resistance, resources will be allocated in an unbalanced way to biotechnology.

Where are Innovations in Health Headed? North, East, South, West...? The Compass Guiding Scientific Research is Pointing Towards Profit.

"Scientific knowledge emerges from a process that in intensely human, a process indelibly shaped by human virtues, values and limitations… Science is a social enterprise… [and] takes place within a broad social and historical context, which gives substance, direction, and ultimately meaning to the work of individual scientists…"
- National Academy of Science, National Academy of Engineering, Institute of Medicine [1].

What is driving research endeavors if not the collective needs of people? An economic and political compass is guiding scientific research, driven by the "logic of capitalist expansion" [7], where instead of accountability to society, research is steered towards earning profits for shareholders. In this way, the research endeavors undertaken by scientists are likely to be determined by market forces rather than real human need. This ideology coincides with the ideology of benefiting society, only at opportune times, or as Mckinlay has termed it: "There is only a 'coincidental relationship' between the production of goods and services in accordance with the logic of capitalism and any resulting improvements in the health and general welfare of mankind." Such forces embedded in the direction of scientific research are exemplified in that:

"Sixty six percent of the USA Government's expenditure on research and development is on military research [9]. Ninety percent of global expenditure on medical research is on diseases causing 10% of global burden of diseases, [10] and of 1233 new drugs developed between 1975-1997 only 13 were for the tropical diseases" [1]. Not only is most of the revenue spent on research not for the majority of people's health problems, a large portion of the research is also not even spent on drugs that are new or innovative in the sense that they are useful to society. These drugs, as a result of molecule manipulation, allow patents to be obtained for drugs of no value to society, what Thomas Bodenheimer has dubbed the "me too" drugs [2]. This type of research is uneconomical and wasteful as there is much research needed in other areas of healthcare and social expenditure.

Since the market revolves around research on commodities that can be bought and sold, the importance of research into non-profitable aspects of health, such as long-term environmental and lifestyle studies and measures, have remained minimal [2,11,12]. This may produce genetic screening and gene-based therapies that are marketed as "magic bullet" solutions to disease and used, at best, excessively, and, at worst, marketed and used as replacements for other measures. As Willison and Macleod have noted: "…modifiable behavioural factors, such as obesity, inactivity and smoking account for over 70% of the cases of stroke and colon cancer, over 80% of coronary artery disease and over 90% of adult-onset diabetes", so that ignoring the importance of these areas in healthcare would be both costly and inefficient in addressing the majority of health problems [12]. Market forces and the success of shareholders being the determinants of research focus instead of societal health needs, results in a heavily promoted approach to diseases as drug and biotechnology-oriented when evidence suggests socioeconomic factors simply cannot be ignored.

Research Process – Effects of the Biotechnology Industry

As stated above, the market may have a profound effect on the focus of research, but what are the effects on the research process itself? Donald Willison and Stuart MacLeod have looked at whether or not patents are benefiting society by first outlining how research and patent use should be carried out, with benefits to society: "By granting time-limited market exclusivity, patents create the potential for inventors to generate high returns on successful innovations. In exchange, the inventor provides a complete description of the invention so that others may build on the technology to create improvements or other breakthrough discoveries." [12]. Yet as government research funding through grants becomes more scarce, researchers are forced to turn to the private sector, thereby creating a lack of objective scientific knowledge, or what Baird has termed a lack of, "a body of independent scientists without commercial affiliation who can provide more objective input and opinion when society has to deal with choices posed by developing technologies" [11].

The few high profile cases in the past of physicians or scientists covering-up undesired results or even forging results, has been connected to the large financial motive present, or as Bodenheimer states, "Science is supposed to be objective, but when money is at stake, subjectivity may certainly come to the fore" [2]. To demonstrate how the market can affect

the research process, Willison and Macleod [12] cite a survey of 100 Universities in the U.S. with the greatest amount of funding from the National Institute of Health (i.e. public funding) in 1998 [13]: "In a survey of over 2100 life scientists, about 20% of respondents reported delays in publication of 6 months or more to allow for patent application, to protect their scientific lead, to slow dissemination of undesired results, to allow time for patent negotiation or to resolve disputes over the ownership of intellectual property." They have also cited a survey that concentrated on geneticists in 50 U.S. Universities with the maximum government funding [14]: "47% of geneticists who asked other faculty for additional information, data or materials regarding published research reported denial of at least 1 request in the preceding 3 years. In 28% of cases, respondents were unable to replicate published research as a direct result of this refusal to share information. The rate of denial of requests for data was equivalent to that reported by non-geneticists. However, geneticists were more likely to report that the withholding of data impeded progress of their research (58% v. 38% respectively)." These findings were especially prevalent where there was more academic-industry research partnerships and commercialization of university research. Since secrecy and lack of educational dispersal throughout academia is not the way to improve on an innovation or to find new and ground-breaking discoveries, these effects of industry on scientific research can be viewed as paralyzing at worst, or at best dulling, to reaching societal benefits. As Baird has pointed out: "The opinions of academic researchers with investments in biotechnology firms, or with appointments on their boards or as consultants, cannot be accepted as objective, but this is not often taken into account" [11].

Patent Scope: Can They Put a Patent on Someone's Brain? What is Deemed Worthy of Patents is Consistently Tested Under the Law, with Repercussions on Research.

For now, human beings cannot be patented for ethical reasons. It could be speculated though, that in the future, when such technology is developed, some human organs created and developed in the laboratory would be eligible for patent protection. Could these organs include the entire human brain – or would that be going too far? How far patent protection can go is partly based on ethical issues and public consensus and partly on the many legal interpretations of current laws. Regarding laws, we have section 2 of the Patent Act of Canada, which says that an "invention" comprises, "any new and useful art, process, machine, manufacture, or composition of matter" [15]. The dynamic relationship between the theory of what a patent is meant to include and this interpretation by law is elucidated by Willison and MacLeod: "To qualify for a patent, the invention must be deemed useful, novel and not obvious. The utility criterion requires that a clear application is known. Novelty means that the invention has not been described before in the literature. The criterion of non-obviousness demands creativity on the part of the inventor" [12]. They have noted that where these criteria came into consideration was, for example, when Pfizer, a company that patented Viagra, a drug used for erectile dysfunction, was denied a patent on the entire class of phosphodiesterase-5 inhibitors for erectile dysfunction on the grounds of "obviousness," since the

knowledge for this class of drugs already existed in the literature.

These criteria are only guides though in the highly contentious fields of biology and ethics where the distinction between life forms that constitute property, such as molecules, micro-organisms or non-human animals, are still highly debatable and controversial among the public. A case in 1980 in the U.S. where the U.S. Supreme Court rules in a 5-4 split decision that "the genetic modification of a bacterium to break down oil spills was consistent with 'a new composition of matter,'" set the precedence for the majority of the rational behind today's patent decisions; that is because components of an organism, its DNA sequences and genes, may well be patented if a whole organism (the bacteria) can. Canada, although having issued patents for certain yeasts and moulds, has drawn the line at so-called higher life-forms such as seeds, plants and non-human animals, although in the U.S., Europe and Japan, such patents have already been issued [16]. A federal Court of appeal ruled earlier this year that the Harvard Oncomouse, a mouse susceptible to cancer and so used in cancer research, fit the criteria of "non-obviousness" and was described by a justice Marshall Rothstein as "a new and useful 'composition of matter'" and so an "invention" according to the patent act [17]. The decision of the Court of Appeal has been appealed to the Supreme Court and is currently under review.

In the general distinction between discoveries, "upstream discoveries" are very broad discoveries, for example on the H2-receptor responsible for gastric acid secretion, and "down stream" applications are, for example, the development of H2-receptor antagonists, which work on these receptors. Before 1980, the discoveries eligible for patents were only the specific tests or therapies that made use of the "upstream discoveries" [12]. For the purposes of research and the goals of maintaining useful and innovative new inventions, it has been noted by Willison and Macleod that, "An excessively broad patent – particularly on an upstream discovery - might block or place severe constraints on the ability of others to develop new tests or therapies that build on the patented invention" [12]. If companies are able to place very broad patents, for example on higher life-forms or "upstream discoveries," more lawsuits and time-consuming court appeals from possible intellectual property rights violations would result. Many researchers who lack the funds to deal with the litigation may decide not to research in a greater number of areas, and so such broad-patents may very well discourage and impede important research endeavors.

Moving From Our Satellite To The Ground: How Do We Go From Observing These Problems In Patent Use From Our Satellite to Making Real Changes On The Ground?

1) Targeting Patents in Canada:

As discussed, some of the "upstream" patents and litigation hassles from large multinationals can cause barriers to research endeavours and technological accessibility. Willison and Macleod have outlined reforms proposed here in Canada by the Ontario government regarding Canada's Patent Act:

- Narrow the scope of gene patents;
- Create clear exemptions for experimental and noncommercial

clinical use of a patented invention;
- Introduce a morality clause, the basis on which a patent may be challenged;
- Make provision for a separate ethics review panel;
- Create a faster, less expensive dispute-resolution mechanism' and
- Permit compulsory licensing of genetic diagnostic and screening tests, giving government authority to require the patent holder to license the test to another firm, under reasonable conditions.

2) Targeting Research:

As one measure to reduce the number of clinically similar functioning drugs ("me-too" drugs) on the market, Marcia Angell proposes policies to force new drugs to be tested against older treatments already on the market for the same condition, rather than just testing against placebos [26].

3) Drug Marketing:

Marketing restrictions on the pharmaceutical industry are needed to ensure information patients and health professionals receive about drugs are guided by independent research rather than corporate-sponsored information. A greater reliance on independent consumer information on medicines is therefore required. A summary of non-brand sources of drug therapy information is available online at http://www.ti.ubc.ca.

4) Increasing Corporate Transparency:

A second important reform widely accepted by both those who think research should be done as a public utility and those who think research should be market-led is a greater transparency in the business operations of the pharmaceutical sector.

Marcia Angell describes why drug companies should open their books as well as why the industry should be regarded as a public utility [26]:

"Drug companies reveal very little about the most crucial aspects of their business. We know next to nothing about how much they spend to bring each drug to market or what they spend it on. (We know that it is not $802 million, as some industry apologists have recently claimed.) Nor do we know what their gigantic "marketing and administration" budgets cover. We don't even know the prices they charge their various customers. Perhaps most important, we do not know the results of the clinical trials they sponsor—only those they choose to make public, which tend to be the most favorable findings. (The FDA is not allowed to reveal the results it has.) The industry claims all of this is "proprietary" information. Yet, unlike other businesses, drug companies are dependent on the public for a host of special favors—including the rights to NIH-funded research, long periods of market monopoly, and multiple tax breaks that almost guarantee a profit. Because of these special favors and the importance of its products to public health, as well as the fact that the government is a major purchaser of its products, the pharmaceutical industry should be regarded much as a public utility."

5) Organizing Locally for Global Change:

Consumer organizations representing public interests in pharmaceutical policy can be an important way for people to start projects or help work on campaigns that address some

of the global and local problems described in this article. An organization called Health Action International Europe [20], for example, is one such organization that has members from Europe, North America and beyond.

As in the case of South Africa discussed in this article, some very vital work was done by organizations working right out of the U.S. to help bring about changes for South Africans. An AIDS organization called Act Up New York [21] and James Love and Ralph Nader's Consumer Project on Technology [22] helped catalyze the wider public dissent that pushed for the topic of AIDS/HIV drug accessibility to become a major issue in the 2000 presidential election campaign. Combined with work from a network of progressive public health practitioners, concerned organizations and scholars in South Africa and around the world, this world-wide organizing helped fuel the public outcry that forced the 39 pharmaceuticals to drop their case against South African government in April 2001. Yet as Toby Kasper, coordinator of the Access to Essential Medicines Campaign for Médecins Sans Frontières South Africa, has pointed out: "[T]he decision to drop the South African court case, and some recent announcements of price reductions on antiretrovirals can be seen as attempts by the pharmaceutical industry to avoid having HIV/AIDS catalyze an international movement seeking to address the problems in the TRIPS Agreement. The companies seem to be increasingly willing to sacrifice the (already marginal) sales generated on HIV drugs in Africa in an attempt to forestall the development of a larger social movement that might ultimately lead to the TRIPS Agreement being significantly altered or even removed from the WTO" [23]. There are many organizations and online resources which take a critical look at global issues such as the TRIPS agreement, with links to other resources withing each of them [24, 25].

6) Political Will and Commitment Necessary:

As opposed to charitable gestures by the pharmaceutical industry, more systemic changes are needed to ensure that quality drugs can access people in developing countries in a sustainable manner. Thrupp has evaluated regional-level cooperative scheme of the Caribbean counties (CARICOM) and compared it with the national-level policy of Cuba to perhaps find applications for other developing countries [4]. She found that the limitations of CARICOM consisted of its voluntary nature and lack of enforcement mechanisms for its member countries. Although the national-level policy of Cuba may not be adaptable in its entirety to other countries, due to the specific context of Cuba's 1959 revolution and its framework of socialism and structural transformation, some of its policies may well be adapted to other regions of the world.

It is worth noting that Cuba's conditions resembled that of other Latin American countries before the 1959 revolution. These conditions consisted of "high morbidity and infant mortality rates, very high incidence of communicable diseases, extreme maldistribution and inadequate health care services and doctors, and gross misuse of government health funds for private purposes." Due to its systemic changes Cuba was able to implement the following changes: the bulk purchasing of drugs instead of finished packaging (a direct foreign exchange savings of over 30 percent), development of its own domestic

production, thus reducing external drug dependence, and the building of a solid research and development capability so as to increase technological self-reliance. Cuba has further taken measures to eliminate commercial brands of drugs wherever possible and maintain well-trained professionals and technicians all along the distribution chain, including in remote regions. The improvements Cuba has made in the health and pharmaceutical sector have been dramatic. They included a reduction of infectious and parasitic diseases and those caused by malnutrition to insignificant levels and an almost complete eradication of poliomyelitis, diphtheria, tuberculosis and tetanus through measures such as vaccination programs. It must be emphasized that the dramatic improvements in Cuba came about as a result of broad-based social change and restructuring. A strong political will and commitment to both implement and enforce these changes was a prerequisite.

References:

1. Benatar, Solomon R. (2002, September 20). Human rights in the biotechnology era 1. BioMed Central International Health and Human Rights, 2, (3) 1-11. [http://www.biomecentral.com/1472-698X/2/3/]

2. Bodenheimer, T.S. (1985). The transnational pharmaceutical industry and the health of the world's people. In J.B. McKinlay (Ed.), Issues in the Political Economy of Health Care (pp187-216). NY/London: Tavistock Publications.

3. Bond, P. (1999). Globalization, Pharmaceutical Pricing, and South African Health Policy: Managing Confrontation with U.S. Firms and Politicians. International Journal of Health Services. 29 (4), pp765-792.

4. Thrupp, L.A. (1984). Technology and planning in the third world pharmaceutical sector: the Cuban and Caribbean community approaches, International Journal of Health Services, 14, (2), pp189-216.

5. Glucksberg, H. and Singer, J. (1982). The multinational drug companies in Zaire: their adverse effects on cost and availability of essential drugs. International Journal of Health Services, 12, (3).

6. Lall, S. (1980). The Multinational Corporation – Nine Essays. London: Macmillan.

7. McKinlay, J.B. (Ed.). (1985). Issues in the Political Economy of Health Care. NY/London: Tavistock Publications.

8. National Academy of Science, National Academy of Engineering, Institute of Medicine. (1994) On being a scientist (2nd ed.). Washington, DC: National Academy Press.

9. Sivard, R.L. (1996). World social and military expenditure. Washington, DC: World Priority Press.

10. WHO Geneva. (1996). Investing in health research and development. Report of the ad hoc committee on health research relating to future intervention policies.

11. Baird, P.A. (2000). Genetic Technologies and Achieving Health for Populations. International Journal of Health Services. 30 (2), 407-424.

12. Willison, D. and MacLeod, S. (2002, August 6). Patenting of genetic material: Are the benefits to society being realized. eCMAJ, 167, (3). [http://www.cmaj.ca/cgi/content/full/167/3/259]

13. Blumenthal D, Cambell E.G., Anderson M.S., Causino N, Louis K.S. (1977).Withholding research results in academic life science. Evidence from a national survey of faculty. JAMA, 277, (15), 1224-8.

14. Cambell, E.G., Clarridge, B.R., Gokhale M, Birenbaum L, Hilgartner S, Holtzman NA, et al. (2001). Data withholding in academic genetics: evidence from a national survey. JAMA, 287, (4), 473-480.

15. David Gambill. (2002). Court Allows Patent on Harvard Mouse. Canada Law Book. http://www.canadalawbook.ca/headline52_arc.html.

16. CBC News Online Staff. (2002, June 6). Patents OK for higher life forms. http://cbc.ca/stories/2002/06/06/cloning_patents020606

17. CBC News Online Staff. (2000, Aug. 4). Court allows genetically altered mouse patent. http://cbc.ca/storyview/CBC/2000/08/03/mousepatent000803

18. Danaher, Kevin. (2001) 10 Reasons to Abolish the IMF & World Bank. New York: Seven Stories Press.

19. BBC News. (2001, Apr. 19). SA victory in Aids drugs case. http://news.bbc.co.uk/1/hi/world/africa/1285097.stm

20. Health Action International Europe. http://www.haiweb.org

21. Act Up New York. http://www.actupny.org

22. Consumer Project on Technology. http://www.cptech.org

23. South Centre; An Intergovernmental Organization of Developing Countries. http://www.southcentre.org/info/southbulletin/bulletin11/bulletin11web-02.htm

24. Global Issues that Affect Everyone. http://www.globalissues.org

25. ZNet; A community of people committed to social change. http://www.zmag.org

26. Marcia Angell. The Truth About Drug Companies. Excerpt from The New York Review of Books. http://www.nybooks.com/articles/17244.

THE BESTEST, MOST KICK ASS, HUMAN GENOME PROJECT

BY DAVID NG

Mondo-Genetic-Services is proud to announce its latest venture, "The Bestest, Most Kick Ass, Human Genome Project." Hot on the tails of the International Human Genome Sequencing Consortium and Celera Genomics, we present to you a novel approach in the elucidation of mankind's blueprint of life. Rather than using the frequently studied yet boring human cell lines, or samples from a small group of ethnically diverse, anonymous, and likely dull individuals, we propose a completely different strategy – that is, we plan to use the genomes of individuals handpicked by the editorial staff of People magazine, a move we feel will cater to the desires of you and your friends. Currently our impressive roster of prospective subjects include the following:

People's Choice Favourite Motion Picture Actor - Harrison Ford
How can any human genome project not have samples from the man revered as Han Solo and Indiana Jones? The man who has uttered such immortal words as "Punch it Chewie," and "Nazi's – I hate these guys." In related news, Mondo-Genetic-Services has also tried to recruit his girlfriend Calista Flockhart into the project, but has recently learnt that she simply did not have enough tissue.

People's Choice Favourite Motion Picture Actress - Sandra Bullock
Mondo-Genetic-Services feels that the inclusion of Ms. Bullock, the purveyor of such classics as Speed 2 and Miss Congeniality, into the Bestest, Most Kick Ass, Human Genome Project is practically self explanatory. Besides, the editorial staff of People magazine all agree that she "is really hot, but in a nice way."

People's Choice's Favourite Performer in a Children's Television Program - Goofy
Is he a man? Is he a dog? Is he a man-dog? Be one of the first to find out, here at the Bestest, Most Kick Ass, Human Genome Project.

People's Choice Most Interesting Person of African Descent - Olusegun Obasanjo
Through email correspondence, the editorial staff of People Magazine have finalized an agreement to sequence the DNA of President Obasanjo, of Nigeria. In return and given their capacity to act as an overseas partner in a balance account transfer from the Central Bank of Nigeria, he will place 20% of US$21,320,000.00 (TWENTY ONE MILLION, THREE HUNDRED AND TWENTY THOUSAND U.S DOLLARS) into their corporate accounts.

People's Choice Most Interesting Person of Asian Descent - Michelle Kwan
Yes, the folks at People magazine are certified KWAN FANS. Michelle has agreed to participate in this project and in return, we will help start up an official Michelle Kwan fan club. More to the point, inclusion of DNA from this outstanding athlete will allow us to finally answer one of life's most troubling questions – that is, how exactly does figure skating get judged?

People's Choice Favourite Television Icon - Arthur Fonzarelli
"The Fonz" was a cultural icon of the 1950's and is certainly deserving of a place in the Bestest, Most Kick Ass, Human Genome Project. Not only did he seem to have telekinetic powers, but this is one guy who must have seen a lot of sex! Since the lubricated condom wasn't introduced until 1957, and the oral contraceptive wasn't even invented until the 60s, Mondo-Genetic-Services wouldn't be surprised if Mr. Fonzarelli himself sired half of Middle America.

People's Choice Favourite Television Comedy Series - Cast of "Who's the Boss"
In an attempt to secure DNA sequences that espouse the best of American family virtues, the Bestest, Most Kick Ass, Human Genome Project will obtain tissue samples from the entire cast of "Who's the Boss." This will include cells taken from Tony Danza, Judith Light, Katherine Helmond, Alyssa Milano, and even the little boy whose name no one can remember.

People's Choice Favourite Deity - Jesus:
In a coup d'etat for this project, Mondo-Genetic-Services has secured the sole rights to sequence and publish the Prince of Peace's very own DNA. Furthermore, our scientists have also discovered that due to the principle of the Holy Trinity, this agreement also effectively grants us sole rights to the genetic code of the Holy Spirit and of God himself

People's Choice Reader's Pick - George W. Bush
Because apparently America, like the rest of the world, is wondering "what the hell is up with that?"

ELSEWHERE AND OVERHEARD

BY CAITLIN DOWLING

Can dandruff be polluting the planet? Or is it an April Fools? See this Scientific American article…
http://www.sciam.com/article.cfm?chanID=sa003&articleID=00009FFB-6E34-124C-AE3483414B7FFE9F

T Rex bones yield soft tissue, blood cells – Science Blog
http://www.scienceblog.com/cms/node/7363

Extinction came in phases, not one cataclysmic event – BBC article
http://news.bbc.co.uk/2/hi/science/nature/4398401.stm

Paralyzed people can now control artificial limbs by thought alone
http://news.bbc.co.uk/2/hi/health/4396387.stm

"I really want to actually see the gun that's been supposedly aimed at my head for four years."
Jack Campbell, CEO of DVForge, who organized a contest to design a Mac Virus for his company's computers, then cancelled it after realizing it might actually invite trouble.

"If some people decide that they want blind children and white rice, it's their choice. I'm offering the possibility of yellow rice and no blind children. But the decision what people want to eat is theirs."
Ingo Potrykus, the creator of controversial GM "golden rice", in 2001. He launched the 2nd generation of the rice last week, which is suggested to contain more benefits than the last. (www.grain.com)

"We cannot stop the glaciers melting using foil."
Raimund Rosewald, head of a landscape protection foundation, about the Swiss authorities plan to wrap glaciers in foil during the summer to protect them. (www.exploreworldwide.com) (www.ananaova.com)

"It is like a saying in Polish," says Tryjanowski. "Artificial jewellery to the wife and real diamonds for the mistress."
Piotr Tryjanowski at Adam Mickiewicz University in Poznan, Poland, on new finding showing that male birds catch bigger food 'gifts' for their prospective mistresses, than for their long-term partners. (www.newscientist.com)

"They have that slippery, slurpy sensation when you eat them that makes them very seductive."
Diane Brown, the Los Angeles-based author of The Seduction Cookbook . New findings from Barry University, Florida, suggest that oysters do in fact live up to their reputation and increase libido. (www.newscientist.com)

EINSTEIN AT PRINCETON.

BY JONATHAN COHEN

Einstein sits and thinks under the dark trees
surrounding a white cottage — where no war
came, even during the years when young men
flooded out from this campus, cold from tap
like the beer they'd drunk at the Tiger-
town Inn just before their first induction.

He stirs, but no amount of induction
can help him explain how these knotty trees
survived pen-knives, like claws of a tiger,
incising the names of loves pre-war.
A stick falls to the ground — a muffled tap
returns his thoughts from trees to absent men.

The ones who carved their names were still young men,
giddy with the thought of their induction
into eating clubs — they called that night tap.
Later, some found their food among the trees
of some island, stunning birds, stunned by war,
ready with clubs for enemy, tiger.

Now, in stadiums, they praise the Tiger,
shouting "Rah, Rah!" for their eleven men.
"Fair Harvard's come? Now this is truly war,"
they say, not making the induction
from their two experiences. The trees
rustle, give Einstein's memory a tap:

With screwdrivers, his friends had gone to tap
bits of uranium, tease the tiger
until the tail lashed out, toppling trees
with hot roaring breath. But first, other men
would wire solenoids; by induction,
the contacts would close, and with them the war.

The birds and squirrels seem to be at war,
imagining slights in an acorn's tap,
where one party claimed a clear induction.
Einstein's thoughts are broken off — a tiger
might make a better arbiter than men,
he thinks, dispensing peace beneath the trees.

Make an induction: both man and tiger
tap fury for their ends; yet only men
think war ends, leaving them safe among trees.

CONTRIBUTORS

Jonathan Cohen is a writer and editor living in Irvine, California, primarily working in creative non-fiction and memoir. His work has appeared twice in the Santa Monica Review, and he has been nominated for a 2005 Pushcart Prize.

When she's not ice-fishing or making her own shoes, Caitlin Dowling leads a quiet life, as a masters candidate at the school of Journalism at UBC. Okay, the first two aren't true, but she does love research, and finding the news and quotes that make us laugh or intrigue us:)

Joanne Fox is a Research Associate at the UBC Bioinformatics Centre who likes to introduce herself as a biologist who gets to play with computers all day long. She lives with her family, which includes their singing dog, Penney, in a historic fishing village just outside of Vancouver.

Bethany Lindsay is a Master of Journalism candidate at UBC's School of Journalism. In a previous life, she was an intrepid biologist, but has abandoned tracking down lizards for tracking down leads.

W. Stephen McNeil is an Assistant Professor of Chemistry at Okanagan University College in Kelowna, British Columbia. His lectures and conversation tend to incorporate a large degree of both gesticulation and pontification, occasionally of a frighteningly unbridled and reckless nature. He often reminds people of his namesake on "Blue's Clues", and he knows that already, so you really don't need to mention it again.

Christopher Monks took science in high school. He lives in Massachusetts with his wife and two sons. Visit his website Utter Wonder and fall in love with the Internet all over again.

David Ng is a biochemist and the Director of the Advanced Molecular Biology Laboratory (AMBL) at The University of British Columbia. His writing has appeared in Maisonneuve, Biochemical Journal, McSweeney's, The Journal of Biological Chemistry, Yankee Pot Roast, as well as in his own life science education site, bioteach.ubc.ca. Disturbingly, he has both the means and the expertise to clone himself, but (thankfully) promises he won't.

David Secko is a molecular biologist and a science writer, who is currently studying journalism at the University of British Columbia. He thinks Steven Wright was right when he asked: "ok, so what's the speed of dark?" His writing has appeared in The Scientist, The Tyee, Canadian Medical Association Journal, Science's Next Wave and UBC's Thunderbird Magazine.

Claire Salvador's favourite colour is red; she likes insects and daisies (even if they don't smell very good). She is currently learning how to play chess, and is the undisputed champion of her household of two.