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Brown Univ 9/3/96 Freshmen Convocation, Class of '00

Dear President Gregorian,

I appreciate the chance to say a few heretical words to a class of bright freshmen in front of so distinguished an audience.

I've heard it said that the splendor of knowledge at our great universities was the outcome of a long and venerable process. Freshmen came in possessed of a little knowledge, left it behind, and it gradually accumulated to the magnificent heights that we readily observe on this and many other campuses.

Now I really don't quite subscribe to that theory; but I do have a few words of admiration or of opportunity that attaches to the special state most of you are in: bright and eager, or you wouldn't be here; but not yet overloaded with a surfeit of knowledge and wisdom. Not all: some of you have passed that happy state, and to you few "wise guys" probably nothing I say will be of any value or interest.

Now you may be so loaded with work that just has to be done, that you may not have time to reflect on the special advantages of a combination of intelligence and ignorance (if you are wise enough to admit to both.) As you learn new subjects, new disciplines, you have the never-to-be-repeated opportunity of learning them for the first time, a fresh outlook, and assessing what makes sense to you as you assimilate them. In the accumulation of our culture, and I speak mainly for science which I know best, a lot of square pegs have been forced into triangular holes, in the effort to build some sort of edifice that will be a scaffold for the integration of a lot of learning. Some of these will be honestly presented to you as provisional, and to be taken on faith; but many more will not, for the professors themselves have forgotten the foundations by which they had been persuaded during the many years since they were freshmen. And two years from now will already start to be too late. In graduate school some of you will start all over again, but never with the fresh approach you could offer today.

Pay particular attention to the precepts that you find hard to understand: the fault will not always be in yourselves; and even if they prove in the end to be correct, you will have gained more by reexamining the steps of proof, perhaps found a sounder one than is in the books. It is no accident that many of the greatest discoveries, mainly in physics and mathematics, but occasionally also in biology and medicine, have come to the very young, those who were too ignorant to realize that they were contravening long held traditions, or doing something just a bit odd and out of the way. Think of a Jim Watson who was just 27 when he surmised the structure of DNA and instigated the most important scientific revolution of this century. I've known him almost since he was a freshman, and believe me he took (and takes) nothing on faith.

Now I know what a burden it is to be completing your canonical learning at the same time as you keep some opening in your head to question its roots. It will be a great challenge of

balance, and you will have to make up your own mind as to your capacity and interest in exploiting this opportunity. You might in future come to it again, but perhaps only with a radical change in career. It is very hard to retrace the steps of one's own learning. This is one of the defects of the human mind, compared to computers. They are often exalted for their faultless memories: the magnetic storage can hold billions of potential chess moves. But even more remarkable is how they can be perfectly erased, and start all over again when the program is debugged. We can't quite do that.

This need for balance emerges in many aspects of the scholarly, especially scientific career. I have tabulated a few of the paradoxes that color any scientific biography: the conflicts of:

imagination vs. critical rigor
 iconoclasm vs. respect for established truth
 arrogant audacity toward nature vs. humility and generosity toward colleagues
 efficient specialization vs. broad interest
 experimentation vs. reflection, reading speculation
 ambition vs. sharing of ideas and tools
 celerity (priority) vs. deliberateness (reliability)

but the most important in my mind and experience, is how to be very serious about the purposes of the profession, and at the same time keep a child-like sense of fun, imagination and fantasy.

There is one vital respect in which your world will be transformed by another revolution that matches that of biology, namely information, the cyberworld. So much knowledge is now being shared electronically, we are rapidly approaching the reality of a unified world brain: just see the millions of sites that you can search or browse with Netscape or Explorer. Fluency in using these informational tools, and most importantly, in how to assess them critically, is rapidly overtaking substantive knowledge as the core essentials of a modern education; in the same way as using a calculator has displaced memorizing the multiplication tables. Most immediately, we will see this in the vocabularies of foreign languages and the jargons of knowledge specialties. This is the extension of writing as the means of gathering human intellectual product throughout the reaches of time and space. I don't think your curricula will have begun to accommodate to this reality during your term at Brown, and you may have to supplement these on campus academic offerings with what you can find for yourselves. But don't believe everything you see crawling on the net either.