

### To the Editor:

#### *Humbug, Chickweed, and Research Funds Distribution*

Robert Park's recent article, "A Matter of Gravity: Will Space Station Freedom Devour Materials Science?", in the February 1991 *MRS Bulletin* (p. 5) struck a resonance of my hackles. These words are a result.

My case begins with a meeting that took place in the early 1970s in my office in Morristown, New Jersey. It was at the Materials Research Center of the then Allied Chemical Corporation (now Allied-Signal). A few people from the Grumman Aircraft Corporation were visiting us to discuss a possible joint research proposal to NASA regarding crystal growth in space. I found the meeting to be frustrating. On one side, it seemed an exotic and exciting thing to do. On the other, what was the purpose to be other than expensive romance? Neither the meeting itself, nor its postmortems, came even close to answering this question. For the Grumman people, with their company in dire straits at the time, the purpose was job preservation. We decided not to participate, but they did get a contract and did some work.

A few years later, I heard a report of their work, as well as the work of others, on the processing of materials in space at the 1976 meeting of the European Association for Crystal Growth (see 1976 *Crystal Growth and Materials*, edited by E. Kaldis and H.J. Scheel, North-Holland Publishing Company, 1977). This report described, if not the lowest, some of the lowest research productivity (results/dollar spent) on record. At enormous expense, nothing critical had been learned.

Then in the late 1970s, I was invited to a NASA meeting at the headquarters of the American Institute of Aeronautics and Astronautics (AIAA) in New York. NASA was trying to drum up monetary support from industry for the space processing program. I was one of 6-10 industrialists at this meeting. The NASA leader was an expert on convection for whom I had considerable respect, so I listened carefully. There was talk of latex spheres, perfect semiconducting crystals, and biochemistry and how such things would revolutionize industrial products.

I got stuck trying to swallow the last of these items, if not the others. Most of my fellow industrialists also got stuck.

Like others who have learned to keep physical units consistent, I knew that compared to the binding forces in liquids and gases, gravitational forces are small

(very small). I had also observed that astronauts did not come back from space trips dead or maniacal, so there did not seem to be first-order effects of "zero-gravity" on biochemistry. If there were, they would be expected to shift the delicate equilibria in the human organism. Revolutions almost always are associated with first-order effects, so I couldn't see what truly important new technology, or science, would come out of the proposed experiments.

Furthermore, recalling Engineering Economics 101, I knew that transportation costs are usually a minor fraction of the selling prices of products, not a totally dominant fraction. Similarly, the "rent" on employed capital is usually a minor fraction of selling prices. So, if there were any products, they would be commercially unusual indeed. This, combined with some awareness of price-consumption relations (more people shop at discount houses than at expensive department stores), led me to great skepticism regarding the revenues that the new products might generate. I felt that the ratio of them to normal commercial revenues was likely to be equal to, or less than, the ratio of gravitational to electrostatic forces. Data indicate that for semifinished technical materials a price of \$1,000 per pound yields annual revenues of about \$2 million; raising the price by a factor of 10 drops the quantity purchased by about the same factor so net revenues remain constant. Thus future revenues could not possibly justify the proposed research expenditures (for industrial research, please remember).

I did not recommend that Allied Chemical make a monetary contribution to the NASA cause. To the best of my knowledge the responses of the other industrial representatives were similar.

Not long afterwards, a National Academy of Sciences committee, headed by the late William Slichter, reviewed NASA's zero-gravity program. They issued a "statesmanlike," but negative, report that got tabled, or at least not widely discussed.

After 20 years have passed, it seems incredible, and is painful to realize, that some of my annual April agony is still getting frittered into this humbug. This project must have inherited some of the genes of chickweed. Perhaps its managers are descendants of the Aircraft Nuclear Propulsion project. This is not to say that space technology is not worthy of further development. Of course it is. But it should not be justified by means of a specious scam.

As Park pointed out in his article, the

direct expenditures on such humbugs are only part of the pain. They also consume effort (money) that could be applied elsewhere. As business people say, they use "opportunity money" on nonopportunities. Thus, as policy errors, their magnitudes are twice as large as they seem. If policies split roughly evenly into good and bad, it doesn't take many humbugs to swamp the good.

More particularly, Park emphasized that materials science and technology is likely to be a prime and chronic sufferer. And "zero-gravity" materials processing is nowhere near the main stream, or most of the tributaries, of the materials field! In the business world such muddled behavior leads straight to bankruptcy of the firm. In government it should lead to disenfranchisement, an action that seems long overdue for the "materials processing in space" project. Continued great damage may be done if the use of half-truths by scientists becomes habitual. It will compromise the whole enterprise.

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#### *A Question of Attribution*

On behalf of the Art Conservation Research Foundation, Ltd., I am writing to set the record straight about a report that appeared in the August 1990 issue of the *MRS Bulletin*.

I am referring to the report written by James Druzik on the session he chaired during the 1990 MRS Spring Meeting in San Francisco. One of the two papers presented during that session was "The Mechanics of Deterioration of Surfaces Exposed to Environmental Causes," by G.A. Berger and W.H. Russell. In it, and in his oral presentation, William Russell elaborated on one of the first important findings yielded by their unique instrument, the Berger/Russell Stress Tester for Stretched Canvas. *The finding that very small but abrupt temperature changes alone cause considerable stress changes in canvas paintings and are, therefore, detrimental to them, was made as early as 1981.* It was a revolutionary finding because it went contrary to all the accepted expert opinions which claimed that excessive dryness causes the decay of objects.

This finding by G.A. Berger and W.H. Russell was published and illustrated in:

1. "The Behavior of Canvas As A Structural Support for Painting" (Preprints to the IIC Congress in Washington, DC, 1982);
2. The Poster Session of the above Congress (our poster won the first prize);

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3. "The New Stress Tests on Canvas Paintings and Some of Their Implications on the Preservation of Paintings" (Preprints to the ICOM-CC Meeting in Copenhagen, 1984);

4. "Some Conservation Treatments in the Light of the Latest Stress Measurements" (Preprints to the ICOM-CC Meeting in Sydney, 1987);

5. "An Evaluation of the Preparation of Canvas Paintings Using Stress Measurements" (*Studies in Conservation*, Vol. 33, No. 4, 1988);

6. "Practical Applications of Stress Tests" (Preprints to the 16th Annual Meeting of the AIC, New Orleans, 1988);

7. "Deterioration of Surfaces Exposed to Environmental Changes" (*Journal of the AIC*, Vol. 29, No. 1, 1990); and last but not least,

8. In our contribution to the 1990 MRS Spring Symposium: "The Mechanics of Deterioration of Surfaces" (Postprints in press).

Druzik's enthusiastic endorsement of this important finding is correct, but credit for it honestly and truthfully belongs to Berger and Russell.

Mira Berger  
Art Conservation Research  
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### Reply:

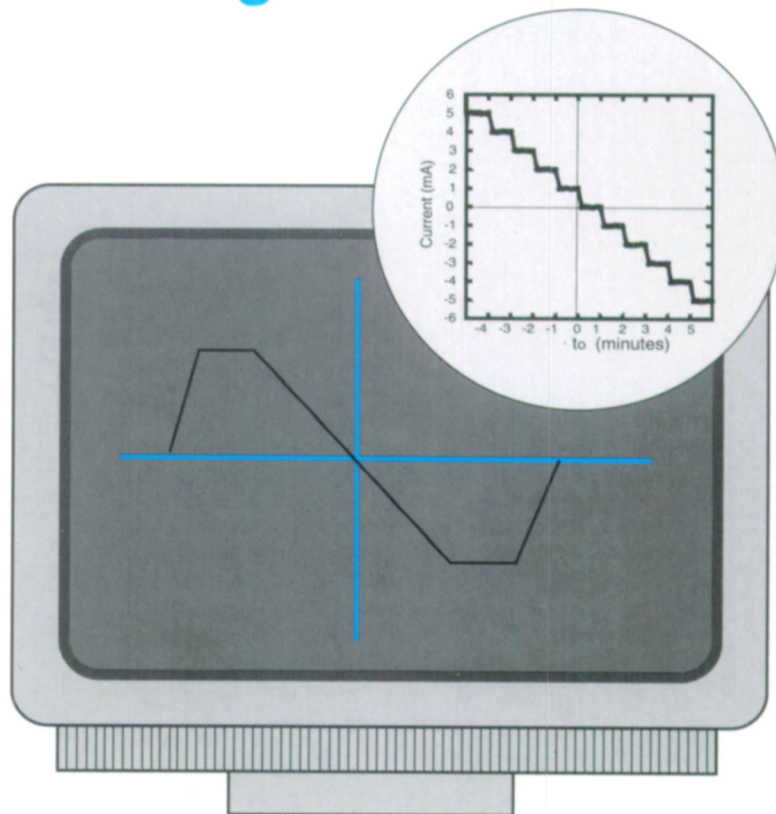
The priority for this "finding" was not assigned in the August 1990 article. Therefore it was neither attributed nor misattributed.

James Druzik  
Getty Conservation Institute

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