An Erratic Journey Through Science and Society

David T. Suzuki, *Sustainable Development Research Institute, University of British Columbia*

The most powerful force shaping society, our lifestyles and expectations today is science when applied by industry, medicine and the military. New scientific insights, ideas and techniques pervade every aspect of our lives, changing not only our aspirations and the way we do things, but altering the way we perceive the world, and our notions of who we are, how we got here and where we are going. Yet with rare exceptions, scientists are virtually invisible in the popular media in debates and reports on economic, social and even environmental issues.

As both a scientist and a journalist in the print and electronic media, I have constantly had to reflect on the nature of the relationship between science and society and the responsibilities that accompany to the role of scientist. In recounting my personal experiences, I hope some insights may be conveyed in this complex issue. I was privileged to receive an exceptional liberal arts education at an outstanding undergraduate college and an intense training as a grad student and post-doctoral fellow, yet was totally unprepared for the questions that I encountered in my chosen discipline of genetics. But let me start at the beginning.

Growing Up in British Columbia

Early in this century, my grandparents emigrated to Canada. Both of my parents were born in Vancouver, British Columbia, as was I in 1936. On December 7, 1941, when Japan attacked Pearl Harbour, my life was changed forever. The racism that had festered in B.C. ever since Japanese and Chinese came to the province as cheap labour in the late 1800s could now be vented openly under the guise of self-defence and patriotism. But my family felt itself Canadian to the core. We had never visited Japan; English was our spoken language at home. In the months following Pearl Harbour, the Canadian government moved to control the perceived threat of its Japanese population by invoking the War Measures Act against all people of Japanese ancestry. Under conditions of extreme threat to state, this legislation enables the government to suspend all rights of citizenship, including the right to speak out in public. Private property and possessions can be confiscated and bank accounts frozen, while individuals can be rounded up and incarcerated indefinitely without trial or communication.

The War Measures Act is a heinous piece of legislation because it’s easy to guarantee all kinds of rights and freedoms when times are good, but those guarantees only matter when times are difficult. That’s what men and women fought and died to protect, but when put to a serious test by World War II, Canada failed miserably. Twenty-two thousand Japanese, most Canadian citizens by birth, were rounded up and sent to internment camps in abandoned settlements deep in the Rocky Mountains. Each evacuee was allowed to take seventy pounds of personal belongings with them. My father was shipped to a camp to build the trans-Canada highway and was finally reunited with us a year later.

As the war drew to an end, the internees were offered a choice: renounce Canadian citizenship and take a free one way ticket to Japan or remain in Canada by getting out of British Columbia and moving east of the Rocky Mountains. Bitter and disillusioned, most internees signed to “repatriate” to Japan. As Canadians by birth, my parents were a small minority who chose to stay in Canada.

Pearl Harbour, incarceration and expulsion from B.C. shaped my personal psychic demons -- a knee-jerk aversion to any perceived discrimination or bigotry and a compulsive need to try to excel at whatever I did to prove my worth.

My family was impoverished by the loss of all their savings, our home and almost all of our possessions. We ended up working as farmhands in southern Ontario where we children were taught that hard work and education were the way to extricate ourselves from poverty.

Education

Fortunately, I did well enough in school to earn a scholarship to Amherst College where, motivated by outstanding students and dedicated teachers, my horizons were expanded by a curriculum that required me to take at least 40% of my upper level courses in the humanities even though I was an honours science student. I was able to take advantage of the requirement by taking courses in such subjects as classical music, religion, political science, English literature and modern history.

All through my childhood, fishing and camping had been my great joy and I became an avid insect collector as a teenager. Beetles were the focus of my special fascination. So at Amherst I knew that biology would be my specialty. In my junior year, I took two courses -- embryology and genetics -- that enthralled me with the exquisite beauty and elegance of development and heredity. They set me on my research path.

As a senior in the fall of 1957, along with the world I was electrified by the announcement that the Soviet Union had successfully launched Sputnik into orbit. In the agonizing months that followed, American rockets failed to match the Soviets as it was realized how advanced the Soviet Union was in science, mathematics and engineering. As U.S. President, Lyndon Johnson and then John Kennedy embarked on a race to catch up and beat the Soviets to the moon, billions of dollars were poured into the newly formed NASA and rapidly growing university science faculties.

I enrolled in the PhD program in zoology at the University of Chicago in a golden period of enthusiasm and expansion in science. Genetics and the natural sciences were exploding with vigour and excitement. Even though I was a Canadian, I was a beneficiary of the enthusiasm of those heady days in the United States.

Becoming a Scientist

As students, we were imbued with a sense that science was the best way to understand and explain the workings of the world. We were taught and believed that through science, the curtains of ignorance were pushed back to reveal the deepest secrets of the cosmos. Nothing lay beyond our enquiring minds, the only limit to finding answers was research money. As a geneticist studying the insect Drosophila, a fruit fly, I joined a small band of specialists called “chromosome mechanics” who exploited specially-engineered mutations and chromosomes to devise elegant experiments for probing Drosophila’s secrets. As budding scientists in the early ‘60s, we took pride in the fact that we were probing basic phenomena like cell division and chromosome organization and felt ourselves superior to ecologists and other scientists in applied areas such as medical and human genetics.

Through graduate school I acquired the belief that science could eliminate superstition and ignorance, providing us with an understanding of the biophysical forces impinging on our lives. Through a better understanding of mutation, recombination and gene activity, I believed, we would eventually be able to manage many hereditary

problems that afflict all humankind. I was part of a community who believed that greater scientific understanding would improve the lot of society and all humanity. Science would confer the insights needed to predict and control the important forces affecting us in our daily lives.

I became a research associate in the Biology Division of the Oak Ridge National Laboratory in Oak Ridge, Tennessee, working in the lab of the brilliant geneticist, Dan Lindsley. Born out of the Manhattan Project, the Biology Division had attracted a group of world renowned scientists in many disciplines. That year at Oak Ridge was filled with freely shared knowledge and excitement and became my ideal of science at its best, a community held together by enthusiasm and a thirst to learn through experimentation.

In the early ‘60s, there were job opportunities for the asking as university science departments exploded with federal funds. But one result of my experience with the Japanese-Canadian evacuation was a deep concern about bigotry. In Oak Ridge, segregation both overt and hidden was everywhere. I joined the NAACP and developed an excessive revulsion against the prejudice so apparent around me. In the United States I had received an outstanding education, made lifelong friendships and enjoyed incredible generosity and hospitality, but nevertheless chose to return to the Canada which had incarcerated and expelled my family from B.C. It was still my home and I wanted to work to make it a better place.

I returned to Canada in 1962 to the Department of Genetics at the University of Alberta in Edmonton. It was a shock to find that at a time when my American peers were routinely receiving $20,000 to 40,000 research grants, the average beginning Canadian researcher might start at $3,500! My first grant came in at $4,200, a larger sum than most, I was told, because I had a year of postdoctoral experience. Fortunately, my Oak Ridge experience enabled me to apply for and receive a substantial grant from the U.S.A.E.C. that enabled me to get my lab up and running.

Television -- An Interesting Diversion

The University of Alberta broadcast material on a local community channel on a weekly series of one hour programs called *Your University Speaks*. It was broadcast on Sunday mornings and I was sure had a miniscule audience. I was asked to be on a show and apparently did well because I was invited back and eventually did eight programs on various aspects of genetics.

After appearing on *Your University Speaks*, I was astonished to find that there were actually viewers when they commented on my performances. My family never owned a television set during my boyhood. They bought the first one long after I had gone away to college so watching TV had never been part of my boyhood. But I realized that television was potentially a very powerful educative tool. And I had learned that a camera pointed at my face was not intimidating, something I’ve come to appreciate as I’ve watched eminent scientists crumble in front of a TV lens.

Even as I was moonlighting in television, I was obsessed with research. But it was difficult to be hamstrung by the lack of research support which I felt reflected a public, and hence a government, that was uninformed about the role and importance of science in society. Television, I began to think, could be used to inform people about the nature of scientific enquiry, the insights we were gaining and the sheer joy and excitement of discovery. It’s something I continue to incorporate into my programs today but my interest at the time was to show how science revealed answers to questions we ask about

the world, thereby replacing ignorance with information. I wanted to convey that science is an activity that nations do as part of culture. As a country claiming to be civilized, Canada, I argued, must support a top-notch, vibrant community of scientists.

Educated by Students

As the most junior member of the Genetics Department, I was assigned to teach genetics to a group of agriculture students. To my surprise and delight, they worked as hard as they played. And they constantly pushed me for the agricultural implications of genetics with questions about the green revolution, ways to improve milk output or weight gain by gene engineering and perpetuation and amplification of animals by cloning. As a snobby basic scientist, I hadn't paid attention to the practical consequences of genetics and so was forced to read and discover a vast, interesting literature.

One winter in Edmonton motivated me to move to the University of British Columbia. There most students in my class were pre-meds who would quiz me about medical genetics, human heredity and the possibility of genetically engineering people. As with the aggies, the pre-meds forced me to read more. Even though I had received top training in genetics and a liberal arts education, I hadn't been prepared in any way to grapple with the issue of science and society.

At one point, I was invited to give a talk about genetic engineering to students in a campus dorm. I explored the implications of DNA transfer by transformation and transduction and the possibility of cloning. My talk provoked a student who demanded to know why, if there are such terrible possibilities that arise from new techniques, I was still doing research in genetics. I answered glibly that I was doing basic research into mechanisms of cell division and chromosome behaviour in Drosophila, not applied work. The student immediately countered that knowledge is like a huge pool of information. Like water added to a lake, a scientific report raises the level of knowledge but becomes disseminated throughout the body of information. So when a practical application is drawn from that body of knowledge, there is no way to distinguish what critical increment had made it possible. Ideas and insights are built on the collective base of accumulated knowledge so the distinction between practical and basic is artificial. He was right and spurred me to read more widely.

The Expurgated Part of History

To my shock, I discovered that eugenics, the attempt to apply hereditary principles to improve the human genetic condition, had been created and supported by leading geneticists of the day. Eugenics was considered a legitimate scientific discipline complete with its own journals, societies, university courses and textbooks. Among the traits eugenicists claimed to be hereditary were tuberculosis, syphilis, sloth, indolence, drunkenness, criminality and deceit. Indeed, Edward East, a distinguished Harvard professor and President of the Genetics Society of America, once wrote: "In reality, the negro is inferior to the White. This is not hypothesis or supposition; it is a crude statement of actual fact."

Genetics was a young discipline in the life sciences, marking its beginnings in 1900. As geneticists elucidated principles governing heredity and found that they were universal, there was an understandable sense of excitement and exuberance. Intoxicated with their insights, geneticists believed themselves on the verge of elucidating rules that could be applied to eliminate hereditary disease and abnormalities while increasing the level of intelligence and ability. Extrapolating freely from studies on inheritance of

physical traits like flower colour in plants or wing shape in flies, geneticists reached conclusions about inheritance of intelligence and behaviour in which their beliefs and values were often proclaimed as scientifically demonstrable fact. But words like "superior" and "inferior", "better" and "worse" reflect *value judgments*, not scientifically meaningful assessments.

To my horror, I learned that Josef Mengele, the infamous doctor of death at Auschwitz, was a human geneticist who held peer-reviewed research grants to study twins at the death camp. Race purification, a key part of Nazi policy, rested on the extravagant claims of geneticists and was tacitly, if not overtly, supported by geneticists in Germany. Thus, the Holocaust could be attributed in part as the consequence of the exuberant boasts of geneticists earlier in the century. Not surprisingly, in revulsion against the consequences of Nazi policy, by the end of the war, the accepted wisdom in genetics was that human behaviour and intelligence were primarily an expression of environmental factors.

Adding to my shock, I began to realize that the underlying rationale that had justified the incarceration of Japanese-Canadians had also been genetics. Transcripts from Parliament reveal the British Columbia Member of Parliament, A.W. Neill, ranting in 1937 "To cross an individual of the white race with an individual of a yellow race, is to produce in nine cases of ten, a mongrel wastrel with the worst qualities of both races." While not quite a Mendelian ratio, it was, nevertheless, an apparently quantified claim. In February, 1941, Neill told the Prime Minister "We in British Columbia are firmly convinced that once a Jap, always a Jap." Implicit in Neill's proclamation was a belief in the hereditary nature of perceived racial traits such as perfidy and deceit. Thus, bigotry was cloaked behind the legitimizing claims of scientists. At the very least, this lesson from recent history warns us about the hazards of extending the boundaries of claims beyond the immediate experiments. As scientists in the infant field of molecular genetics dazzle us with their latest discoveries, their exuberant claims echo similar sentiments from decades before.

Social Responsibility of Scientists

As I learned of this part of history, the grotesque intersection of two great passions in my life -- genetics and human rights -- was an agonizing confrontation with the issue of science and society. I realized that scientists are first and foremost human beings with all of the foibles, idiosyncrasies, talents and shortcomings of any other group of individuals. Our perspective is shaped by self-interest, training and professional aspirations and it is easy to become so enthralled with our work that without reflection we make grand claims about the potential power and utility of our discoveries and ideas. However, we can no more transcend the personal beliefs, values and idiosyncrasies that shape our perspective any more than any other group of people. Thus the only way to temper the claims and rush to apply ideas is to engage in serious discussion with an informed public. After all, they are free of the self-interest of scientists yet will be impacted by the consequences. And their taxes help fund the research in the first place.

But one problem is that scientists work with arcane tools, terminology and concepts that few non-scientists can penetrate. Scientists are bilingual, speaking both scientific jargon and the vernacular of society. So they have a special role to play, as translators from jargon-laden descriptions to everyday language and demystifyers of the nature of scientific activity.

After moving to Vancouver in 1963, my lab expanded rapidly and I was caught up in the excitement that comes from interesting research and an ambition to publish. Somehow people in television in Vancouver had heard about my involvement with *Your University Speaks* and I began to receive invitations to talk about research in my field, do book reviews or comment on new "breakthroughs". But I was consumed with enthusiasm over work going on in my lab. We had embarked on research that demonstrated that temperature-sensitive mutatations that had already proved to be powerful research tools in micro-organisms could also be readily induced and studied in Drosophila. The ability to control the expression of a mutation simply by changing temperatures proved to be very useful in a variety of ways. Nevertheless, I also decided to try to get a television program to explore the issues that arose from the impact of science on society. Fortunately, I received the E.W.R. Steacie Memorial Fellowship from the National Research Council of Canada. It is awarded to the "outstanding Canadian research scientist under the age of". It paid for someone to be hired to teach my courses so I could devote full time to research. I was able to hold it for three years and it enabled me to explore television. I proposed a series called *Interface: Science and Society* to British Columbia's education channel. I was able to interview outstanding scientists ranging from Carl Sagan to Jonathan Beckwith. In 1969, the CBC approved a nationally broadcast series to be called *Suzuki on Science*. We explored ideas at the cutting edge of research by interviewing top scientists. But the budget was so small, it was basically "talking heads" which are anathema for television. After two seasons, I quit the series and assumed that my career in television was over.

In Canada, the premier science program was a series of half hour programs called *The Nature of Things* that had originated in 1960. The series did not have a host and each show covered a single topic, often on natural history, without a host. In 1974, Jim Murray, the executive producer of *The Nature of Things*, proposed a new series to be called *Science Magazine*. Each half hour program of *Science Magazine* would carry two to five reports on unrelated topics presented in a magazine format. I was asked to host the series and it was an instant success. Audience analysis revealed the magazine format was especially appealing to younger viewers who were increasingly restless and conditioned to flit from topic to topic. For me the problem with short items in a magazine format was that there was less opportunity to explore deeper ramifications of ideas. Each report was hyped with a breathless sense of "golly, gee whiz, what will they think of next?"

After five years, *The Nature of Things* and *Science Magazine* were fused into one series of one hour programs called collectively, *The Nature of Things with David Suzuki* which I have hosted since 1979. The show is the longest running series on the CBC and has been broadcast in more than 80 nations.

Venture into Radio

In 1975, I was asked to host a weekly one hour science on CBC radio. *Quirks and Quarks* was an immediate success, garnering a large and loyal audience by radio standards. I hosted the program for its first four years and it continues as one of CBC radio's flagship programs to this day.

Public radio in Canada is still a potent force, garnering a fiercely loyal audience. Unlike television which is carefully staged and often contrived, radio is spontaneous and warm with opportunity for humour and surprise. In television, the visuals overwhelm and dominate the senses while radio requires the active participation of the listener. The

human brain is a creative organ and with radio, words can elicit an infinity of responses and the most abstract ideas can be followed through a listener's imagination. Television shies away from ideas that cannot be illustrated with pictures. The CBC radio audience is older, better educated and professional. Unfortunately, the radio audience is dwarfed by the reach of television.

Hard Choices -- Research or Media?

Science for me had always been a full time passion that extended far beyond a regular working day five times a week. But to do radio and television well meant a full time commitment too. As long as I wasn't teaching, I could keep up with the lab and remain involved with the media. But as the media involvement increased, it cut into research time. UBC hired Tom Grigliatti, one of my top PhD students, after he had spent a year of postdoctoral study at Yale. Tom shared the lab with me and to my relief, very quickly carried the research into new areas. Eventually, I was able to remove myself completely from research and lecturing.

The scientific community gives lip service to the need to have public discussions about science. But in my experience, scientists have a harder time acting on it. Once when acting as the moderator of an all-day panel on genetics, I introduced James Watson and then asked his opinion on social implications of molecular research. To my amazement, he lashed out in a stinging attack on what he perceived as my biases. Both Richard Feynman and Philip Morrison bristled when I suggested that scientists have an obligation that goes beyond mere civil duties of all other citizens. Scientists are reluctant to participate in programs in which there is serious questioning or legitimate criticism of certain aspects of science. Scientists readily claim potential benefits of their work but when faced with serious public debate, are reluctant to explore the negative consequences or accept special responsibilities.

As a journalist who has asked critical questions of science and scientists, I have felt deep resentment if not outright hostility from my colleagues. I cannot say what motivates the resentment but it is real. In my experience, popularization of science and rigorous discussion of science's limits and hazards are not considered worthy academic activities.

Technology's Unpredictable Consequences

The year I began my second career in television (1962) coincided with the publication of Rachel Carson's *Silent Spring*. Though she was vilified by scientists working in the chemical industry, she was right and galvanized massive public concern that became the environmental movement. Her seminal book pointed out that technology, however beneficial, invariably had costs and because our knowledge about how the world works is so limited, we are seldom able to anticipate beforehand, what those costs will be. For example, biologists could not have warned of biomagnification of molecules up the food chain because they only learned of the phenomenon when raptors like eagles began to disappear. In the same way, we learned of radioactive fallout, electromagnetic pulses and nuclear winter long after the first nuclear bombs were exploded. Readily transmitted plasmids carrying multiple drug resistance were discovered only years after antibiotics were used as growth promoters in animal feed and over-prescribed to humans.

Carson's prescient warning was never more important than today when we seem so anxious to apply every incremental discovery to market a new product or technique. It astounds me how readily scientists ignore her message and the lessons of history in order

to rush to market their insights. When I graduated with a PhD in 1961, genetics was an exciting area and I was filled with excitement over the latest ideas of chromosome and gene structure and genetic regulation. When I tell students today about some of those hot ideas from the '60s, they often snicker because in 1999, ideas and concepts from 1961 seem naive and far off the mark. But those students are shocked when I tell them twenty years from now when *they* are professors and tell their students the greatest notions from 1999, their students will be just as amused. The very nature of science is that most of our current ideas are wrong, irrelevant or unimportant. Science progresses by demonstrating that our hypotheses and conjecture need to be overhauled, thrown out or modified. It is not a denigration of science to point this out, it is simply a statement about the very nature of science. Scientism, the belief in the authority of scientists, is undermined by the very nature of the enterprise but scientists are prone to forget this.

Scientists and the media are understandably enthusiastic about the insights we are gaining and applications in many sectors. Computers, telecommunications, space research and genetic engineering are advancing at astonishing rates. In our intoxication over new discoveries, we forget how much we have yet to learn. I have been involved in many battles over destruction of wilderness areas by logging, mining, damming and development. I am often told that silviculture is sufficiently advanced to enable us to destroy an ancient forest and replace it with a "normal" forest, to produce high quantities of fibre. But a tree plantation is not a forest. We haven't even identified most of the biophysical components of a forest -- air, water, soil, micro organisms, insects, etc, let alone how they are interconnected.

Ecologists like E.O. Wilson point out that while systematists may have given names to 10 to 20% of the species on the planet, we have detailed knowledge about a fraction of one percent of the ones that are identified. With such a minuscule information base, how can anyone claim to be able to "manage" wild organisms or ecosystems? Yet that is the basis of our claims to be able to control the impact of large clearcuts, dams, mines, etc and our faith in environmental assessments and cost/benefit analysis. There is simply no way that a scientific basis can be claimed for these abilities.

The great strength of scientists is in *description.* We make discoveries because everywhere we look, our knowledge base is so tiny, we are bound to find out all kinds of things. But this means that our ignorance is so great we have virtually no capacity for *prescription,* that is, to suggest steps to correct problems that we encounter. We have so much more to learn to learn before we can feel confident in our predictive abilities. The one component in our surroundings that we can try to control and manage is ourselves. In the global ecocrisis, the challenge is not to try to shoehorn nature into our economic and political priorities -- we can't do it even when we try -- but to control human behaviour and actions that impinge on our surroundings.

Geneticists Should Take More Time

In my area of knowledge, genetics, the past decades have been a time of tremendous and understandable exuberance over the insights, techniques and applications that are pouring out of the field. Thus, it is proclaimed that the benefits of the Human Genome Project will be an understanding of and treatments for a wide range of human problems from cancer to schizophrenia. Yet we have known the molecular nature of sickle cell anaemia for almost half a century and we are a long way from curing it. It is hubris to claim imminent benefits from the HGP. DNA is a linear sequence of

information that must be transformed into multidimensional products acting within a complex multicellular milieu over time. The notion that simply deciphering the linear DNA sequence will confer the ability to understand and safely manipulate higher levels of complexity and interaction is totally unwarranted at present.

After Arthur Jensen's claim that differences between Blacks and Whites in their performance on IQ tests are genetically based, the scientific opinion that human behaviour is affected primarily by environmental factors, began to shift again towards a hereditarian basis. This notion was reinforced by claims of researchers like Hans Eysenck, Hans Krebs, Richard Herrnstein and others that such traits as IQ performance, criminality, social problems, poverty and social class have a strong genetic component. Such biological determinism is reinforced by the frequent claims at yet another "breakthrough" in discovering a new gene for alcoholism, manic depression, extroversion, risk taking, shyness, homosexuality, and so on. What is truly astonishing in these reports is the ready confusion between *correlation* and *causation*. In virtually every case, scientists document correlations of an allele or restriction enzyme fragment with a condition and then immediately claim a demonstration of a causal relationship. Clearly scientists must be better informed about the nature of their activity, the nature of proof, and the limits to enquiry.

History is filled with examples of the fact that scientists are not immune from the temptation to massage or select data, to buttress claims of discovery. If scientists are willing to employ exaggeration, deceit or dishonesty merely for greater fame, promotion or acceptance to medical school, we can only speculate on what people will do under pressure from venture capitalists and vast sums of money.

The Dark History of Science

There have been numerous examples of horrific atrocities committed under the guise of scientific research. It's not just studies performed under the Nazi or Japanese regimes. In Canada and the United States, people have been experimented with without their knowledge or approval. Treatment was withheld from syphilis patients at Tuskegee, mental patients were fed radioisotopes, unsuspecting populations have been exposed to aerosols of bacterial agents, mentally and physically handicapped patients were sterilized under the guise of eugenics, patients were treated with LSD, and so on. These stories reveal human fallibility of scientists and demand that we demystify our activities and allow broad public participation in discussions about new techniques and ideas. It is not enough to engage only the scientific community or discussants selected by the scientific establishment.

Scientists haven't openly discussed the implications of funding sources and scientific objectivity. Scientists working for industry or government agencies are seldom free to make their results known to the public when there are negative political or economic implications. In principle, universities are the last bastion of openness and freedom of information exchange. Buffered from interference by tenure, academics are positioned to explore the moral, ethical and social implications of research. I remember interviewing MIT's David Baltimore and Harvard's Mark Ptashne for *Suzuki on Science* when they were young radical scientists. They freely criticized Dow Chemical and Monsanto for their production of napalm and agent orange for use in Vietnam. Today, both of them are eminent scientists involved in biotechnology and I wonder whether either would be as critical of the two companies today.

After the Arab Oil Embargo in 1974, the Alberta government decided to press ahead with the construction of ten more oil extraction plants on the province's tar sands deposits. Syncrude, the one plant already in existence, put out 50 tonnes of sulphur dioxide a day. We decided to do a program on the ecological implications of the new plants for *The Nature of Things* and asked ecologists at both the Universities of Alberta and Calgary for interviews on the consequences of increased acidity in the atmosphere. No one would talk to us on camera because they were all funded by the oil industry. The role of tenured university academics involved with biotech companies remains to be discussed seriously from the perspective of the public's right to know what's going on.

Information SuperHYPEway

Finally, I must comment on the vaunted benefits of the information superhighway. Educators, entrepreneurs and politicians sing the praises of the potential benefits of the information revolution. But what I see is a shattering of the world we know through fragmentation of information into bits and pieces. People no longer understand how their lives and the things they consume are linked to everything else in the world. We are no longer aware of the sources or producers of food, clothing, material goods. All of these are simply objects to be purchased without knowledge or care for the condition of the workers who laboured to make them available, the ecological costs of their harvest, manufacture and transportation.

The average person is now awash with information. I am often told about some amazing new fact or invention and when I ask the source of that bit of knowledge, am told "I read it" or "I saw it on TV". Usually the person recounting the story cannot inform me whether it was in *The National Enquirer* or *Scientific American* or shown on *The Nature of Things* or *Jerry Springer*. Information becomes validated simply because it exists.

When I began my career in television, I knew the medium was a cesspool. I assumed that my programs would glisten like jewels, attracting special attention from the audience. Instead, i discovered once in the cesspool, one looks like a turd like everyone else. The reason is that most people don't watch television carefully and critically. The TV is usually left on and the viewer roams the channels, snatching snippets and being distracted by phones, visitors, snacks or crying babies. By bedtime, a person's brain is a mush of factoids no longer anchored to a source or context that informs us why it matters.

In a world in which virtual reality is hyped as the coming mode of experience, I find that the problem is that virtual experiences are BETTER than reality. We can experience the kinkiest of virtual sex without fear of AIDS or being caught, we can have all of the nerve tingling rush of a gunfight that we lose, we can live through the heart thumping high of a car race and crash. I had always assumed that my programs would convey a sense of wonder and delight of the natural world but now I realize that television is a created reality. We may send a cameraperson to the Arctic or Amazon for six months to do a natural history film. An editor then takes shots that often took agonizing hours, days or even weeks to film and strings them together into a sequence that implies that in the Arctic or Amazon, all hell breaks loose in a flurry of bird, mammal and insect life. Yet as anyone who has been to these places knows, it's not like that at all. The one thing nature needs to become apparent in all its splendour and complexity is TIME. And the one thing television cannot tolerate is dead air because the viewer is armed with a channel changer and the attention span of a hummingbird. So all

of us end up competing for viewers by being more raucous, outrageous, shocking, unexpected, etc to capture and hold a fragmenting audience. The victim of all this is reality.

Advice from the Trenches

I am occasionally asked by fresh PhD graduates how they can "get into television". I'm afraid my personal history offers little in the way of useful guidance. Scientific research was my first love and passion, but the fluke of my personal experiences with bigotry and racism led me on an erratic path to the electronic media. I did not set out to deliberately carve a career in television, I was simply open to opportunities when they came up.

As I approach retirement and reflect back over my career, I don't regret leaving research. I had the excitement of making discoveries that could be published in top journals and attract the interest of my peers. I never went into television to "become a star" so I have been surprised at becoming a minor celebrity in Canada. Now with hindsight, I realize that television is an ephemeral medium. Images and ideas pour out at viewers who are distracted by all kinds of other things. One program quickly fades in a person's mind after a night of watching TV. Indeed, I am always amazed at how often a person will hail me, wax ecstatic about my show and then mention a particular topic he/she enjoyed. When I reply that we've never done a show on that subject, they'll often think for a minute, then reply "Oh. It must have been *Jerry Springer*" or "*Oprah*". I seem to get credit for anything vaguely scientific regardless of where it appeared. What has happened to me is over, specific issues come and go, but viewers form an impression of the host. That's what gave Edward R. Murrow, Barbara Walters or Walter Cronkite such credibility. So where I had thought that I was simply conveying information with which a viewer could be empowered, instead I have been given the power of a large viewing audience. Thus, politicians or businesspeople respond to me in the knowledge that I have that viewership. It is an enormous responsibility to live up to.

As information channels open up and computers access information anywhere on the planet, programs become increasingly short, strident, loud, kinky, sensational or violent in order to keep an audience.

While an appearance on one or two programs will probably vanish from public memory with little lasting impression, scientists need to be a more persistent presence in programs. Science is deeply embedded in our culture and economy and scientists have to be considered important participants in discussions and debates. So lest my personal history discourage other scientists from becoming prospective media personalities, I urge you to consider it while encouraging others who may be so inclined.