

TO DARE TO ATTEMPT IMPIOUS WONDERS

Science & Canadian Literature

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THE PARADOX OF THESE TIMES is that things are not what they seem to be. We live enmeshed in a web of technological marvels, the principles and operations of which often we barely understand.

The chances of survival on this earth
are perhaps one to three now
this year of the atom. Do not increase them
by adding that strange word *love* to your vocabulary.¹

That is indeed a problem, but there is hope in the possibility that equal in its power to the strange word *love* is the sweat-borne action of understanding. The poet must be careful that he is not substituting comfort and convenience for survival, mistaking soft for safe. The basis for both comfort and survival is the fit and proper application of science — our knowledge of the working of the universe. But do we realize it? David Suzuki tells us that, on the basis of his street interviews, most people see science as something that does not affect them and is of little concern to them.² In the United States, the White House worries that the American population is drifting towards “virtual scientific and technological illiteracy”³ with the potentially catastrophic effect that many important national decisions will be made on the basis of ignorance and misunderstanding. These are serious matters that suggest a constriction of our vision and a weakening of our adaptation to the world as we make it. Love, without some direction from understanding, cannot save us. Understanding comprehends love; the depths of understanding must be plumbed for love to work its best. That is the part for literature to play in man’s attempt to rationalize himself.

For my part, I shall quickly explore the nature of science — and technology, which is something else. I shall examine the relationship of science and literature, and see if the phantom of the Two Cultures can be appeased. I shall seek literary scientists and scientific litterateurs to ask what it is they can offer us in understanding.

Science is one of the great creative activities of man. Definitions of science abound, but for pragmatic purposes let us go to a committee of learned men. They will start us with our feet on the ground. The Frascati definitions of the Organization for Economic Co-operation and Development (OECD) say, "Basic research [which I shall call 'basic science' later] is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view."⁴ If we grant the savants a certain leeway with the use of "phenomena," we have a definition we can use.

As an example of another definition, we can quote Wilder Penfield, who said that Science is the knowledge of physical phenomena while the Arts embrace all other forms of human knowledge.⁵ This is not a workable definition, not only because it lacks any explanation of how science works, but more importantly because on one hand it casts everything into a pair of global categories of little analytic value, while on the other it is too restrictive in its "either-or." It raises a kind of fundamentalist C. P. Snowstorm. Both Penfield and Snow will appear later in these pages.

As is the case with any creative endeavour, science has its few prime practitioners, standing recognized, well above the thousands of lesser talents. The very best have insight and abilities, methods of procedure and incisive thought that are only dimly perceived by others, but the beauty and universality of their results demonstrate the value of their techniques. The intellectual achievement of grand science is homologous to the achievement of grand art, literature, or any mind-designed accomplishment.

Science as an intellectual activity is more open than any other. By this I mean that the practice of science is more than just the use of the imagination. It requires imagination bound to externals; it bears within itself a burden of proof. There is, with any result of science, the possibility of its being shown to be wrong, in a way that no work of art, no piece of literature can be shown to be wrong. Literature, art, or science may be shown to be bad, but only to science can "wrongness" be attributed, hence only to science is something other than a value judgment possible.

"Openness," as expressed here, is enforced in science because science deals with verifiable results. Science is undertaken according to rules, which do not necessarily constitute a formal "scientific method," but are rules of honesty, enforced by reiteration and repetition; of testing of probabilities; of establishing hypothesis and theory with the corollary of the possibility of the growth of knowledge and even substance; of formal publication, which, by exposing methods and data, allows, even calls for further testing and continued growth. This is the "Sense of consolidating progress which belongs to a science" spoken of by Northrop Frye.⁶

Scientists hardly ever make a statement without reference to "the literature," the very basis of their own endeavours.

The data of science are external; they are recognized, not invented. Explanation follows recognition, which is the famed inductive method. Imagination takes its leap at two stages: first, in the invention of methods to force recognition of phenomena (experimentation); second, in explanation (theorization). Both may be elegant and beautiful, and appreciation of them is expressed in those terms by practitioners.

The openness of science is to be contrasted with the closed nature of literature or art. The closed nature of, say, literature, is indicated by the fact that it is not reiterative or repetitive — it is unique in a way that science is not. Nor is it probabilistic, nor does it grow from inclusive theory. The subject matter of literature is internal and invented. Its publication exposes the inventions of the author for acceptance or rejection on the basis of the judgment of the audience — and "the power of the writer to bounce the reader into accepting what he says."⁷

If it is the case that science is "open" and literature "closed," are they then mutually exclusive? Can literature deal with science? These are simple questions for which answers readily leap out: no, they are not mutually exclusive, for they are both artificial; yes, literature can deal with science, as it should be able to deal with any subject. It is the author's problem to deal with his subject in an enlightening manner: by delineation and analysis of personality; by implication in plot; in imagery; or in any way to the limit of his imagination. If it is possible to explore the motives and emotions of Ginger Coffey or Hagar Shipley, why not those of an active researcher, someone flagellated by the need to know as much as possible about something, sooner than anyone else?

Is there any subject of that sort in Canadian literature? Not really, that I have seen. Perhaps Lesje Green gets close, but she is not a scientist originating data; she has intelligence, curiosity, and with them gains the satisfactions of a good technician. She seeks what is known, not what is not. Even so, her reactions to her problems are modified by her interests and training. Of course they are, to our advantage, for it is a rare occasion on which technical backgrounds are seen in literature to affect relationships. But the stupendous, egotistical and often annihilating drive of a productive, cutting-edge scientist is not there.⁸

Has it ever been? I know of one piece of literature in which the mind and attitude of a scientist is laid bare and his motivation made explicit. It is *The Life of Galileo* by Bertold Brecht. The memory of it colours all my observations on the possibilities of connection between literature and science. Towards the end of the play Galileo makes a general statement which says what modern philosophers of science say: "The pursuit of science seems to me to require particular courage. It is concerned with knowledge, achieved through doubt. Making

knowledge about everything available for everybody, science strives to make sceptics of them all."⁹

Science, perceived as broadly as possible, is still more complex than shown here so far. It has many parts; it is easy to distinguish basic science, applied science, and technology, though like all distinctions these are quite often not made. They are even denied at times, usually in fervent, democratic zeal. But I hold that there are differences (in which opinion I get support from the OECD Committee), and that literature should recognize them. That means that science explored in literature need not confine itself to the Galilean stratosphere, but that the biosphere of Lesje Green has some priority in exploration because it is nearer each of us and encompasses most of us in science.

For a definition of basic science we may return to the OECD. We may also paraphrase its committee for applied science: original investigation directed primarily towards a specific practical objective, i.e., science with intent. And technology: systematic use of knowledge and practical experience directed to producing, installing or improving processes, systems, and services. The three, basic science, applied science, and technology, are directly related, with fuzzy boundaries. Theories of electricity were utilized to develop a means of transmission of sound over distance; the telephone today is rather better than it was 50 years ago although its operating principles remain unchanged. Basic science established the possibility, applied science built it, and technology maintains and improves it.

What is of interest historically is that technology was much the earliest to appear. Man needed and provided goods and services long before he sought a theoretical explanation for their operation. Assimilative or applied science followed, marked by the change from Stone Age to Age of Metals. Creative natural science, basic science, is described as making an appearance about the middle of the sixteenth century, bringing promise of Utopia soon after, but really flowering only in the past 150 years — and seeming less Utopian in the process. Utopia, as a state of mind, is more a function of literature than science. "Reality is imperfection," says Ralph Gustafson.¹⁰

I have distinguished basic from applied science and both from technology because in the public's eye they are seldom separated and the sins of one are often visited on another. They are related and interdependent, which means that there is no reason why a scientist cannot move back and forth between them, and the best often do. Much modern science advances by using the latest technological machinery. These marvels, in turn, are developed by taking advantage of the latest applicable knowledge. But I insist that they are separate; they are separated by intent. Technology, of course, fits well into popular fiction, particularly of the sort recently described as "thinly novelized instruction manuals"¹¹ in which process is the main theme, syncopated, more or less, by frenetic plot. The strug-

gles of the scientist are rather different, but when they appear in literature very often they are directed to some (often malevolent) end — they are applied science. Rigorously controlled curiosity is not strong as a motivation among recent heroes of fiction. That is a pity, for as Northrop Frye has observed, “Between imagination and belief there is constant traffic in both directions.”¹² Although Frye’s context was different than mine here, what he has described, in addition to gods, philosophical positions, and political loyalties, is the escapement and mainspring of scientific action.

GOETHE CLAIMED THAT THE IMPULSE to understand the relations of the parts to the whole, which ruled his activities in science, was the same as his artistic impulse. I know of no better authority to support the claim of creative unity between science and the arts than Goethe, for he did reach pre-eminence in both fields and we must listen when he says that creative life is the same in science and in poetry. Goethe came to science in his mature years. Barker Fairley argues that it gave him discipline and that it put him at a far remove from “the average run of literary dreamers about nature of whom there was an abundance in his day”¹³ and who are still around to pump out a sizeable proportion of our poetry. Fairley’s comments on the discipline of Goethe are interestingly comparable to Forster’s on H. G. Wells: “The addition of science has strengthened his mind and suborned his hysteria,”¹⁴ although it must be recognized that Forster is rather less sympathetic to Wells than Fairley to Goethe.

Regrettably, Goethe is almost unique in near-modern times. Not even Voltaire, another marvel of energy who lived to a great age, produced new ideas both in science and the arts, although he mastered and championed Newtonian ideas. It is only for the ultra-exceptional that success does not lie with specialization.

Wilder Penfield, when he retired from a brilliant scientific career, said that he then lived the life of a professional writer. What came out as literature, then and earlier, was good, wholesome, and gave little insight to the mind and motives of science. His novels are well-organized and are provided with maps and handy lists of characters. That is tidy, but it hardly reveals essentials. His essays tend towards the inspirational. So Penfield is polar; though he saw both sides, he illuminated only one.

English literature has its writers who take, with more or less success, the subject of science and scientists into their bag. Dickens (e.g., *Dombey and Son*, *Bleak House*) described the consequences of technology on society. H. G. Wells worked on the fringe of science throughout his career and included science and scientists in his writing. In *Tono-Bungay*, George Ponderevo is distracted from the main events by his own scientific career, his social instincts are coloured by his concep-

tion of science, and Wells uses the text to comment on the attractions of science and to fictionalize scientific advances (for instance, the discovery of canadium, a mythical radioactive element — mythical, but nevertheless representing the state of an active science at the time of writing). I know of no writing of good fiction today in Canada that keeps us up to date in science.

C. P. Snow is another Englishman whose works of fiction have significantly utilized science. *The New Men* and *The Search* are from works specifically using science as a main theme. The one thing that science as a theme must accomplish is to transmit a sense of the attitude of scientists. Perhaps because that attitude is a result of training and discipline in stubborn rationality, it is only occasionally possible that a writer not scientifically trained can approximate the inner life of a scientist as hero. Even Brecht was trained in medicine, which must have deepened his insight, though I do not know of his giving credit to it.

Data, data, data
Sang the stars.¹⁵

Surely that is an opening. Stars provide entry for poet and scientist. E. W. R. Steacie, a Carlylean hero credited with taking the National Research Council of Canada into its period of greatness, said, "It seems to me that on historical grounds there is emphatically no incompatibility between science and the humanities."¹⁶ Steacie goes further, saying that "science is one of the humanities, although technology is not."¹⁷ Thomas Kuhn quotes another source: "The more carefully we try to distinguish artist from scientist, the more difficult our task becomes."¹⁸ But this does not solve the problems of difference, because they do exist. Kuhn, in another context, comments on communities of practitioners of this or that, and makes each real and distinctive from others, by its possession of a common paradigm.¹⁹ The idea of the Kuhnian paradigm has been embraced with enthusiasm by many scientists. The sense of a paradigm is a sense of shared commitments, a characteristic set of beliefs and preconceptions. So there are differences, and by them we can distinguish community differences between artists, scientists, and humanists, as well as within each group, and talk of chemists, physicists, and biologists among scientists. For that matter, paradigmatic differences can be used to distinguish organic from inorganic chemists, physical chemists from biochemists, and so on. But all share a plesiomorphous paradigm: imaginative, creative curiosity.

Even so, we are trapped by attitudes. We are told that

All that scientists, as scientists, ever do
Is to stick labels and numbers
On things that are already there;
And don't let them tell you differently.²⁰

That is a terribly narrow and despairing view, and bad advice to boot. I tell

you differently. As I have tried to make explicit, scientists do not invent facts, but by exploring nature in imaginative and creative ways they may reveal incredible, profound and exquisite phenomena. It is the effects of the discovery of such phenomena on the discoverer himself or on the world in general that the writer can and should explore. As the exploration of the motivation and responses of such an unusual and creative being as Magnus Eisengrim enriches our literature tremendously, it should be equally valid and rewarding to follow, say, a fanciful physicist, for such a person may be emotionally driven, affected by his past and fearful of the future. In fact, it is difficult for a novelist or poet to avoid science, for we are embedded in our knowledge of nature and that is what scientists have done for us. In untold ways we are affected by this knowledge and our use of it. The insight of Heisenberg and Skinner are echoed in the words of V. S. Naipaul: "As I write, my own view of my actions alters."²¹ How subtly are we influenced and how seldom do we recognize it.

C. P. Snow made popular the idea of two intellectual cultures, the literary and the scientific, separate from each other and uncomprehending. Although Snow spoke primarily on a British theme, his conclusions were generalized in the English-speaking world as a single debate: arts *vs.* science. Well, indeed there are problems. For example, a recent report of a conference between physicists and historians noted that there was a failure "to produce any effective interchange."²² The physicists talked mostly among themselves and are said to have "rather misunderstood the few questions from historians." I suppose such examples could be totted up and analyzed statistically, but the data are not profound. Both science and the arts, however either of these is expressed, are artefacts, and that alone is sufficient to unite them. They are of one stream along which the current of thought can carry ideas and insights from one place to another. Although it may be a quick run in one direction and hard paddling in the other, source and destination for ideas are never isolated.

F. R. Leavis argues thus, in thunderous passages, palisaded by parentheses, dissected by commas.²³ Unsparring, infuriatingly righteous, Leavis demands humaneness, declares the inseparability of a transmitted culture and pleads for standards to which an educated public may appeal. Northrop Frye has taken a somewhat more understated view. He sees the separation of "two cultures" as inevitable and bound to increase; "... it cannot possibly be cured by having humanists read more popular science or scientists read more poetry. The real problem is not the humanist's ignorance of science or vice versa, but the ignorance of both humanist and scientist about the society of which they are both citizens."²⁴ Though mild in tone it is a well-stamped ticket to perdition. Nor does C. T. Bissell offer much more help. He has suggested that those who look to science for answers based on "calm objectivity and ingrained cosmopolitanism" may "preach a naive gospel," and he named C. P. Snow and H. G. Wells as

exemplars.²⁵ If true, what does that do to the value of science as a theme of literature?

We seem to keep coming back to the same cluster of problems. The benefits expected of science are greater than can be delivered, and science is at fault because it cannot deliver that which is expected of it. Is science just “an elastic band, holding a bundle / of small white filing-cards / printed with important facts”?²⁶

TWO THEMES SEEM TO PERVADE the literature and other writing in Canada that deals publicly with science: Frankenstein and Prometheus — monster-maker and bringer of fire. These are two sides of the science model, though Mary Shelley herself called Frankenstein the modern Prometheus. Indeed, the Shelley circle seemed to try to stay *au courant* with advances in natural philosophy and took it as a proper and expected topic of their writing. Maybe then one mind could enfold and understand much of what was known. That does not obtain now — there are tens of thousands of journals of science alone, transmitting arcane facts and fancies in all the major languages of the world.

That leaves us with attitude. It is probably the most important contribution science can make to humanity. It certainly is the aspect of science most amenable to literary treatment, hence exegesis. The scientific attitude comprises sceptical curiosity, which it attempts to satisfy by logical procedures. Science is as simple as that, but as it builds its own base, and accretes technology, it often appears monstrous, foreign and impenetrable. And many a specialist likes to maintain a certain privacy, or glories in the appearance of mystery.

Frankenstein in his laboratory may, in the public mind, prototypify science at a technological frontier. At least latterly, with a cinematic glaze, he seems to. Originally, Frankenstein was not often, and increasingly reluctantly, at his bench. It was the humanitarian consequences that motivated the story; the science was minor and the scientist regretful. Indeed the monster himself seemed to be more torn by human emotion than moved by inhuman motor connections.

Today, the picture of the isolated, lonely scientist is entirely incorrect. The best science is still done by the best scientists, those with imagination, energy, single-mindedness, and motivation, but it also calls for institutional money, often in large amounts, to provide the human and technological assistance. Governmental assistance to science is now rated in proportion of Gross National Product (whereat it may be noted in passing that Canada lies very low in the scale in any international comparison — which may reflect its dim appearance in our society and its small place in our literature).²⁷ Scientists do not work alone; they work in teams, with colleagues, students, research associates, technicians. The enterprise is collective. Right at the boundaries of knowledge, science is as much like a pro-

fessional athletic league as anything, with teams competing for an elusive prize — the answer to a puzzle. J. D. Watson has told us something of that life²⁸ and Jacob Bronowski suggested his account, or at least its protagonists, as models for scientists in literature.²⁹ Scientific research is engrossing for the people involved; its results are often dramatic for the public in general. Moreover, it is unending through the full career, unless the individual is sidetracked by administrative duties or fame.

The primitive legendary account of the curiosity of the spirit of man, now recognized as the motive force of science, is the story of Prometheus. Present before the gods appeared, the Titans were suppressed and supplanted by the gods, but the irrepressible Prometheus was midwife to knowledge and tutor of mankind and, with his forethought, attempted to box the spites.

Politically involved with the gods, threatened, tortured, and occasionally forgiven by them, his good works often undone by the pandoric ignorance of mankind, Prometheus persisted in his search for understanding and safe use of the forces of nature. We faintly perceive Prometheus's labours on our behalf; indeed, it is said that we wear rings with stone settings in memory of his Caucasian chains.

F. P. Grove proclaimed the Promethean fate for mankind.³⁰ Worthwhile goals, he said, are unattainable, but the failed attempt is glorious, even though we remain shackled to a mountain. Art that does not mirror the Promethean fate, he continued, is untrue in its fundamentals. That sounds as if it makes tragedy universal, which is truly pessimistic and restrictive. Still, we can escape it as individuals, for our concerns are not normally for universals. We can work quite happily with limited goals. Our operational dimensions are much smaller than the universal limits. For instance, the Laws of Thermodynamics place inexorable restrictions on universal reactions (there is only so much energy, and its upper and lower limits are the same), but smaller, local orbits allow all sorts of ingenious reactions and apparently improbable uses of energy.

Margaret Atwood, as speechwriter, sees as clearly as anyone the struggle for knowledge that a scientist undertakes:

Since I dared
to attempt impious wonders

I must pursue
that animal I once denied
was mine.

and the frustration that may accompany profound research and that will require the utmost ingenuity, the most dogged persistence, the fiercest striving; for all too often, in place of results there is the answer: "I will not come when you call."³¹

That is the spirit; that is where literature can illustrate scientific effort.

There *has* been a truly Promethean figure in Canada. His name was Henry Marshall Tory. His accomplishments were so vast in the Canadian scene that an estimation of his influence can hardly be made. A simplified listing of his accomplishments shows him to have been involved in the establishment of the University of British Columbia, the University of Alberta, the Research Council of Alberta, the Khaki University, the National Research Council of Canada, and Carleton University, as well as serving on innumerable commissions for federal and provincial interests. Threatened, tortured and occasionally forgiven by his masters, Tory persisted in his task to make Canada intellectually independent. It is said that "the air about Tory was never still for very long; he moved always to the snapping flutter of banners."³²

One does not hear much of him these days. On my shelves I see two books entitled *The Canadians*.³³ In one, published in 1979, there is no mention of Tory. In the other, from 1967, Tory receives four index references, all of which relate to one 20-page chapter called "Science and Medicine." The probable reason for this is that Prometheus was silent. Tory's written output, except for letters³⁴ and reports, was negligible. A couple of introductory books of algebra and the editorship of a pedestrian *History of Science in Canada* were his contribution. His forte was action; he saw what Canadians needed and he did his utmost to get it for them — whether they recognized their needs or not. Many of use owe the safety of our academic perches to the nests of learning he planned and started well.

Scientists, too, recognize Prometheus and the dangers a generous and encompassing spirit faces. There is for Canada a *Guide Michelin* to the back country of science administration as travelled in recent times. It was written by F. R. Hayes³⁵ from the vantage of a lifetime of first-class science and top level institutional administration. Salty, outspoken, witty, and deeply concerned, Hayes has been able to characterize the popular denigration of science and its near-strangulation, perhaps inadvertent, by political control. To his Prometheus, which was Science itself, he provided a Pandora in the form of Senator Maurice Lamontagne, who opened the box of spites with the publication of the report of his commission.³⁶ Only delusive hope remains; Canadian scientists call it MOSST.³⁷ There is the mother-substance of a whole series of establishment novels in that stuff, especially in the transcriptions of the hearings.

Civilization Exponentiating: an odd phrase I heard from Carl Sagan, CRT-engendered³⁸ to express our desires and raise our hopes for ever-increasing mechanically and electronically cradled life. This becomes the world of science fiction, that strange and largely preposterous genre that has replaced tales of magic and fairies. Science fiction has been claimed to be a window to the future. What it is, of course, is an imaginative projection of technology, and never very far at that. No science fiction writer, dreaming generalities for the future, has the power of a technologist planning specifics for tomorrow. We are regularly surprised by what

is brought forth by applied scientists. Roger Bacon, in the thirteenth century, predicted mechanically powered ships and flying machines, submarines and cars, but he did not direct science to them, he simply gave voice to a desire. Such devices were developed in due course, when it became possible by the concomitance of knowledge to make that step towards increasing convenience, so desired by man.

As an example of the power of science fiction to resemble and affect the future, we can take Ralph Centennius's piece "The Dominion in 1983."³⁹ J. R. Colombo, in his introduction to it, quotes Lawrence Lande as saying that it is a work of "science fiction — probably one of the earliest in Canada — brilliantly executed with many accurate forecasts, especially Chapter 2 on Science." I think Centennius's piece is just silly. His predictions in science are no more accurate than the ones he makes in demography, economics, politics or social advance. It is sort of fun to read, but much less so than, say, any one of the "Sunshine Sketches," and to much less value. One cannot blame Centennius for missing the future. Sincerity, concern and patriotism do not guarantee sight of things to come. We cannot bespeak our expectations. In the web of guesses that is cast over the future, some meshes are bound to entangle fact, but most fall hitless to the ground. What the best of science fiction may do is to raise questions of ethical concern, as by Aldous Huxley or Olaf Stapledon. Dorothy Livesay speaks of this, setting a hierarchy of concerns to be mourned, then choosing from among them:

... deed neglected, desecrations done
 Not on the lovely body of the world
 But on man's building heart, his shaping soul.
 Mourn, with me, the intolerant, hater of sun:
 Child's mind maimed before he learns to run.⁴⁰

Livesay's words reflect equally on past and future: failed dreams; bespoke expectations.

Science fiction deals little with science. It tries to stretch technology, do wonders with meccano, and generally falls behind real life.

CANADA HAS DONE WELL with its describers of fierce nature. Jack London, C. G. D. Roberts, E. T. Seton, Vilhjalmur Stephansson, Sheila Burnford, Fred Bodsworth, Farley Mowat, James Houston, Grey Owl, make a sampler, with scenes for every taste. These names are catalogued by Alec Lucas.⁴¹ Most of us, I daresay, have been influenced one way or another by such writers and cherish our own image of the true north strong and free. Only in these high temperate (temperate?) latitudes do the Seasons roll by with such inexorable pontificality: high ritual and circumstance for each. Then, for each an outpouring

of good, bad, and indifferent verse, tinged variously with biology, meteorology, physics and biochemistry.

. . . frost-fingered wind rolls snow
Through lifeless stubble,
And sap hides in the roots of things⁴²

*

Spring is here, the breezes blowing,
four inches of top-soil going, going;
farm ducks rolling across the prairie;
Spring is here — how nice and airy!⁴³

*

I grazed the green as I fell
and in my blood
the pigments flowed like sap.
All through my veins the green
made a lacey tree.⁴⁴

*

And soon, too soon, around the cumbered eaves
Sly frosts shall take the creepers by surprise,
And through the wind-touched reddening woods shall rise
October with the rain of ruined leaves.⁴⁵

There is, too, the literature of personalization of the creatures of nature, everywhere a fantasy of absolutely certain charm and interest. A kind of sociobiology enters into these works. Sociobiology, defined as the systematic study of the biological basis of all social behaviour, is currently a widely discussed, controversial region of science. It deals with heredity, kinship, behaviour of all sorts and altruism. It takes as one of its functions "to reformulate the foundations of the social sciences in a way that draws these subjects into the Modern Synthesis [of evolutionary theory]."⁴⁶ Here is a scientist proclaiming the oneness of man's curiosity. We are predisposed towards sociobiology's conclusions, because we have been told of puzzled but instinctive curlews, we have been told of the blind determination of misplaced house pets, we have been told of the joys of freedom of the otter. Yet this gives us a certain uneasiness with scientific sociobiology. Although its data require the highest standards of quantitation and the most rigorous use of scientific methods, we are always aware of the literary licence available to the storyteller who uses nature as his scene and creatures as his protagonists. The imagination of man is one for literature or for science. The results of science are put in place by imagination, not by numbers, which only serve to support conclusions. What of the licence that is used?

Of the nature stories, in many ways the most complex and certainly the most unusual is F. P. Grove's myrmecological fantasy.⁴⁷ The adventures of the ants he

follows make sense if one takes the deeply ironic myrmecocentric point of view that "our own race stands at the very apex of creation as far as that creation is completed today." The ant lore presented is relatively accurate, certainly for the time it was written; Grove is punctilious in reference and clearly was familiar with ants from more than the picnic viewpoint.

Not only that, but Grove comprehended much of the fine flavour and challenge of science. In the great argument of *Anna-zee*, the core of science is revealed when the question "How?" — when answered — is shown to lead to "Why?" "How" can be answered, but leads only, and infinitely, to further questions; science supersedes itself. Grove's statement, "The achievement of any ant of science is merely the basis for the achievement of another ant of science," is absolutely Kuhnian, made 20 years before Thomas Kuhn pointed out that, "unlike art, science destroys its past."⁴⁸ It is part of the openness of science: everything is exposed, to be changed.

Grove, in *Anna-zee*, says, "In fact, what was left of the science of a few milenia ago? Names, that was all; and, perhaps, a few things to laugh at. Venerable names — names revered in spite of the fact that the theories, hypotheses, and so-called discoveries with which they were associated have long since disappeared into the limbo of a forgotten childhood of thought."

Kuhn says, "Science textbooks are studded with the names and sometimes with portraits of old heroes, but only historians read old scientific works. In science new breakthroughs do initiate the removal of suddenly outdated books and journals from their active position in a science library to the desuetude of a general depository."

In the progress of science "Why?" is unanswerable and not scientific, but is demanded constantly when "How?" is answered. Grove's philosopher-ant proclaims that the sole and exclusive ultimate value of a fact is that it allows the question "Why?" "Ants are constituted in such a way that they must ever try to storm heaven. They are suspended between two worlds: the world of the knowable and the world of the unknowable."

Grove's ants observe, speculate, and erect hypotheses, which are testable, in the most modern style. He has tried and, I think, largely succeeded in capturing an essence of science among his artful ants.

Moreover, this represents a more mature and reasoned position than Grove himself took some 20 years earlier when, in his essay on "Realism in Literature,"⁴⁹ he described science as being "in a state of everlasting flux; it changes almost from moment to moment; and certainly from year to year." At that time he misinterpreted the flux as an instability that reflected indecision — a kind of fiddling rather than a building. In the 20 years between the essay and the novel, Grove changed his denial of the ability of science to interpret phenomena to a recognition that "Why?" is not a scientific question, and with that, to recognize, at least

over nature, which is perhaps the last of his great Bronze Age misapprehensions. Watch The 6000, beautifully characterized, take its place to do man's will:

A lantern flashed out a command,
 A bell was ringing as a hand
 Clutched at a throttle, and the bull,
 At once obedient to the pull,
 Began with bellowing throat to lead
 By slow accelerating speed
 Six thousand tons of caravan
 Out to the spaces — there to toss
 The blizzard from his path across
 The prairies of Saskatchewan.⁵³

It is glorious — and dead false. I remember, long after that poem was written, the winter in Saskatchewan (was it 1947?) when trains were swallowed up by blizzards and left entombed till spring, thirty feet beneath the surface of the snow!

But I take a special example to make a special point. A biologist, as one kind of scientist, matures to the recognition that every species is successful in its own terms, that every species (including us) is the product of its own evolution, and that the forces of nature, physical and biological, still determine the ultimate course, despite man's fearful wish that it were not so. One characteristic of science is that it does depreciate the concept *imperium hominis* and reduce man's ego. Maybe that in itself is thought to be undesirable for purposes of literature. If so, that in itself depreciates literature.

If we stay with E. J. Pratt we see the poet, *par excellence*, of material man. His assumptions are simple and honest. He illustrates superbly; his pictures never expose a soul. His compulsive cataloguing of things shows the end, not the processes of technology and science. Pratt produced encyclopaedias of faunas ("The Great Feud"), naval technology and practice ("Behind the Log"), he rivalled Janes in his descriptions of boats ("Dunkirk"), and he linked them all with astronomy, anatomy, and ancient and modern geography. Pratt's is technological poetry, skilful and attractive constructions that stir admiration and emotion, but do not set us on new ways.

A step further along, we come to perceived demonic science, a response to the unease felt towards cool intellectualism. Anyone understanding, or seeming to understand, those things which are preferred to be seen as mysteries, is suspect and open to scorn, for mysteries are easier to accept and easier to blame than our own irrationality or misunderstanding.

Like Moebius's strip, this argument has reversible sides:

And being gods to themselves
 grinding lenses and finding new beasts
 in human semen ditchwater monsters

peering beyond the moon
 to reach the dark side of knowledge
 where people die and worse
 they don't know why they lived.⁵⁴

One side is simply a continuation of the other. There is no dark side of knowledge, save ignorance. The adventure and value of science is that it can illuminate the darkness and disperse it. Wilful denial of that is simple obfuscation. One thing science does know is that it has a never-ending task, because each scene illuminated reveals new roads, new corners, new intriguing shadows. That is one of the chief experiences of science. Though it be imperfect, unfinished, and worked by inconstant man, science is necessary and should be celebrated. George Orwell knew that: "In Newspeak there is no word for 'Science.' The empirical method of thought, on which all the scientific achievements of the past were founded, is opposed to the most fundamental principles of IngSoc."⁵⁵ The transcendence of a model system left no place for empirical thought or study, and certainly not for new knowledge or deeper understanding. I borrow a phrase from Leon Eisenberg⁵⁶ to say that "mysticism, hermeneutics, and transcendental rapture" are no substitutes for science and reason. Northrop Frye is right to say "We have so much less to fear from science than from a misuse of words."⁵⁷ To avoid science in literature becomes a disuse of words, and that too may be a fearful error.

THERE IS NO NEED FOR SCIENCE to perfume literature. It is but one of the interests and occupations of man and under many circumstances plays no direct role in the details of his affairs. But it is not usual for science to be universally absent from a modern literature. From a limited experience, it seems to me that Quebec literature dwells little on matters of science, even though Camille Laurin seems to believe that science can be packaged and directed the same as social propaganda. Laurin, in planning his Utopia, has either missed, or perhaps agrees with Frye's dictum that "No society can plan for its own culture unless it restricts the output of culture to socially predictable standards."⁵⁸

By and large, the poetry and prose of Quebec these days is intensely personal in either the individual or the collective sense, echoing the parochial celebration of the land. There is beautiful science being done in Quebec, but as a universal subject it is, for now, irrelevant to the narrow needs of that self-isolated nation and is left out of the voice of its writers.

À la droite du silence
 Un peuple de patience
 Se lève
 Pour quitter sa nuit.⁵⁹

The struggle is for an immediate end; science is seen as a luxury. It will appear in literature when identity needs are satisfied. Unrealized by most writers, it could be of help even now, for it will be a significant part of whatever identity emerges.

The beauty of form provides aesthetic experience, "but rarely do [writers] refer to the beauty of process or *function*."⁶⁰ Form is fixed: it is the product, it is the image, it is the still photograph advertising the movie. Movies form a continuous sequence; the most recent movie is, in our experience, really just a continuation of the last one we saw, and so back to the time we began going to the cinema. It is when we see the old stills that we realize that changes have occurred. During the movie itself, we do not realize that our response must be changing too.

Science deals with process; literature deals with form. That could be a great aphorism; regrettably it is not precisely true. However, bits of reality do stick to it. I reiterate that science is more open than literature. Literature is more closed than science. Literature tends to encompass its subject in its analysis; science tries to pave a segment of a road. Of course process is dealt with in literature, often deliberately and extensively: *Jalna*, for instance, or more effectively in *A Dance to the Music of Time*. Nonetheless, each of these is sharply circumscribed, with little past and no future. At least I know of no sequels by successors to original authors that have themselves had any real success. On the other hand, succession is the business of science. This means that there is a qualitative difference between literature and science, but neither does it deny the fact that both are activities of the same creature, nor does it make a rule that literature cannot represent science. Literature can, and should, take the still photographs that record some instant in the process of science and thus provide what could be a profoundly annotated picture of us ourselves in one of our modes of imaginativeness and creativity.

Margaret Atwood has no section on "Science" in *Survival*. What does that mean? For one thing, it may suggest that there remains a belief in the dichotomy of science and art as human endeavours, that instead of human creativity being a centre from which results radiate in all directions into an expanding sphere of experience, each activity of mankind is a self-centred puttering. That suggests to me that we are early closeted with our limited interests and can expect little advantage from other sorts of experiences. What a paralytic portent! Nor do I think that Atwood means such a thing, for as much as any active writer that I know, she involves science, its contributions and its concepts in her work implicitly (*Frankenstein*) and explicitly (*R.O.M. recurrens*).

If the creative activities of man can be thought of as the ever-expanding outward growth of interpretive understanding, powered by a single creative source, specific in the biological sense, i.e., belonging to the species man, then it is possible to view the results of his creativity in a global sense. Our present status, the

frontiers of our attempts to live fully and to understand that life, then are represented by the surface of that globe, the shell of a sphere.

Such a globe has a geography. On its surface one might find more or less discretely, the continent of literature, the kingdom of prose and poetry in the empire of words. Over the globe, music, say, may be displaced in one direction, and science in another. All will have their provinces and satrapies; often there will be shared jurisdictions. But the most important attribute of this metaphor is that all are on the same surface and, even if polarly displaced, one can be reached from another. Travel between seemingly isolated regions is possible. A bit of a sense of adventure, a willingness to sample other customs uncondescendingly and a recognition that motivations here and there are not widely different, will allow the traveller to discover that the natives are friendly.

Therefore, literature can treat science. It may be by an open-mouthed traveller in a foreign land, full of misconceptions about awesome wonders or fanciful tales of not yet explored regions, or it may deal with the experience of people immersed in their work, affected by it as well as by the same emotions and outside forces that affect us all.

Love and understanding are interchangeable here. The writer has a chance to help save us.

The biochemist exhales words which few can swallow,
the professor drones out truths which none will follow,
and on a bushel of talk and a hi-diddle-diddle
sits the Saviour Poet dangerously there in the middle.⁶¹

Science in Canadian literature? — it's all opportunity!

NOTES

¹ Raymond Souster, "Memo to the Human Race" (1952), *Collected Poems of Raymond Souster*, Vol. 1 (Ottawa: Oberon, 1980), p. 153.

² Speech to the University of Alberta, *Folio*, 17 (20 November 1980), pp. 3-10.

³ Clive Cookson, "Notes from Washington," *C.A.U.T. Bulletin*, 27 (December 1980), p. 11.

⁴ Organization for Economic Co-operation and Development. *The Measurement of Scientific and Technical Activities* (Paris: Frascati Manual, 1975).

⁵ "Science, The Arts, and The Spirit," *Second Thoughts* (Toronto: McClelland & Stewart, 1970), p. 1.

⁶ *Anatomy of Criticism* (Princeton, N.J.: Princeton Univ. Press, 1971), p. 8.

⁷ E. M. Forster, *Aspects of the Novel* (1927; rpt. Harmondsworth: Penguin, 1976), p. 82.

⁸ It should be noted that Margaret Atwood has had long time fascination with the illustrative catalogues of science, or at least with the Royal Ontario Museum and, despite her protests, she finds herself "dragged to the mind's end / deadend, the roar of the bone- / yard, I am lost / among the mastodons and beyond." Perhaps we

- there see the gestation of Lesje Green. Margaret Atwood, "A Night in the Royal Ontario Museum" in *The Animals in That Country* (Toronto: Oxford Univ. Press, 1968), pp. 20-21.
- ⁹ (London: Methuen, 1963), Scene 14.
- ¹⁰ "Dr. Johnson Kicks Hocking's Shin," *Rivers Among Rocks* (Toronto: McClelland & Stewart, 1960), poem 29.
- ¹¹ Thomas Hopkins, review of *The Clan of the Cave Bear* by Jean Auel, *Maclean's* (6 October 1980), pp. 64-65.
- ¹² *The Well-Tempered Critic* (Bloomington: Indiana Univ. Press, 1963), p. 150.
- ¹³ *A Study of Goethe* (Oxford: Clarendon, 1947), p. 201.
- ¹⁴ Forster, p. 34.
- ¹⁵ Ralph Gustafson, "Four Songs for Antiquated Music — Transfigured Night," *Rivers*, poem 40.
- ¹⁶ J. D. Babbitt, ed., *Science in Canada. Selections from the Speeches of E. W. R. Steacie* (Toronto: Univ. of Toronto Press, 1965), p. 68.
- ¹⁷ Babbitt, p. 74.
- ¹⁸ "Comment on the Relations of Science and Art" (1969); rpt. in T. S. Kuhn, *The Essential Tension* (Chicago: Univ. of Chicago Press, 1977), p. 341.
- ¹⁹ "Second Thoughts on Paradigms" (1974); in *Essential Tension*, pp. 293-319.
- ²⁰ David Andrew, "Pure and Applied Rivers," *The Lure of Lanark* (Ottawa: Borealis, 1974), p. 19.
- ²¹ *The Mimic Men* (London: Andre Deutsch, 1967), p. 219.
- ²² *Science*, 207 (1 February 1980), p. 517.
- ²³ *Nor Shall My Sword* (London: Chatto and Windus, 1972).
- ²⁴ "Varieties of Literary Utopias," *Daedalus*, 94, No. 2 (Spring 1965), pp. 329-30.
- ²⁵ *The Strength of the University* (Toronto: Univ. of Toronto Press, 1968), p. 237.
- ²⁶ Margaret Atwood, "Provisions" in *The Animals in That Country*, p. 1.
- ²⁷ I have dealt with some of these matters in a report to the Alberta Society of Professional Biologists, "Biology and Science Policy in Canada," *Biology, Science Policy and the Public, a Symposium* (Edmonton: A.S.P.B., 27-28 April 1978), pp. 28-58.
- ²⁸ *The Double Helix* (New York: Atheneum, 1968).
- ²⁹ "Honest Jim and the Tinker Toy Model," *The Nation*, 206 (18 March 1968), pp. 381-82.
- ³⁰ *It Needs To Be Said* (Toronto: Macmillan, 1929), pp. 88-89.
- ³¹ Margaret Atwood, *Speeches for Dr. Frankenstein* (Bloomfield Hills, Mich.:
- ³² Mel Thistle, *The Inner Ring* (Toronto: Univ. of Toronto Press, 1966), p. 212.
- ³³ J. M. S. Careless and R. C. Brown, eds., *The Canadians 1867-1967* (Toronto: Macmillan, 1967); George Woodcock, *The Canadians* (Don Mills: Fitzhenry and Whiteside, 1979).
- ³⁴ I have not seen all the letters myself, but the samples quoted in Thistle (see footnote 32) and Corbett show a man literate, incisive, well-ordered, and clearly directed towards an end. His vision was broad and his confidence overwhelming.

- The letters, it seems to me, would be a goldmine for the biographical novelist. E. A. Corbett, *Henry Marshall Tory, Beloved Canadian* (Toronto: Ryerson, 1954).
- ³⁵ *The Chaining of Prometheus* (Toronto: Univ. of Toronto Press, 1973).
- ³⁶ "A Science Policy for Canada," *Report of the Special Committee of the Senate on Science Policy* (Ottawa): Volume 1: A Critical Review: Past and Present (1970); Volume 2: Targets and Strategies for the Seventies (1972); Volume 3: A Government Organization for the Seventies (1973); Volume 4: Progress and Unfinished Business (1977).
- ³⁷ Ministry of State for Science and Technology.
- ³⁸ CRT — cathode ray tube, the increasingly ubiquitous device across the surface of which flit the green letters and numbers, or the coloured pictures of computers, word-processors (!) and television.
- ³⁹ Ralph Centennius, "The Dominion in 1983," in J. R. Colombo, ed., *Other Canadas* (Toronto: McGraw-Hill Ryerson, 1979), pp. 296-319.
- ⁴⁰ "Of Mourners," in Ralph Gustafson, ed., *The Penguin Book of Canadian Verse* (Harmondsworth: Penguin, 1959), pp. 167-68.
- ⁴¹ "Nature Writers and the Animal Story," in Carl F. Klinck, ed., *Literary History of Canada* (Toronto: Univ. of Toronto Press, 1976), Vol. 1, pp. 364-88.
- ⁴² James A. MacNeill, "Chinook," *Prairiefire* (Saskatoon: Western Extension College Educational Publishers, 1976), p. 16.
- ⁴³ P. G. Hiebert, "Song to the Four Seasons," in F. R. Scott and A. J. M. Smith, eds., *The Blasted Pine* (Toronto: Macmillan, 1957), p. 73.
- ⁴⁴ P. K. Page, "Summer," in *The Penguin Book of Canadian Verse*, pp. 202-03.
- ⁴⁵ Archibald Lampman, "September," in *The Penguin Book of Canadian Verse*, pp. 71-73.
- ⁴⁶ E. O. Wilson, *Sociobiology: The New Synthesis* (Cambridge, Mass.: Belknap Press, 1975), p. 4.
- ⁴⁷ *Consider Her Ways* (Toronto: Macmillan, 1947). Anna-zee's argument occurs on p. 167 ff.
- ⁴⁸ Thomas S. Kuhn, "Comments on the Relations of Science and Art" (1965), in *Essential Tensions*, p. 345.
- ⁴⁹ *It Needs To Be Said*, p. 56.
- ⁵⁰ Hugh Garner, *Death in Don Mills* (1975; rpt. Toronto: Bantam, 1976).
- ⁵¹ Tom Farley, "Gravity," in *The Last Spaceman* (Ottawa: Borealis, 1974), p. 42.
- ⁵² Miriam Mandel, "Group Therapy," in *Station 14* (Edmonton: Treefrog, 1977), p. 21.
- ⁵³ E. J. Pratt, "The 6000," Northrop Frye, ed., *The Collected Poems of E. J. Pratt* (2nd Ed.) (Toronto: Macmillan, 1958), pp. 58-60.
- ⁵⁴ Al Purdy, "Atomic Museum," in *Sex and Death* (Toronto: McClelland & Stewart, 1973), pp. 123-24.
- ⁵⁵ *Nineteen Eighty-four* (London: Secker and Warburg, 1949), p. 198.
- ⁵⁶ "The Social Imperatives of Medical Research," *Science*, 198 (16 December 1977), p. 1105-10.
- ⁵⁷ *The Well-Tempered Critic*, p. 47.

⁵⁸ *Anatomy of Criticism*, p. 348.

⁵⁹ Gilles Marsolais, "Aube," in *La Mort d'un Arbre* (Montréal: Librairie Déom, 1967), p. 36.

⁶⁰ Harold J. Brodie, *Fungi, Delight of Curiosity* (Toronto: Univ. of Toronto Press, 1978), p. 32. But listen — "L'eau: / Je me suis changée en neige / pour danser / avec le vent." Félix-Antoine Savard, *Aux Marges du Silence* (Québec: Editions Garneau, 1975), p. 62. The poets can bring bright understanding to us all.

from a continuation of

LOG ENTRIES

Christopher Dewdney

WINTER CENTRAL

A spill contained in the fissure of light admitted by its own manifestation. An illumination of the crystalline moss of slanting light fissured by the lens of the control data truck. The surveillance car behind the control data van carries the gamma radiation equipment necessary for these types of covert "hot" waste dumps. The van is on its way to the exchange centre.

The visitation of the luminous discharge is correct in the seething mass of frozen light waves already parting for the control blind. The figure, discernible only after computer enhancement, standing in the centre of the luminous discharge. The lens held by the hand carries filament waste-disposal sea of crystals, imperfect by the highway maintenance teams. Control data imperfect response to the van maintaining radio silence in the absolute surveillance of the anterior vehicle. Astounded luminous figure holding the cameral to the light-spill a fissure dump in the hot light of central winter. The image taken away by their heat, the image deflected by transmitted images from the bicameral care-package following closely. Visited by a luminous discharge of gases in the image clarification process. Wafer by-product of the programming, a non-actual event. Identity withheld for security reasons, as the negligible remnants of the countless passings fry the ice into a frilly brocade of tormented hydrogen.

* * *

directional leakage accounting for only 2% of our de-coded material. Data-base was originally detected after assembly of a mam-