editorial

VERBAL PULSARS

WHEN I WENT TO SECONDARY SCHOOL, xenon was inert. That's not the way I usually think of those years, but it usefully characterizes a certain frame of mind: of a time when atoms methodically revolved in their molecules, the sea was silent, and science held within its grasp the secrets of the order of the universe. Even then the picture was distorted, of course: atom bombs, in the name of order, had already disintegrated an order of another kind, and educators' scientific "fact" was some steps behind scientific theory. As time moved on, researchers discovered that the world they analyzed was far more complex and far less predictable than they had thought. Now xenon will actively combine with some other elements *and scientists know it*; the movement of atoms seems a lot more random than it had earlier, *at least as observers record it*; and scientists eager for accuracy now speak of leptons, hadrons, gluons, neutrinos, and the *flavour* of quarks. (Quarks come, I am led to believe, in six flavours, each of which can have three colours. This information may be out of date.)

Scientists speak to each other more concretely in mathematics than in such verbal terms, though each of the terms (including "colour") possesses a mathematical meaning. Like Leacock's Dean Drone, who assigned to his mathematics teacher his own failure to progress in life, the rest of us may despair of following the idea of Number through to its logical consequences, but the flavour of quarks gives those who work with words something to sink their teeth into. In many ways, the language of those in the sciences and those in the humanities operates on parallel planes — even the word "language," as the computer programmer uses it, refers to a binary code of abbreviations and not to the aural felicities, the contextual implications, or the multiple (perhaps intentional) ambiguities of a phrase like "the green teacher's wastebasket." And whereas poetry and prose fiction rely on the associational processes of reading which ambivalence, allusion, and assonance allow, the language of the technical report strives to avoid them entirely, and to achieve instead a precise and exclusive set of referential meanings. Such a difference spells out a difference in expectations of life as well as of language, one

declaring itself accountable to that which can be imagined, the other to that which can be demonstrated by repeated experiment and "blind proof." The one appears to favour invention, the other utility. Yet such dichotomies are not universally applicable. It may be true that many scientists see language (the image, the sentence, the essay, the book) as a mechanical means of conveyance rather than as a plastic medium of art or a subject of investigation in its own right; it may also be true that many investigators of the world or words and the contrarieties of human behaviour use an ostensibly technical language to give their observation and judgments the illusion of "scientific" authority; but it does not follow that scientists must fail to imagine or poets to be precise. Seeking words to express what they understand, both groups of people have borrowed from each other. The "flavour of quarks" tells us so. It tells us also of an implicit effort on the part of scientists to use mathematics to describe the very large, the very small, and the very complex — and words to tame them. They talk of the "Big Bang," the "Missing Link," of "floppy discs," "black holes," "software," and (misleadingly, at first) of "spreading time" (the time it takes for a pulse to double its size). Laymen, by comparison, have borrowed the language of science to expand the parameters of metaphor: more than one human relationship in the twentieth century has been perceived as "symbiotic," "polarized," "amoebic," or "biodegradable" — which neither ratifies them more convincingly nor makes them more real than they would otherwise have been, but marks them unquestionably as the product of their own time.

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Scientists learn about science from other scientists and from laboratory practice. Laymen learn about science by listening to David Suzuki and by reading the columns of *Time* magazine; by looking at *Equinox*, *Scientific American*, *National Geographic*, *Creative Computing*; by absorbing the intelligent popularizers of science: Roderick Haig-Brown, Lewis Thomas, Carl Sagan, Jacob Bronowski, Isaac Asimov, Loren Eiseley, Stephen Jay Gould — variously from their essays and their programmes on television. (So popular is *National Geographic* indeed — so colourful, so glossy, so heavy, so carefully preserved in dens and rec rooms across North America — that one scientist in mock method has calculated the time it will take for parts of the continent to sink into the sea from the cumulative weight of suburban collections.)

Each year, in addition, bookstores fill with a variety of new volumes designed for the enquiring lay reader more than for the specialist.

The range of new publications is wide: from new handbooks of basic BASIC to fundamental attacks, like Ian Reinecke's *MicroInvaders* (Penguin), on computer technology. Opposing the actual technology less than its implications, Reinecke claims that videocommunication (because it pre-selects information)

is "undemocratic," that the economics of mass computerization translates into there being fewer modes of communication, rather than opportunities for a greater variety of individual expression, and that academic TV courses in Ontario and B.C. are about as academically useful as the training programmes given an encyclopedia sales staff. These are clear dangers. Captivated by the arts of high rhetoric, however, Reinecke dismisses those who applaud computers as "boosters" and "utopian propagandists" who would use TV as a means of behaviour modification and transform men into machines; intrinsically he argues that watching TV is less productive than the active enterprise of going out to watch a sports event: at which point he invests more persuasive power in his rhetoric than in his logic, and the main justification for his concern dissipates in a cloud of emotion.

By contrast, emotion enters only indirectly into a book like Zile Zichmanis and James Hodgins' splendid *Flowers of the Wild: Ontario and the Great Lakes Region* (Oxford), as when (about the Ox-eye Daisy) the writers neutrally observe, in a metaphor it is not certain they are even aware of: "This species is too aggressive for most gardens." Combining photographs with illustrations (and with data specifying genus, habitat, features, uses, and other information), the book is essentially a catalogue of some 250 flowers, from Agrimony and Bloodroot to Grass-of-Parnassus and Spotted Jo-Pye Weed. "Scientific accuracy and skilful composition," writes the Royal Ontario Museum director in a preface, make the illustrations "both useful and aesthetically pleasing." Indeed they do. The flower names tell more still: of settlers with an eye for cultural mythology as well as for concrete images, with a need to preserve as well as to see. The volume is also a handbook with paradoxical intent: at once to encourage environmental recognition and ecological preservation and to aid domestic cultivation of the plants of the wild and wayside, presumably after they are taken from the wild in the first place.

While Sandford Clark's *Environmental Assessment in Australia and Canada* (Westwater) faithfully records a set of workshop proceedings on the legal basis for governmental and industrial involvement in environment use (and so limits itself to a professional audience), Paul Tisdall's *In Search of Human Origins* (CBC) is more discursive in form and more open to the general reader. Tisdall takes interviews with Richard Leakey, Robert Ardrey, Desmond Morris, Clifford Jolly, and others, concerning current ethnological thought, and recounts some of the changes that have taken place between Darwin and DNA. His interest is less in the categorization of ideas than in the "speculative consequences" they lead to. But Tisdall manages also to give the enquiry some human dimension: "I was dizzy with bones," Leakey says, with an excitement born of watching his theory about human development take palpable form in the fossil evidence he carefully unearthed and reconstructed. Other works are more interested in establishing the historical record than in pursuing the excitement or implications of discovery.

W. E. K. Middleton's *Radar Development in Canada* (Wilfrid Laurier Univ. Press), a factual account of the impact of World War II on the radio branch of the National Research Council, is a case in point. Compare Middleton with George Woodcock, writing in a note appended to *The Benefactor* about the changes that stereophonic recording have had on radio drama: "one is [now] among speakers in a landscape of sound." One writer turns technology into historical data, the other into metaphor. Compare both writers with Northrop Frye, who (writing in *Science* in 1981) identifies *metaphor* with *equation*. Or compare all three with those who have assembled *The Cambridge Encyclopedia of Earth Sciences*, ed. David G. Smith (Prentice-Hall). More than a reference record, this book takes the work of 32 contributors (including William Fyfe and R. Kerrich of the University of Western Ontario, who write about Earth Chemistry) and transforms what could have been raw data alone into an absorbing sophisticated symposium on the earth's behaviour. There are chapters on tectonics — with passing reference to the work of J. Tuzo Wilson on Continental Drift — and on tides, gravity, the function of satellites, energy, sand, ice, microbial impact: the whole book shows a general fascination with *process* which makes it quite unlike the taxonomic structure of, for example, *Flowers of the Wild*. Profusely illustrated, the photographs, diagrams, and maps add another extraordinary dimension to our appreciation of the earth; the coronagraphs, the polarized light thin sections, the computer-enhanced satellite photos seem like abstract art — or perhaps a concrete art of another order. The question is: how does the mind react — decoding information from what it perceives, or understanding meaning through metaphor, analogy, and the aesthetics of pattern and design?

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Besides Tuzo Wilson, several other scientists loom large in the collective national portrait of Great Canadians: among them, Alexander Graham Bell, Frederick Banting, Charles Best, Wilder Penfield, Hans Selye. Why — for their actual accomplishments, or for the lustre they directly or indirectly give us as an inventive, rational, practical people? Should a communications theorist like Marshall McLuhan be listed among them? Is theory ever truly scientific? Have communications had more impact on Canadian writing than scientific theories have? Is Sandford Fleming a communications theorist because of his mapping of Standard Time Zones — or is he a cartographer of the limits of the political imagination? Why is it that there has been more enquiry into the connections between medical history and literary expression in Canada than between literature and any of the other sciences? Does the Canadian literary fascination with the *anatomy* have any scientific parallel — is there more interest in diagnosis than in analysis, description, or measurement? or more interest in theoretical modelling than in techno-

logical application? When Hugh MacLennan writes that "science is the new theology," do we believe him?

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I once thought that literature concerned itself only with the past, and science only with the future; now I'm not so sure. Seemingly such a conclusion follows logically from the research methods that students of literature and science employ. Literary scholars seek repeatedly to verify texts and to weigh contemporary judgments against the cumulative views of generations past (taking alchemists and phrenologists into account, when a world-view requires it), whereas scientists and technologists require only the latest experimental results, the results which render all previous enquiry invalid (hence unnecessary, hence of interest only to the antiquarian). The literary scholar asserts the need to preserve tradition in the light of what we value, the scientist/technologist to shape the future in light of what we learn. They speak to each other, each repeating a message for the *n*th time, on planes that appear never to intersect. "The realm of science," said Duncan Campbell Scott to the Royal Society of Canada in 1921,

> appears to an outsider to be a wonderland. By comparison, literature seems to be divorced from life, and we would need to point to some book that had altered definitely the course of the world's thought to match some of the discoveries of Science which have changed our conceptions of the nature of life and of the universe. Perhaps ... I am confusing for the moment the function of pure literature with the function of Science. Literature in its present form is vowed to the service of the imagination; its ethical powers are secondary, though important; and it cannot be forced to prove its utility.... [Furthermore, the] biological notions of Elizabeth's day are merely objects of curiosity, but Marlowe, Webster and Shakespeare are living forces.... Created, beauty persists; it has the eternal element in its composition....

Yet beauty is not the sole attribute of literature, nor an attribute of art alone. Eternity is an unknown. And just as literature attempts as often to throw light into the future as it does to ratify the past, so does science as often record the past as shape the future. In fact, the more one learns about the relation between the scientific observer and the truth observed, the more it becomes clear that scientists are historians despite themselves. The astronomer, recording supernovas and white dwarfs, is observing or decoding phenomena that have taken place light years away and before; the physicist using the electron-microscope traces the path where the electron has been; the anthropologist (who by his simple presence among a people has disturbed their former way of life) records a life that has already altered. How then to brace for Futureshock, prepare for change?

Isaac Asimov once spoke of science fiction as a "topical fairytale where all scientists' experiments succeed" — then later regretted the remark, because of its implication that scientists desire only success and that they cannot or do not learn

from failure; in fact, he adds, many of the greatest insights derive from serendipity. Because the accidental discovery does not take place logically, the mind is freed at such times from the constraints of received expectation. Eureka: the penny drops, the light dawns, the kettle whistles, the apple falls.

The science fiction writer whom Asimov describes is one like himself or like Arthur C. Clarke: one who explores in imaginative narrative the possibilities inherent in a scientific principle. Science fiction in Canada appears to owe more to Doris Lessing and Ursula Le Guin than to Asimov and Clarke, however, for it is more inclined to political fantasy than to scientific enquiry. The examples are not numerous — the stories of Phyllis Gotlieb and Jean-François Somcynsky, tales collected by John Robert Colombo, Hugh MacLennan's *Voices in Time*, Spider Robinson's *Mindkiller*, Carol Matas's *The DNA Dimension* — but Lessing provides the pattern, in works like *The Sirian Experiments* and *The Making of the Representative for Planet 8* (Clarke Irwin), the third and fourth volumes in the *Canopus in Argos: Archives* series. The mode is primarily documentary or archival; the theme involves the explanation of how political power operates (through symbol and ritual) and how male-female relations represent accommodations to the distribution of power between empire and colony; and the narrative compels interests less through suspense than by the pattern and process of revelation. In an appendix to the latter book, Lessing even goes so far as to provide a commentary on the process of reflection that led to the writing in the first place: fascinated by the power which the historical Captain Robert Scott's *Zeitgeist* held over him and his doomed Antarctic expedition, she constructs a narrative to enquire into the constrictions of a fictional "Time of the Ice": it is a time when rulers are ruled not by judgment or sensible planning but by their own rhetoric, when they identify so completely with their own propaganda that they no longer doubt it — and hence do not, cannot doubt themselves.

Like Lessing, MacLennan and Matas and Robinson are less futurists than historians of the exaggerated present. Robinson's *Mindkiller* (Holt Rinehart) is an allegory about mindcontrol and human choice, and about the central character's decision to surrender his independence to the "Conspiracy-for-Good" because "mindfill" from a Good Person must intrinsically be a Good Thing; it is a frightening failure to allow for the limits of good intentions or the creativity of error. Matas's children's book *The DNA Dimension* (Gage) argues equally vehemently the opposite case: when four children fall through the snow in Winnipeg into a world of perfect symmetry, total centralism, and a choice only between programming and elimination, they fight to preserve themselves not from the good man's paradise but from the dictatorship that he requires to engineer his version of perfection. The moral? not quite what the reader expects, in a decade of Western Alienation: at the end of her book, Matas asserts her case stridently, declaring scientists to be potential agents of political evil because they gain

people's trust by fighting hunger and disease. In both cases, the simplistic conclusion derives from the failure of the causal logic. But do readers read fantasy for logic, or only to confirm their current opinion about the *status quo?*

For that matter, do literary writers write about science to test their knowledge or to support their expectations? When E. J. Pratt "set / A tripod's legs upon a trilobite" and wrote

> It was the same world then as now — the same,
> Except for little differences of speed
> And power, and means to treat myopia
> To show an axe-blade infinitely sharp
> Splitting things infinitely small, or else
> Provide the telescopic sight to roam
> Through curved dominions never found in fable,

he was not minimizing the differences but rather (despite the gruff Hibernian tonal understatement of the passage) placing his faith squarely in epic progress. When in *Two Solitudes* MacLennan averred that "Science and War . . . have uprooted us and the whole world is roaming," he was declaring his allegiance to Classical verities even in the face of the change he found it necessary to accept. But in both cases the "scientific" reference is *thematic.* How should we judge Dave Godfrey's *formal* literary fascination with computer technology (the "Fables and Inputs" in *Dark Must Yield,* for example) or with quantum mechanics and the "uncertainty principle" in *The New Ancestors*? How do we interpret the allusions to Giordano Bruno in the poetry of Margaret Avison or in Chris Scott's novel *Anticthon*? How do we understand the formal discontinuities that interrupt Chris Dewdney's meditations on technology and knowledge?

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There is a cartoon reproduced in Fred Alan Wolf's lucid introduction to physics for non-scientists called *Taking the Quantum Leap* (Beaverbooks); it depicts two people in conversation. "Is that a good book?" asks one; "No," replies the other, "it's a sufficient condition for reality." Taken out of context, forced into its mundane literalness, jargon from any discipline seems bizarre; the physicist's in-joke here reminds us in addition of the impossibility of separating an evaluation from the evaluator. We misunderstand the basic idea of matter, the particle, Wolf observes, if we assume it has properties independent of the observer; and this interpretation of matter is born of the twentieth century, born out of the research of Max Planck, Albert Einstein, Niels Bohr, Murray Gell-Mann, which disputes the Newtonian presumptions that had governed the quest for a "hidden mechanical order" that would explain the world. The false presumptions are these: that things move continuously, that things move for reasons, that all motion can be broken into component parts, that (because he is "just" observing) an observer

does not disturb. They led to a quest for an objective reality that twentieth-century physics belies, and to a belief in the power of technology to explain how and why things work. To challenge such assumptions is implicitly to break with the accepted notion of reality. What replaces it? A belief that the discontinuous processes of motion are the basic paradigm of matter: it is by moving that matter continues to exist; not to move is to cease to exist. How movement takes place is another issue, for this is not a theory of progress, only of change. Wolf adds that by choosing among any alternatives, we repeatedly choose to see what we do see, making our "reality" sensible but also paradoxical, like a Vasarely painting or a *trompe d'oeil* box: "our acts of observation are what we experience as the everyday world." We do choose — living, as human beings do, yearning for design. But as with postmodernist fiction, physics thus inveigles the observer into accepting some responsibility for the putting together of truth. If the world pre-exists, the observer is logically incapable of affecting it; but if the observer *does* affect the environment, he becomes part of the world's continuing process. What restrains this practice from solipsism? Peraps cosmic will, Wolf suggests (the scientist enquiring after religion): perhaps the dreams and observations of God. Or perhaps, as the biologist Lewis Thomas frames an answer, the processes we see are all only parts of the unified *organism* we call the world.

"In brief," Ihab Hassan summarizes, partway through *The Right Promethean Fire* (Univ. Illinois), "relativity, uncertainty, complementarity, and incompleteness are not simply mathematical idealizations; they are concepts that begin to constitute our cultural languages; they are part of a new order of knowledge founded on both indeterminacy and immanence." His book says as much by its method as by its subject; an enquiry into "Imagination, Science, and Cultural Change," the text is disrupted to *enact* the new science — there are "intertexts" within the "texts," and "slippages" within the "frames," fragments of memoir both framing and shaping the substance of his insights. Ostensibly his book is about American culture at large ("indeterminacy surely need not deny an ideal of harmonious perfection") — but in some ways it seems without knowing it to be as much about Canadian culture in particular ("nor is strangeness sometimes but the action of an immanent future in our lives"). By extension, we might ask, need language fragment itself in order to comment on fragmentation? Is it not possible to dream or observe our way *through words* (as well as through numbers) towards coherence, logic, value, meaning? If we declare that "we are the masque: performance, performer, performed," are we merely taking refuge in an isolating Yeatsian trope, or do we thereby claim for ourselves once again an involvement with the world we thought we had lost?

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The fact that most lay people closely identify the world of "science" with the world of "technology" creates a problem of interpretation as well as one of classification. People admire scientists and technical experts because they solve puzzles, create things, cure diseases, and generally make life better — and at the same time they are deeply suspicious of scientists and technical experts because they create puzzles, destroy things, cause dis-ease, and generally make life seem stranger and more unknowable. If the strangeness derives largely from the new vocabulary of number (we need mathematics to understand twentieth-century physics, and twentieth-century physics to understand the ideas of uncertainty and motion which permeate modern life), the suspicion derives largely from the fact that (whatever its positive byproducts), science has too often been put to destructive political use. As one of Robertson Davies's characters effortfully describes: "In Paracelsus's time the energy of universities resided in the conflict between humanism and theology; the energy of the modern university lives in the love-affair between government and science." Too true, but also a paradox: we live with the image of the mad genius in his laboratory concocting potions and plotting world takeover, with the moral equation between eating the fruit of the tree of knowledge and pursuing evil, and also with the bland assurance of quality that a doctor's white coat gives a television commercial for laundry soap or headache pills; as a culture we seem concurrently to believe all three. We yearn for the paradisal good life, but we do not yearn to go back to a pre-technological society to get it (Clifford Jolly may tell us that the Pleistocene Age was "a pleasanter time to live in . . . than the present," but we do not take him at face value); we talk of the "good old days" and elect to power governments that promise to retrieve them for us, but we know they can't, and won't, because times have changed — the need is more psychological than political, more ideological than logical, which invites manipulation. What the paradox suggests is that people live in the presence of change but always in the hope of order, and that they surrender to external authority (scientist, churchman, politician, tycoon), altogether too readily, suppressing their suspicion of the institutional structure because their fear of insecurity and uncertainty is greater still. What it also suggests is that a little more willingness to enquire into the unknown might have ramifications far beyond the results of any immediate enquiry. Scientists themselves divide on their interpretation of the results they get — the biologists and the information theorists assert the possibility of holistic pattern, while the physicists pursue the implications of randomness, the mathematics of fragmentation — and they understand the implications of each other's specialty all too little. But if people ever begin to surrender utterly to their inability to understand, even to congratulate themselves on their ignorance as though that somehow ratified their "specialist" expertise, then they open up territory for the ambitious (and usually no more adequately informed) to occupy, and they create opportunities for rule by fiat rather than by

shared desire. Too many people in the humanities in particular have written science off as numerically incomprehensible; others hang on desperately to the snippets of information they remember from schooldays or glean from *Time*. Yet they, like the scientists and all other people, are daily shaped by the currents of ideas around them — as true in an age of quantum mechanics and computers as it was in an age of positivism or a sun-centred universe — and insofar as they cannot afford to be unaware of the impact science has on ideas and life, they can only pretend now that the sea is silent, light is constant, time is steady, and the world is a Cartesian plane. The scientists in their turn can, one hopes, learn from the humanities to think associatively, can learn not to reduce culture — or all processes of understanding, verbal ones included — to simple systems of quantification. In other words, they cannot ignore each other, and the world they share.

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Conclusions: 1. Everything connects. 2. Perhaps.

W.H.N.

H_2O

Henry Beissel

at the speed of light
a seed
contains the universe
that is
light cast into a black
hole

slows into darkness
explodes
a whirl of particles
grows
a beginning of elements
in a drop

of water the mystery
of matching
atoms of making
three
out of two
in time