Award Address

Can Any Good Thing Come Out of Nazareth? (John 1:46)

1999 George C. Pimentel Award, sponsored by Union Carbide Corporation

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We are in the era of Big Science, which also means big institutions where the Big Science is done. However, higher education in the United States is unique in that parallel to the array of big institutions is a system of small, liberal arts and sciences colleges where students receive the personal attention and faculty contact that are often not possible at larger institutions. While these smaller institutions are limited in resources and finances, studies have shown that they contribute a disproportionately higher number of leaders across a spectrum of disciplines, including chemistry. This address summarizes my personal odyssey and the reasons for the award (*1*). In it, I emphasize the advantages enjoyed by liberal arts and sciences students and faculty that enable them to overcome the view that great things can only be done in large, cosmopolitan settings. In St. John's Gospel, Nathanael, referring to the origins of Jesus, asked the somewhat cynical question that is the title of this paper. His friend Philip simply replied, "Come and see." I invite the reader to do likewise.

Beginning the Odyssey

In the beginning was the word, and the word came in several parts. Part A: Teach as you were taught. Part B: Publish or perish. Part C: Don't expect any money. The time was the late sixties. I heard the beat of this drummer from many sides: from my own graduate school experience; from colleagues, friends, and neighbors; from former teachers and professors. So, I proceeded to teach (at the College of New Rochelle) as I had been taught, always trying to remember the good things and methods I was taught, and discovering that the good things were rare, little nuggets constantly eluding my grasp amid a pile of chaff. Survival in the "publish or perish" game was still far off, and I also knew there wasn't any money, so why expect it? I found that teaching as I had been taught did not work. My assignment was the non-majors courses that students were taking to fulfill their science requirement. The students were terrified. They did not know any chemistry; they did not care about chemistry; and they could not wait to get out of chemistry. But somehow I had it in my head that they should all become "miniature" chemistry majors and that I was the instrument or angel of the Lord who would bring about this transformation. It turned out to be Armageddon. I concentrated on teaching, teaching, teaching. Meanwhile, where was the learning, learning, learning? I was totally unaware of the disconnect between my teaching and student learning. This impasse went on for the first year or so of teaching, and then all the benefits of teaching at a small, liberal arts and sciences college started to kick in.

The late sixties were not exactly tranquil years. The second year of my college teaching career began quietly, but almost before the students had a chance to mislay their syllabi, things really started to happen. First came the student demonstrations. Then came the sit-ins. Then came the building takeovers. Now, you must understand that the genteel young ladies who constituted the undergraduate population of the College of New Rochelle did not take over buildings, but they did understand some of the fundamental objectives of the late sixties movement, one of which was educational reform. They questioned the basic curriculum. They asked why they were required to take the courses prescribed. I began to ask myself the same thing. They began "rap" sessions among themselves and with those faculty who would participate. I, being a liberal type, decided to participate. I went to all of the student rap sessions. I agreed to plan alternative courses to be held in living rooms and on lawns rather than in the traditional classroom setting. While doing all of this extracurricular "stuff", I also continued to teach my regular course load (albeit to a much reduced student population). Thus began the unraveling of the word that I had heard in the very beginning.

photo by T. Eppridge

An angel doing chemical microscopy, Science Building, College of New Rochelle.

In my zeal for educational reform, I agreed to be a member of the curriculum revision committee. I will draw a veil over the bloody turf battles that ensued, but in the end, we did revise our curriculum in such a way that students could have some choice in the matter of courses outside of their major field—a great step forward! By the early seventies, we were well into the new curriculum, but the chemistry courses had not changed much. "How do you change something as sequentially oriented as chemistry?" I asked. Surely it couldn't be done.

Then into the picture stepped Sister Mary Jane Robertshaw. Yes, you guessed it—she is from that thermostat family that used to put out decks of cards with the family motto, "Robertshaw Controls", on the backs. And, I have to say, she does live up to that motto, at least as far as I'm concerned. At the time, Mary Jane was the head of the art department. She asked me to think about developing a chemistry course that would appeal, and even be useful, to art majors. Appeal to art majors? She might as well have asked that I develop a spinach and mushroom quiche that would appeal to the family cat! However, much to her credit, Mary Jane did not give up. She suggested that I spend some time talking over mutual concerns and course content matter with

members of the art faculty. And as we talked, it began to dawn on me that this was the purpose, the very essence of a liberal arts and sciences college: that faculty members and students from the various disciplines would together undertake a journey into freedom—freedom to engage in interdisciplinary discourse, to cross artificial disciplinary boundaries, to exercise vision and imagination in seeing how far these boundaries could be pushed while, at the same time, maintaining our own disciplinary integrity.

Continuing the Odyssey

From this experience came forth the new word. Part A: Teach as you have learned. Part B: Publish to flourish. Part C: Don't ever expect any money.

Part A. Teach as you have learned. How did I learn? As I reflected on this question, I realized that my learning was due in large part to the intellectual curiosity I found within myself. This was coupled with a deep-seated realization that my best teachers had wanted me to grow up to be the best person I could ever be, and they had done everything in their power to make this come true. They allowed freedom, encouraged creativity, channeled wild ideas, and challenged me to go beyond what I thought was possible. So, the least I could do was to try to do this for my own students. Again, I reiterate, the freedom to go all out in my efforts to craft my own professional activities so that they enhanced the lives and aspirations of students is, I believe, a hallmark of the liberal arts and sciences setting. No one was forcing me to get multimillion-dollar grants. I had no pressure to publish in the best research journals. The driving force was the emphasis on the human being. So is it any wonder that I became attracted to the history of chemistry—the human stories behind the great achievements? Is it any wonder that this attraction to the human dimension would spill over into an interest in how all of this came to be—the scientific dimension of archaeology we call archaeological chemistry? And so it came to be that through the vision and encouragement of Sister Mary Jane, I developed several interdisciplinary courses in color and chemistry (*2*), cybernetics and human values (*3*), and chemistry for artists. I also began research projects in archaeological chemistry (*4*). When I could not find textbooks, or when I found that suitable references were uneven in quality and in level, I wrote my own books (*5*). When I wanted to do research, I found a fertile field in which I could involve not only chemistry majors but art and art history majors as well. The chemists and the artists actually spoke with one another! It was this pursuit that eventually led to a Fulbright lectureship in Israel, a symposium, and a book on archaeological chemistry, to say nothing of a long string of publications in the art/history/chemistry/archaeology interface. This interdisciplinary thrust also led to my interest in the history of chemistry and to my activity in the ACS Division of the History of Chemistry, where I have served as Program Chair, Chair of the Division, and now Division Councilor. It led to my long-term relationship with the Chemical Heritage Foundation that culminated in my becoming Editor of *Chemical Heritage* and Director of Educational Services.

But the important thing is that all of this activity actually counted in the eyes of the administration—what I was doing fell squarely within the mission of a liberal arts and sciences college. There was no fear factor involved in worrying over whether or not I would be promoted or granted tenure, as long as I was giving all of my attention to my students in these activities.

And of course, it was from my students that I learned the most, and from whom I have drawn my inspiration. I am humbled by the sheer energy and perseverance that many of my students have shown.

Just as my involvement with students was moving along quite well, I met some of the movers and shakers in the Division of Chemical Education—namely, Glenn and Jane Crosby and Ted Ashford. Glenn and Jane encouraged me to organize my first symposium for the Division. Ted suggested that I contact Dwaine Eubanks about serving on the General Chemistry Examinations Subcommittee, of which he was

Chemistry at the interface of art, history, and archaeology

Above: Several natural plant dye sources used in ancient times.

Center: Shell of the genus Murex, the source of the famous Tyrian purple used for dyeing the garments of royalty.

Right: A mid-second century textile excavated from the Bar Kokhba site in Israel.

photos by Zvi C. Koren

chair. Those two events were turning points: they were my launch pad to professional involvement in the Division and led to my long-term service as Division Treasurer, long-term service on the Examinations Institute Board of Trustees (and indeed, to my helping to forge an institute out of what was once a committee of the Division), and to the completion, last year, of my term as Chair of the Division. I believe it also led to Dee Stone's decision to see to it that I become Program Chair of the Clemson Biennial Conference in spite of myself! Not long after I met the Crosbys and Dwaine Eubanks, I met two other people who were to have great influence on the evolution of my professional activities: Mickey Sarquis and Marjorie Gardner. Mickey was instrumental in getting me interested in the high school section of the *Journal of Chemical Education*. She even made me a feature editor and encouraged me to publish a series of papers on artists' colors that people cite to this day (*6*). Marjorie Gardner got me involved with ChemSource: she had the idea, and, with lots of help, we developed an eventually successful proposal that led to a very successful project—all leading to my deep involvement with teacher enhancement on every level.

So we come to Part B: Publish to flourish. Here is the key to freedom. My administration did not care if I published in the *Journal of the American Chemical Society* or *Analytical Chemistry*. They only wanted me to get the word out somehow that liberal arts and sciences colleges did things, that we developed materials at the cutting edge. Whatever we published should be relevant to our mission as a liberal arts and sciences college dedicated, first and foremost, to student learning and personal growth. It should grow out of the courses we taught, the students we interacted with, and the cross-disciplinary faculty that fed our intellectual lives. I do not mean to imply that this freedom allowed second-class scholarship. Not on your life! But it allowed exploratory scholarship, cross-disciplinary scholarship, and in particular, it allowed scholarship in chemical education long before this was a recognized field of endeavor sanctioned by the American Chemical Society.

Part C. Don't ever expect any money—at least from the institution: there simply was no budget available to faculty to attend professional meetings. So how did I manage to get to so many? Here we come to a personal, and in my case, a communal choice. To choose to attend professional meetings and to get involved is a deeply personal decision. Yet it is also a life-giving decision: it is the stuff of innovation in the classroom, of enthusiasm, joy, and a built-in preventive to burnout. The wherewithal? It is here that I wholeheartedly thank my religious community for its unswerving support and encouragement—and for pushing a bit of our very limited resources my way. It is chiefly this support that got me started on my odyssey, that sustained me along the way, and that has brought me to this day.

Conclusion

You have heard about a lot of seemingly disparate projects during the course of this symposium. The first three papers on ChemSource emphasized the development of its two major parts, SourceBook (*7*) and SourceView (*8*), while the third focused on dissemination to teachers using a hands-on approach and attention to the national standards. Two papers dealt with art and chemistry, spanning the centuries from analysis of ancient artifacts (*9*) to the development of CD-ROMs that are part of courses bridging these two disciplines. You have heard about two of the major activities of the Division of Chemical Education, the Biennial Conferences and the Examinations Institute, both pioneering structures that push the envelope of teacher development and assessment a bit further each year. You have heard about the exponential growth of the activities at the Chemical Heritage Foundation, and in particular, the development of its Educational Services. In all of these papers, you have probably detected notes of innovative thinking, initiation of and adaptation to change, utilization of technology, contextual awareness, and interdisciplinary thrusts. If I seem to have been deeply involved in each of these areas, and indeed, perhaps sitting squarely in the center of this web of activities, I suggest to you that it is no accident. It is part of the long liberal arts and sciences tradition of which I unwittingly became a part when I began studying Latin before I studied chemistry and could quote from King Lear almost as effortlessly as I could write a redox equation. It is the tradition being carried on to this day in the hundreds of liberal arts and sciences colleges around this country. It is a system that is unique in all the world. It is a tradition that makes no distinction between the education of students, of teachers, and of the public. It is a tradition that treats scientific literacy as a subdiscipline of literacy in general. It is a tradition that has contributed a disproportionate number of leaders in the sciences and in many other fields (*10*), and yet is in grave danger of disappearing in a world shortsightedly more interested in bottom lines and job training (*11*). It is a tradition that values every discipline as an avenue to freedom—freedom to think, freedom to experiment, freedom to take chances, freedom to innovate, freedom from narrow-mindedness, freedom from bias, freedom from external and self-imposed limitations, freedom for joy, freedom for the proper and disciplined use of passions and emotions, freedom for intellectual and spiritual growth. It is a tradition that puts people first. It is a tradition that recognizes our mutual transcendent destiny.

Perhaps in all of this you have heard the bits and pieces of the original citation: telling the story of chemistry as a human endeavor; taking the landmark achievements of chem-

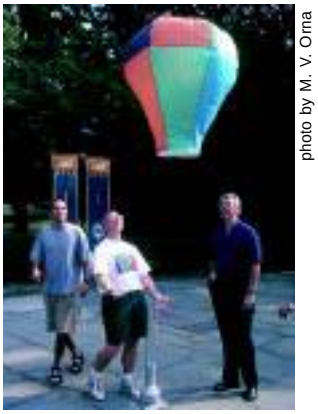

photo by M. V. Orna

Participants in a CHF/CNR summer workshop, applying the gas laws on a practical level, watch jubilantly as their balloon ascends.

istry and turning them into benchmark materials for chemistry teachers; celebrating these chemical achievements through ongoing events and programs; and strengthening the public understanding of the chemical sciences and of related technologies (*1*). But the story is far from over, and the work is far from being done. Indeed, I'm just getting started!

I'm proud and, at the same time, humbled to follow in the footsteps of chemical educators such as George Pimentel, Marjorie Gardner, and Anna Harrison, all of whom have been my predecessors for this award and have had a tremendous impact on my own professional development. They have my gratitude as role models, mentors, and friends. I am also grateful to the Union Carbide Corporation for recognizing the value of chemical education by sponsoring this award.

Mary Virginia Orna chatting with students from the 1998 DuPont Gifted and Talented Summer Program who are visiting the Chemical Heritage Foundation exhibit, "Spinning the Elements: Wallace Carothers and the Nylon Legacy"

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The George C. Pimentel Award in Chemical Education sponsored by Union Carbide Corporation is presented annually by the American Chemical Society to recognize outstanding contributions to chemical education. The award consists of $5,000 and a suitably inscribed certificate.

Nomination information about the Pimentel Award, as well as other ACS awards, is available at *http://www.acs.org/acsgen/awards/awards96.htm*

Note

As noted in the concluding remarks, the Pimentel Award Address followed a half-day symposium that highlighted many of the major contributions that Mary Virginia Orna and her coworkers made to chemical education. Caroline Ayers and James Schreck, coeditors of SourceBook, described the NSF-funded ChemSource project, directed by Mary Virginia, which produced resources to enhance the effectiveness of pre-college chemistry instruction. SourceBook, a four-volume compilation of resource materials, consists of modules that contain student activities with an instructor guide, relevance of the topic to other scientific fields and to everyday life, references to media, humor, etc. Originally planned to assist beginning or "crossover" high-school teachers, SourceBook is recognized as a valuable resource for introductory chemistry teachers at all levels. Marie Sherman, Jean Delfiner, and Al Delfiner emphasized the many ChemSource summer teacher institutes and outreach networking workshops in which they played a major role. Dorothy Gabel—the co-Prinicipal Investigator and developer of SourceView, videotapes, and videodisks portraying exemplary and novice teaching behaviors—described with tape examples how SourceView can be used for such purposes as preservice teacher instruction and assessment. Zvi Koren, an Israeli colleague of Mary Virginia while she was a Fulbright fellow in Israel, described the research activities and major findings resulting from the investigations of the Edelstein Center for the Analysis of Middle Eastern Textiles and Related Artifacts, in which they both worked and which Mary Virginia helped establish. Nancy LeMaster and Carol White, both part of the program team of the 14th Biennial Conference on Chemical Education, spoke of this conference as the meeting that brought together a wide variety of chemical educators to focus on the continuum of chemical education. The Program Committee's inclusive style of leadership, with Mary Virginia as Program Chair, ensured that all levels of chemical education were encouraged to interact—from Nobel laureates to two-year and four-year college professors and researchers to elementary, middle, and high- school teachers. They documented how this Conference opened up to people who had never felt a part of it before, to make them feel welcome, and to get them involved. Dwaine and Lucy Eubanks described the evolution of the ACS Examinations Institute from a standardized testing committee to a full-service assessment body that is responsive to and also drives changes in the content, structure, and process of learning chemistry. Mary Virginia is the longest-serving member of the Institute's Board of Trustees and headed the search committee for its first Director. Ronald Tempest described the mission of the Chemical Heritage Foundation as preserving, recording, and making known achievements in the chemical sciences and related technologies. Mary Virginia is Director of CHF's Educational Services, with a specific mission to carry the story of the chemical sciences to teachers and students through projects that emphasize the human perspective of science as well as its history and impact.