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A Paradigm of Virtue

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Mr. Thos. B. Osborne,
52 Trumball St.,
New Haven, Conn.

Dear Sir:

We are in receipt of your letter of the 28th inst., requesting electro­
types of our #9 Rapid Grinding and Pulverizing Mill, and our #24
Fruit, Wine & Jelly Press, to be used for illustrations in a chapter to
be written by you for a book on methods for the preparation of bio-
chemical products.

In reply thereto, we beg leave to advise that we do not make the
#24 Fruit, Wine & Jelly Press, having improved same and now call
it the #34. However, we assume that what you really use is our #28
Drug Press, which is really the #34 Fruit, Wine & Jelly Press made
heavier and stronger to stand greater pressure - - - -.

Awaiting your furthers commands, we are,

Yours very truly,

THE ENTERPRISE MFG. CO. OF PA.
status of the History of Science? To put it succinctly . . . What good is History of Science?

During the session dealing with the goals and future of our profession, I heard plaudits for the good old days and sighs over the bad old days . . . I heard suggestions made with respect to possible jobs for majors in history of science. I heard graduate students suggest time-sharing, money sharing, and perhaps even a relief expedition. After all the niceties were over, an undergraduate who was with me at the time, remarked: "How is it that almost no one has said anything specific about opportunities or jobs . . . I mean, what do historians of science actually do in the real world? What are they trained to do?"

Well now, I pondered, if one ignores the publications aspect, are we engaged primarily in grinding and pulverizing the history of scientific knowledge, then pressing it out in the form of fruit, wine and jelly student? If so, what are the students doing after they have been suitably pressed? Who or what are they grinding, pulverizing and pressing?

Let us acknowledge that the goals, motivations, aspirations and ideals of 25 years or even 15 years ago have been altered significantly. Altered to such an extent that we appear to have lost not only our sense of proportion but also our sense of direction. As author Richard Bissell so quaintly puts it:

"Your plane is not in from Seattle yet sir," she said. There will be a slight delay."

"I happen to have information on that flight," I said. "The plane is actually at this moment still circling Moose Jaw while the pilots study a 1938 Texaco road map. They've been lost for an hour and are running dangerously low on sugar coated gum tablets and little dry sandwiches."

"But in a larger sense," said Nancy, "aren't we all still circling Moose Jaw?"

Yes, indeed, "aren't we all still circling Moose Jaw" because our maps are inadequate? Is not our supply of tidbits nearly exhausted?

I am here to tell you what the panel discussion failed to do. I am here to tell you what terrain can be opened to view. I am here to describe to you some of the overlooked details and to open up roads and pathways that have been neglected for so long. I am here to tell you what an historian of science can do in the real world.

To those who want or need a title for this personal odyssey, label it simply as: Some Unanticipated Effects of a Graduate Program in the History of Science and file it under "T" for teaching.

I was employed by Bethany College in 1968 to develop interdisciplinary programs as well as to improve existing courses. Starting
with physical science, astronomy and physical geography, I have since added history and philosophy of science, technology and culture as well as my favorite offering, Heuristics. This fall I will introduce another, The New Religion of Technocracy, an interdisciplinary course designed exclusively for incoming freshmen.

What can a historian of science do with such a group of course offerings where classes contain from 8 to 140 students and where there is but one assistant for laboratory work only? The answer for me, lies with the concept of heuristic reasoning coupled to the simple joy of discovery. To quote Polya:

"The aim of heuristic is to study the methods and rules of discovery and invention ... Heuristic, as an adjective, means 'serving to discover'. ... Heuristic reasoning is ... provisional and plausible only ... The study of heuristic has 'practical' aims; a better understanding of the mental operations typically useful in solving problems could exert some good influence on teaching ..."4

If such an influence can be imposed upon our teaching, then what of that nebulous emotion, joy? Can we impose that upon our teaching? For the joy of discovery is almost nonexistent in the schools and colleges of today. Grades, contingencies, compromises, frustrations, anger, aimlessness—these are all present in ample quantity. But joy—even of that variety known as bittersweet—?

What I do in my classes is to continually employ the twin threads of heuristic reasoning and joyous interest. The results obtained by such tactics have often been surprising. Here are a few illustrations:

During last semester’s heuristics course for upper-classmen, I posed one of those lovable problems labeled as ideal—you know the type: the ideal gas laws or the ideal dilute solution? Problem: How long would it take to transport the entire population of New York City (ca. 8,000,000 people) to San Francisco using only commercial aircraft flying out of the three major airports that service New York? Twelve students attacked that problem, but eleven of them agreed that the solution obtained by the twelfth member was the best of the lot. Why? Because, faced with a seemingly immense and difficult task most of the class became bogged down in trivia, a rather universal phenomenon. Their individual searches for provisional and plausible answers produced results of widely differing values. But Ralph, the number twelve man, called the nearest airport, at Pittsburgh, and posed the question to some of the personnel in the control tower. They caught the infection of discovery and before Ralph knew it, he had two or three people fiddling with slide rules, computing re-fueling times, turnaround times and the like until one of them said: "Hey! Wait a minute. We need more information from one of the larger air-

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fields.” With that, they hooked into a telephone trunk line to Kennedy Airport, and before Ralph knew what had happened, two or three more specialists were working out a solution to this hypothetical problem. The final result: A provisional time of one week. You don’t believe it? Try it. You’ll like it.

In the physical science course, renamed Natural Philosophy, I have one overriding goal: To examine the so-called natural world and man’s place in it through a study of the ways in which the physical sciences have altered and are now altering our conception of the universe. I believe in what the philosopher quoted by Loren Eiseley says: “The special value of science lies not in what it makes of the world but in what it makes of the knower.” To this end I have employed heuristic techniques whenever and wherever possible given a large class composed principally of individuals who are, to say the least, not strong in mathematics, how can you develop the concept of acceleration? Inclined plane? Very good. Make one improvement. Place a student and a basketball next to one another at the top of a hill. Release the basketball and tell the student simply to keep up with the ball. He, and the observers, very quickly grasp the idea of positive acceleration.

Negative acceleration is just as easy. Take one athlete at the bottom of a steep flight of steps of a long hill, then merely say: Run up!

Do you want to develop the concept of statistical probability or chance? Forget your equations, formulas and sophisticated equipment for the moment and play a few hands of cards. Have your students throw dice for awhile. The data obtained by such means will bring your “average” students to an understanding of chance that one might never have believed possible.

In short, why not make the teaching/learning experience a joyous one?

In teaching astronomy and cosmology, I wonder if you still obtain the complex sense of fulfillment, mystery and awe that overcomes me whenever I train a telescope upon the terminator of the moon. More importantly, perhaps, have you ever watched the faces of your students, many of whom are viewing that scene for the first time? Have you gone beyond the dry, quantified details of the solar system and turned your telescope upon Saturn? When that ringed giant swims into view and I watch and listen to the students, I am both humbled and elevated. What words, what exclamations spill forth! And, on many an occasion, almost shyly, some of them will turn to face the night sky and whisper to me: “What does it all mean?”

Heuristics and a sense of joy: that is what this historian of science has used to unlock the curiosity and wonder that is our heritage but which often is buried under an avalanche of so-called knowledge to disappear into the void of synicism and righteousness.

What a joy it is then, to witness an emergence from this state. Last
semester, in the history of science course, we examined the development of evolutionary theory. One girl, summarizing the entire semester in a paper entitled, "A Small Change in Perception", concludes as follows:

“When I was a child, I tried to see if I could walk on the edge of the curb all the way home from school. Of course, when I crossed traffic intersections I had to get off the curb, but the rest of the time I tried to stay on my narrow pathway.

“When I was little I could never make it all the way home without falling off. Sometimes I would lose my balance, and other times the big kids would push me or block my way. I wished and wished that I was bigger.

“I knew that when I grew older I wouldn’t lose my balance as much, and when I grew taller and stronger the other kids wouldn’t be able to divert me from my goal. If anyone tried to block my progress I would push them out of my way. I wished and wished that I was bigger.

“When I was big I could make it all the way home without falling off the edge of the curb. I had no more trouble balancing myself, and when anyone got in my way I simply pushed them aside. I still had to leave the curb, though, when I crossed the street at traffic intersections.

“Today, I still play that game sometimes, but it’s not quite the same as when I was a child. The emptiness of my success fills me, and I know that although I am bigger I am also smaller.”

What a different view is afforded by that small change in perception. How it reminds me of Newton’s remark: “If I have seen farther than most men it is because I have stood on the shoulders of giants.”

Who here is willing to change his point of reference and say that if he has seen farther than others it is because he is surrounded by pygmies?

To those of us who are involved with the teaching/learning process, who are concerned with matters beyond the elementary level of imparting data, a word of caution. There is a signpost displayed prominently at regular intervals along the many-branched road we are traversing. It says only—Warning: Dedication is Required.

Without that dedication, without that sense of purpose, we might better leave the students alone, for, as Marie Jonval says:

“. . . it is safer to wander without a guide in an unmapped country than to trust completely a map traced by men who came only as tourists . . .”
FOOTNOTES

1 Presented at the Annual Meeting of the Midwest Junto Section of the History of Science Society, Madison, Wisconsin, April 6, 1972.

2 Letter from Enterprise Manufacturing Co. to Thomas B. Osborne, Sept. 30, 1908. In Osborne Correspondence, Connecticut Agricultural Experiment Station, New Haven, Connecticut.


