

seems to be aimed at becoming Number One *as an end in itself!* Surely that is an empty goal. That is not an uplifting target for a whole people.

Furthermore, the Japanese can be categorized as a "coloured" race and thus could be a powerful role model and leader of the nonwhite peoples of the world. Yet while leaders from impoverished countries such as India and China have played prominent roles in global politics, Japan seems to be content to focus inward, looking out only to compete with Europe and the United States. The Japanese have a strong sense of racial superiority that blinds them to responsibility to people in the Third World. Canadians, in contrast, have opened their country and pocketbooks to the Third World and should be proud of it.

Morita doesn't mention the Third World until the last few pages of his book, and then he simply advises those countries to copy Japan's example. There is no acknowledgement that global starvation is as much economic and political as it is a technological problem.

However, it is Japan's attitude towards the environment that is most distressing. Morita, like all the uncritical technophiles who trumpet the wonders of the Information Age, believes the benefits of technology are limitless. So there is no consideration of its "costs."

In discussing global starvation, overpopulation and habitat loss, he writes, "I am optimistic enough to believe technology will solve all these problems." Yet technology itself is in large part the *cause* of the problems.

Minamata disease, which is caused by mercury pollution, should have warned the Japanese that costs always accompany technological innovation. And as the only country to have been bombed with an atomic weapon, Japan should be aware of the terrible Faustian bargain technology brings.

Tokyo's Tsukiji, the world's largest fish market, is an astonishing experience. The variety and quantity of sea life sold there are amazing. Most of the seafood comes from elsewhere because the waters around the Japanese islands have been polluted and overfished. Japan's great fishing fleets are like buccaneers of the twentieth-century plying the seven seas to plunder them of enormous quantities of protein. Japanese drift nets form a barrier extending thousands of kilometres down the centre of the Pacific Ocean, intercepting fish, birds and mammals alike. It is sheer "piracy" that threatens the ecological balance of the oceans.

Japan is a resource- and energy-poor country, but with its economic

power it has commandeered a disproportionate share of the planet's resources. Thus, for example, Canadian marine regulators, who are under the mistaken belief that they know how to manage the ocean ecosystem, allow herring off the West Coast to be taken in huge quantities at spawning time and sold to the Japanese. Herring is a key species in the support system of larger fish such as salmon, as well as many mammals and birds. But Canadians allow mass "harvesting" of the prespawn fish because their roe is highly prized in Japan. Each female yields a few grams of roe and the rest of the carcasses as well as all males are discarded or rendered for animal feed.

I love herring roe myself, as do native Indians. Because herring are incredibly fecund, within limits we can take some of their eggs without damage. But the vast quantities of herring taken by modern purse seiners (many tonnes per boat) deal a devastating blow to the reproductive capacity of the fish. The ecological value of the live herring populations is immeasurably greater than the revenue from the roe. The Japanese exploit our short-sightedness and avarice by offering money.

But the Japanese are living at the top of the food chain. They have the economic clout to buy what they want or extract from the oceans with impunity. It is neither a wise nor an admirable attitude. As someone whose genes came from Japan three generations ago, I feel sad that such a remarkable people should appear to be so irresponsible, philosophically shallow and bereft of environmental sensitivity. Canadians are leagues ahead of Japan in environmental awareness and a sense of global community.

The Prostitution of Academia

All governments of industrialized countries wish to emulate Japanese success in the high-tech industries, so they are attempting to capitalize on the creative energies of scientists in universities.

Responding to pressure from the government and industry, Canadian universities are encouraging academics to develop ties with the private sector, thereby accelerating the transfer of basic knowledge to

industry. The unique role of academic scholars as a group without a vested interest in business or government is thus terribly compromised.

In a glossy advertisement for the University of British Columbia entitled "Engine of Recovery," President David Strangway states on the first page: "Universities are a major source of free enquiry, providing the ideas that can later be exploited by free enterprise. We need both the push of free enquiry and the pull of free enterprise for success in our society." The rest of the brochure is filled with examples of people, primarily scientists, ostensibly solving practical problems in medicine, industry and society.

Across Canada, universities are rushing to become part of the industrial enterprise, as faculty are being encouraged to become entrepreneurs who exploit their discoveries for profit. There have been few objections to or questions raised about this process. I, for one, do not agree with President Strangway's political-economic analysis of the societal role of universities and I have grave concerns about the headlong rush to industrialize the university. Let me explain.

Historically, universities were never meant to be places where people prepared for jobs or where specialists aimed to benefit the "private sector." The university has traditionally been a community of people sharing in the exploration of human thought and creativity. The common assumption since universities became public enterprises has been that if the best minds of our youth are an important natural resource, then universities will maximize their development.

A good university is a place where scholars, dreamers, artists and inventors can exist with no more justification than excelling at what they do and sharing their skills and knowledge. The full range of human thought is encompassed within a university. One consequence is that such knowledge often leads to criticism of government and industry. University scholars can be a pain in the neck to people in power. That's why academics have fought for *tenure* as a means of protection from harassment for their ideas and social critiques. Society needs objective critics if it is to have more than parochial, self-centred goals. Sadly for most Canadian academics, tenure has become a sinecure rather than a privilege and opportunity.

The industrialization of the university is a mistake for many reasons, one of the more trivial being that it will not do what its proponents claim. In rushing to welcome investment from companies to exploit

new ideas and discoveries, scientists seem to have forgotten or are unaware that most of our current hotshot ideas will in time prove to be wrong, irrelevant or unimportant. Science is mainly in the business of invalidating the latest concepts. So why the rush to apply them?

But I have much deeper reasons for objecting to the industrialization of the university. The essence of an academic community is the free exchange of ideas, a sharing of knowledge. The formation of private companies within universities and with their faculty runs counter to this spirit. Private companies encourage a destructive kind of competitiveness that can be petty and mean. Secrecy becomes a priority when patenting ideas is a primary goal. And the lure of profit can result in both shoddy science and a narrow focus that ignores broader questions of social responsibility and impact.

My most serious concern is with the vital role of the academic as both critic and source of knowledge for society. Without an axe to grind, the scholar is in a unique position to provide a balanced point of view with data to back him or her up. During the Vietnam War, two of the most visible activists among scientists were MIT's David Baltimore (who later earned a Nobel Prize) and Harvard's Mark Ptashne. They were critical of companies like Dow Chemical and Monsanto for their production of napalm, defoliants and tear gas. Today, both Baltimore and Ptashne have their own biotechnology companies while Dow and Monsanto are heavily involved in biotechnology. Do you think for a minute that Baltimore and Ptashne would be as critical of those industries today? Not on your life.

In the seventies, after the Arab oil embargo, I was involved in a film on the massive deposit of oil in Alberta's Tar Sands. At the time, with oil prices skyrocketing, there was talk of perhaps ten more oil extraction plants as big or bigger than Syncrude. Each would produce at least fifty tons of sulphur dioxide a day. That's a lot of acid rain. So we tried to find a university ecologist in the area who would speak to us on camera about the environmental consequences of such development. We were unsuccessful because no one wanted to jeopardize his grant from the oil companies! Yet it is precisely for that knowledge that society supports such experts in a university.

I don't deny a role for university faculty in the application of new ideas. Our top-notch people are Canada's eyes and ears to the world's research, and good people will have ideas that can eventually be

exploited. But the deliberate and urgent push to economic payoff distorts scholarship within the university and subverts its thrust to the will of those who have the money. Profit and destruction are the major reasons for the application of science today, while environmental and social costs are seldom seriously addressed. That's why we need scholars who are detached from those applications.

I remain a faculty member of UBC and because I care so much for the university I am compelled to speak out in criticism. Tenure confers the obligation to do so.

I don't condone but can understand why university scientists, who have been underfunded for so long, are welcoming the Faustian bargain with private industry. But I fail to comprehend why philosophers, historians and sociologists who should know better are acquiescing so easily.

The headlong rush to industrialize the university signals the implicit acceptance of many assumptions that have in the past been questioned by academics themselves. For example, free enterprise, like most economic systems, is based on the unquestioned necessity for steady growth — growth in GNP, consumption and consumer goods.

Steady incremental growth within a given interval is called "exponential growth," and any scientist knows that nothing in the universe grows exponentially indefinitely. Yet economists, business people and politicians assume the explosive increase in income, consumer goods and GNP (and inflation) of the past decades must be maintained to sustain our quality of life. Historians know that this growth is an aberration, a blip that must inevitably stop and reverse itself. But how can the fallacy of maintainable exponential growth be seriously challenged when the university is busy selling the myth that it can help maintain such growth?

Scholars in universities represent tiny islands of thought in society. They are sufficiently detached from the priorities of various interest groups like business, government and the military to point out flaws in our current social truths. But by focussing on issues that are socially relevant or economically profitable, we lose sight of the broader context within which that activity falls; we forget history; we become blind to environmental and social costs of our innovations.

In the U.S., a significant portion of the budgets of universities like MIT, Harvard, Cal Tech and Stanford now comes from private invest-

ment. This has split their faculties in debate over whether there should be such close ties with private enterprise. But while those institutions are private, Canada's major universities are all publicly supported. Yet there has been little debate in Canada over the imminent industrialization of academia. The activity and knowledge of our university scientists is paid for by the public and should be available for their benefit, not hidden behind a curtain of classified information, profit priorities or patent secrecy. Academics who accept grants or investments from the military or the pharmaceutical, forestry and computer industries, for example, will be reluctant to jeopardize that support by criticizing those industries when necessary.

There is another consequence of the increased industrialization of our universities that originates in the mentality of scientists themselves. Among scientists there is a hierarchy of position that is directly correlated to grant size and continued research output. A scientist has to keep his "hand in" to maintain status and credibility with his peers. Anyone who decides to look at a wider range of social, environmental or ethical matters, instead of focussing with tunnel vision on specific problems at the cutting edge of research, loses status in the scientific pecking order. Nobel laureates like George Wald of Harvard and Cal Tech's Linus Pauling and Roger Sperry who have become social activists and critics of some areas of science are often referred to disparagingly as "senile," "over the hill" or "out of his area." As university scientists become bound to private enterprise more tightly, their horizons will be restricted even more and they will be far less patient with those who raise social and ethical implications of their work.

Let me be specific by considering one of the hottest areas of applied science — biotechnology — genetic engineering of organisms for commercial purposes. Biotech companies have been sprouting up on campuses like mushrooms. In a number of international meetings held at universities to discuss the future of biotechnology, none has seriously considered the potential misuse or hazards of the technology. Surely an academic community of scholars who maintain an arm's-length relationship with vested interests of society should be expected to raise those questions. Who else will do it?

One of the claims made to encourage greater investment in biotechnology is its potential to "feed the world's hungry." It is a self-serving, shallow justification. Starvation on this planet is a consequence more

of political and technological factors than a shortage of food. Even if it weren't, the exponential growth of our species' numbers, which has already doubled the global population twice in the past century, will far outstrip any increase in food production brought about by biotechnology. Scientists anxious to justify their research for more support will resist such objections.

Canadians should be wary of the uncritical push to increase the links between university academics and private industry because there are unacceptable "costs."

A Bid for Scientific Excellence

If we look at those areas where there has been a successful relationship between university personnel and the private sectors, it is most obvious in Silicon Valley in California and Route 128 in Massachusetts. These areas of high-tech enterprise are adjacent to world-class universities like Stanford and Berkeley in California and Harvard and MIT in Boston. When there is a community of scholars, important and useful ideas can be expected to eventually spin off into the private sector. But how do we build such a community?

In a world dominated by the U.S., Japan and Europe, we should remember that Canadians have supported a scientific community at starvation levels for decades and we continue to underfund our scientists. At present our research output is about three to four per cent of all of the work done in the world. There are many reasons why most of the money committed to R & D in the provinces and federally will not produce the economic benefits so optimistically proclaimed. I'll focus on one.

Across the country, politicians are allocating research money with a very big string attached. We no longer adhere to the belief that science is a cultural activity a society supports to affirm that it is a civilized one. Research is funded to make discoveries and inventions that will be useful or economically beneficial.

The effect of pressure to apply research knowledge has over-

whelmed the scientific community and now dominates both the criteria for granting funds and the way scientists justify their work. Everyone is looking for a practical angle that will legitimize experiments. This perpetuates a mistaken notion of how science works, but that's the subject of another essay. I believe it is extremely short-sighted to carry out research with a view to its potential use because a severe constraint is imposed on the kinds of problems attacked and experiments done. In the current funding climate, a lot of projects with enormous long-term value will not be supported or will be abandoned. Let me give you two examples of past research that would not have received much support had today's standards been applied at the time.

The first involves work by the Swiss microbiologist Werner Arber. He spent years studying a puzzling phenomenon whereby the properties of viruses were modified after they infected certain kinds of bacteria. He discovered that in the bacteria, the virus's genetic material is chemically altered in a way that does not change its genetic content but does make it resistant to certain enzymes that would normally break it down. It was an esoteric study that seemed to elucidate a special quirk of microorganisms that wasn't very relevant to the central problems of genetics.

We students in genetics studied Arber's work because of the elegance of his research. The puzzling phenomenon revealed the existence of a class of proteins that recognized particular DNA sequences and cut the molecules at that point. Back in the early sixties no one anticipated that this would lead to the discovery of tools that make genetic engineering possible, yet that's what happened. Those proteins, called "restriction enzymes," have become the critical means of chopping DNA into smaller fragments. Arber shared the Nobel Prize for that work, but had he been required to justify his research when he started, even he could not have foreseen its eventual utility.

As a graduate student, I remember sweating over the research papers of a highly acclaimed scientist who worked with corn. Barbara McClintock was a famous American geneticist whose studies into heredity in corn were at once elegant and complex. She discovered a puzzling phenomenon in these plants: under certain genetic conditions in certain parts of the plant, genes seemed to *jump* from place to place on chromosomes. This made no sense and ran counter to accepted genetic orthodoxy that each gene occupies a specific spot on a chro-