EASY WRITING MAKES HARD READING*

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A wind of dissatisfaction now blows across academia in reaction to the discovery that many college students cannot write a coherent paragraph. This deficiency is being addressed in educationally progressive ways: workshops and seminars are being held for instructors, English departments are revising syllabi, and in some universities writing activities are being imposed in technical courses. In short, many educators are *talking* about it, but few are *doing* anything about it—anything with students, I mean. Oft unrecognized exceptions are the engineering instructors, many of whom still mark reports from laboratory experiments and design projects. In fact, at some institutions the engineering professors, not the liberal arts professors, are the ones who most often help students improve their writing skills.

But can we do more? Perhaps we can, but not by attending to those abstractions that are often given prominence in committees, workshops, and focus groups. In one such abstraction we are asked to view the act of writing as a kind of problem, in large part the mechanical problem of getting words onto paper, as if writing were synonymous with word processing. Here we may have encountered a red herring.

In one of his elegant essays on education, Jacques Barzun has noted that we mislead ourselves by regarding most educational issues as problems, because "problem" brings to mind "solution"—the problem of poor writing can be solved, if only we do such-and-such. In fact, the act of writing is not so much a problem to be solved as it is a difficulty to be overcome. A problem, once solved, ceases to be an issue, and we can move on to other things. But a difficulty, like writing (and teaching), has no solution; the difficulty must be faced and overcome, again and again.

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* *The title is a slight corruption of a line from Richard Sheridan.*

But even if we accept that writing is invariably difficult, we can hope to alleviate the difficulties by certain activities. One help is to encourage good editing, for editing means self-criticism, which in turn can lead to self-improvement. Editing often provides much of the pedagogical value in writing, for it is during editing that writers confront their understanding of the subject and decide how the message can be presented so as to be most easily grasped by their readers.

A second help is to encourage good reading; no one has written well who failed to read well. It is here that students of science and engineering may seem most deprived, for what technical literature is well written? Can we identify a body of writing that will inspire young scientists and engineers? Should we allow students to graduate having read nothing technical, nothing except textbooks? If we subscribe to the idea that engineers must synthesize knowledge from diverse areas, shouldn't engineering students read technical material beyond their specialties? If students must now assimilate more information than can be fit into a four-year degree program, won't their chances for future success be improved by the habit of reading?

In grappling with such questions, it seemed worthwhile to compile a short list of books, books well-written and with a technical bent. The list, or some part of it, would implicitly illustrate good writing, and further, it might lead students to see that it is possible to take delight, both serious and whimsical, in technical things.

My list evolves; the current version is given below. The principal criterion for inclusion is only this: the play of ideas, coupled with the author's use of language, must be such that the book sustains interest on second and even third readings. Most of the books are appropriate for readers above the sophomore level. Few readers will develop a liking for every book listed here, but many should find at least two or three congenial companions.

One purpose of the list is to illustrate that a body of well-written literature exists and is accessible to the technically

informed reader. A second purpose is to inspire readers to explore the literature—know your library. My list is only a small, idiosyncratic set from a growing collection. Students can start their explorations with the authors listed below; all have written other books, some in similar, other in more technical veins. A third purpose is an attempt, however modest, to encourage scholarly activity. We in academia seem to have misplaced the idea that a primary purpose of advanced study is scholarship, and all scholarly activity is rooted in reading.

► P. W. Adkins, *Molecules,* W. H. Freeman and Company, New York (1987)
Volume 21 in the Scientific American Library Series
This volume has the trappings of a coffee-table book for the pretentious—slick paper and glossy photographs with nary an equation. But the text admirably exceeds expectations and the photos are *pretty.*

► A. G. Cairns-Smith, *Seven Clues to the Origin of Life,* Cambridge University Press, Cambridge (1985)
Recently Cambridge University Press has begun to reprint selected scientific classics in paperback form. Such an educationally worthwhile practice should be encouraged. This selection by Professor Cairns-Smith may serve as a peerless example of expository writing. You need not agree with the author's thesis in order to appreciate the wit and clarity with which that thesis is presented.

► Philip J. Davis, *The Thread,* 2nd Ed., Harcourt Brace Javanovich, Boston (1989)
In this largely true tale, a mathematician pursues minutia to lengths far beyond the bounds of necessity or any logical conclusion.

► Loren Eiseley, *The Immense Journey,* Random House, New York (1957)
The historical progression of great essayists in science includes Francis Bacon, J.B.S. Haldane, Loren Eiseley, Peter Medawar, Lewis Thomas, and Steven Jay Gould. Of these, Professor Eiseley's use of language is most eloquent.

► Richard P. Feynman, *Surely You're Joking, Mr. Feynman,* Bantam, New York (1986)
Here is a rousing collection of anecdotes that belies the stereotype that researchers need be dull, boring, or worse. All PhD students in science and engineering will find value in the three volumes of The Feynman Lectures on Physics.

► Douglas R. Hofstadter, *Gödel, Escher, Bach,* Vintage Books, New York (1980)
In this synthesis of art, music, mathematics, and artificial intelligence, Dr. Hofstadter makes a compelling case for unity in apparent diversity. Sections of the book that use formal logical systems are heavy going, but throughout the text ideas are combined in striking ways.

► Henry Petroski, *The Evolution of Useful Things,* Vintage Books, New York (1994)
In engineering design, does form follow function, or are the shapes of things driven by more pragmatic considerations? And given the current tendency toward increasing complexity, what can we learn from studies of simple things?

► Robert Scott Root-Bernstein, *Discovering,* Harvard University Press, Cambridge, Massachusetts (1989)
This extraordinary book employs dialog, historical case studies, and broad scholarship to probe the way researchers practice their craft. The conclusions generally flout conventional wisdom about the scientific method, the value of teaching, and the ability of research universities to produce original research.

► Lewis Thomas, *The Medusa and the Snail,* Viking Press, New York (1979)
Through these gracefully written essays, Dr. Thomas reflects on the degree to which our biological heritage has influenced modern human culture.

► E. R. Tufte, *The Visual Display of Quantitative Information,* Graphics Press, Cheshire, Connecticut (1983)
We communicate not only by words and equations, but also by charts, plots, and histograms. This physically beautiful book reminds us that effective figures, like effective writing, cannot be created mindlessly.

► Steven Vogel, *Life's Devices,* Princeton University Press, Princeton, New Jersey (1988)
In language conversational yet precise, this text shows how structural mechanics, fluid mechanics, and energetics explain and limit the functions of living things. By seeing familiar concepts applied to biological situations, traditionally trained engineers may find new interests in old ideas. ❐
