PROFESSIONAL RELATIONS BULLETIN

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FROM THE EDITOR . . .

Henry Hill Award

I would like to begin this column by expressing my deep gratitude for having had the Henry Hill Award presented to me at the Washington ACS meeting this summer. Over the more than two decades I have been active in professional relations activities in the Society -- helping to found the DPR, organizing symposia, editing the *Bulletin*, serving as a member of Council, serving on a wide variety of committees and task forces, and in general, being a pain in the (neck) to those who would have ACS do nothing other than science and education activities -- I have treasured most the friendships I have made through this Division. I am honored to have this recognition bestowed on me by "the member oriented division."

Report from Washington

Politically, this was a quiet national meeting. There were *no* petitions up for action before Council, although several in the agenda book for consideration (to be voted on at the next meeting) will guarantee a lively session in Denver in the spring. Of most concern to members of DPR are the continued efforts to re-organize the governance structure of the Society. The petition to combine into a single Society Committee the existing Committee on Professional Relations (CPR) and the Committee on Economic Status (CES), along with one board committee and a do-nothing co-ordinating committee, was reintroduced. Recall that this lost by only two votes in San Francisco (see Bulletin No. 50), and its supporters feel confident that it will pass this time. CPR debated this issue at length, and voted unanimously to oppose this petition. CES also opposes the petition. A major issue not yet resolved is where to go from here.

In my opinion, the basic issue is one of control; professional relations and economic status are issues of great concern to the membership, and as such, should receive the maximum level of member input by remaining in Council-centered committees. A Society committee would involve far fewer Councilors at the full committee level (where final authority for decisions would be located), and would be open to the appointment of non-Councilor members. On the surface, there is nothing wrong with bringing in presumably knowledgeable individuals, but they are just that -- individuals who represent no one but themselves. Member representation is, in fact, *reduced* by creation of a society committee.

CPR voted unanimously to seek a compromise approach that would allow for some reorganization, but would keep the committee(s) within the Council. CES discussed these suggestions at length, and while there was some support, a majority voted not to accept a compromise and to seek defeat of the current restructuring petition. FAXes will fly. Stay tuned.

Watch on Waste

As many of you may know, ACS is not immune from the current recession. The Society is reducing staff, mostly by attrition. So why is Dr. Crum taking the top level staff for retreats to posh resorts (Hilton Head and Santa Barbara this year)? One wonders why ACS (under Dr. Crum's leadership) bought the Belmont conference center in suburban Washington a few years ago. That dog is losing money -- it is certainly available for staff retreats. How much extra was spent to fly everyone down to Hilton Head? Is anyone watching??

Supply and Demand

It was my privilege to organize and chair a symposium at the Washington meeting on supply and demand of scientists and engineers. Printed in this issue is the presentation by Alan Fechter of the National Research Council. For more information, I call your attention to the detailed *Monthly Labor Review* article listed in the second reference in Fechter's paper; another symposium speaker, Bureau of Labor Statistics Associate Commissioner Ronald Kutscher based his talk on the study reported in that article.

-- Dennis Chamot

Presented at the DPR symposium, "Scientists and Engineers: Supply and Demand," held in Washington, D.C., August 24, 1992.

THE LABOR MARKET FOR SCIENTIFICALLY TRAINED PERSONNEL

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I have been asked to present a realistic appraisal of current and immediate-future market conditions for scientifically trained personnel, a brief look at some longer run projections of the future, a discussion of the limitations of such projections, and some thoughts about how our needs for these personnel will be met. My examination will consider only natural scientists, computer scientists and engineers. Behavioral or social scientists are not included.

Current Conditions

Current labor market conditions for natural scientists and engineers is poor. With the exception of a few "hot" fields, such as biotechnology and environmental sciences, there appear to be fewer job opportunities than there are people seeking jobs. Symptoms of this weakness can be found in a number of indicators:

- Unemployment rates in these fields are higher than normal, although they remain well below the rate experienced by the entire workforce;

- The number of postdoctoral appointments have been on the rise;

- Employers in all sectors of the economy -- academia, industry and government -- report freezes and cutbacks in hiring.

It is not difficult to identify the reasons for the poor state of labor market conditions. Industrial reluctance to hire reflects a number of factors, including:

- Downsizing by corporations as part of their efforts to remain competitive internationally;

- Cutbacks in defense expenditures, which have been occurring in real terms (corrected for inflation) since the mid-1980s -- this trend can be expected to accelerate in the wake of the dramatic collapse of the Soviet Union;

- A rising tendency to locate R&D activities and facilities offshore.

Weakness in academic job opportunities results in part from the following:

- Budget stringency in state governments, a major source of funding for public institutions of higher education;

- Immigration from the former Soviet Union and Eastern Europe.

The state cutbacks have created much uncertainty and has resulted in hiring freezes and reductions in faculty slots, such as the dramatic situation in California. Eastern European immigration can be illustrated by recent hiring practices. For example, the University of Minnesota hired five senior physicists from the former Soviet Union. By that action, their physics program instantaneously achieved world-class status. Given the thinness of the current academic market, especially in fields like physics, mathematics and computer sciences, a small number of such foreign hires can significantly reduce the number of job opportunities available for those currently graduating from U.S. programs.

Federal budget problems affect the job situation for the entire economy, but also are readily manifest in the freeze on federal hiring. Moreover, it will constrain future actions as attempts to control the budget will limit the capability for new initiatives and may even result in termination of existing programs. Recent Congressional treatment

of the SSC and the Space Station may be early warnings of things to come.

Similarly, the stagnation of the domestic economy and the lack of any promising signs that economic growth will accelerate over the next several years further depresses the job situation. Although the demand for scientifically trained personnel may be less affected by this stagnation than the demand for other occupations, it is likely to reduce the amount of job creation below levels that were enjoyed in the 1980s.

Future Conditions

While the near term situation can be characterized as dismal, and while there is no evidence that it will improve markedly over the next few years, there are reasons for suspecting an improved situation in the latter part of this decade. The major reason is the substantial increase in the number of separations from the workforce that is expected as those who became scientists and engineers in the halcyon days of the 1950s and early 1960s enter retirement age. An additional reason is the expectation that economic growth, measured by rate of increase in real gross domestic product, is expected to rise from the recent below-average levels. Given these factors, it is quite possible for the current situation of surplus to co-exist with a future situation of potential shortage. The interesting question is whether that future is so problematic as to justify current actions. The answer can be illuminated by projections of future supply and demand.

Ron Kutscher described the Bureau of Labor Statistics efforts to project occupational requirements (see Ref. 2 for a full report of their work -- ed.). I will focus therefore on other efforts, notably those of the National Science Foundation to assess natural science and engineering degree production at the baccalaureate and doctorate levels, and those of William G. Bowen and Julie Ann Sosa to project faculty supply and demand.

NSF's analysis of natural science and engineering bachelor degrees and resultant estimates of "shortfalls" on the order of magnitude of 700,00 have been widely cited and discussed. Described in more recent times as a simple "what if" exercise, this analysis asks what would happen if movements in degree production was assumed to be largely determined by movements in the 22 year old population, and if we set a goal of producing as many baccalaureates in these fields as we did in the period 1984-1986 -- a period during which production was at historic highs.

NSF has also attempted to project future supply and demand of doctorates in these fields. The study expects demand to exceed supply starting in the mid-1990s, and to increase steadily. The analysis assumes that future movements in the production of Ph.D.s among U.S. citizens can arise only from movements in the lagged production of baccalaureates. It assumes that the supply of foreign doctorates will remain unchanged at 4,500, slightly above 1988 levels. Future job openings arising from separations from the workforce (because of death or retirement) are estimated based on age-specific retirement and mortality rates. These separations are projected to double from 1988 to 2006, increasing from 5,000 to 10,000. In projecting future new job creation, real R&D expenditures are assumed to grow at an annual rate of four percent in industry, three percent in academia, and one percent in other sectors.

Bowen and Sosa examined future market conditions for faculty in the arts and sciences for the period 1987-2012. They project surpluses from 1987 to 1997 and shortages thereafter. The study acknowledges the uncertainties associated with such efforts, and in recognition examines a number of scenarios. The findings are consistent across broad fields and are insensitive to a wide range of alternative assumptions.

In projecting supply, the study assumes that the number of new Ph.D.s who are U.S. citizens, or non-citizens who are permanent residents, will remain stable. The number of temporary vis a holders are assumed to increase in 1992, then remain at 1992 levels. Bowen and Sosa used two assumptions to project supply for academic institutions: (1) the fraction of seeking academic employment will remain stable at 1987 levels; and alternatively, (2) the fraction will decline, but at a slower rate than in the decade preceding the study.

Demand projections are based on expected separations from the faculty, and expected new job creation. The latter are generated based on alternative assumptions about field-specific

enrollments and student-faculty ratios. Demand is expected to increase dramatically in the late 1990s, largely because of the projected downward trend in enrollments (although separations are also expected to increase). The dramatic increase in faculty demand, combined with relatively stable faculty supply, will transform a current surplus into a shortage in the late 1990s.

Evaluation

How are we to evaluate these projected futures? Efforts to describe the future permeate the recorded history of Western civilization. Joseph did so for the Pharaoh of Egypt; the Prophets did so for the ancient Hebrews; the Oracle of Delphi did so for the ancient Athenians; the High Priests of Ancient Rome provided the same service using the entrails of chickens.

In modern times we have gained sophistication. Computer models of varying degrees of Complexity have been developed and used, largely in a policy context, to evaluate "what if" scenarios. However, despite the increased sophistication, these efforts are still an art, not a science -- even when practiced by organizations that are closely associated with science. Such models are based upon assumptions about the future which range from extrapolations of past trends to expert judgements, which can be characterized as educated guesses. Inevitably, the accuracy and credibility of these efforts depends critically upon the validity of their assumptions.

There are two types of problems. First, there are empirical difficulties associated with linking measures of supply, typically formulated in terms of level and field of degree and amount of experience, with measures of demand, typically expressed in terms of occupations. The crux of the problem is that many who are employed in science and engineering fields do not have degrees in these fields, and many who have degrees in these fields are not employed as scientists or engineers. This makes it very difficult to estimate or project supply/demand imbalances.

Second, these efforts fail to consider feedback mechanisms that can operate to offset imbalances as they emerge. When job opportunities are scarce, students reconsider their options and employers become more selective in recruiting. When job candidates are scarce, students and immigrants are attracted from other markets and employers increase their recruiting efforts, offer more attractive compensations and employment packages, etc. Failure to consider these mechanisms produces worst-case scenarios.

These problems have implications for the efforts summarized above. The NSF "what if" study for baccalaureates, by failing to explicitly consider demand factors, set a target for degree production that was probably too high, given the demographics. In the NSF projection of doctorate supply and demand, the assumption that degree production was solely a function of past baccalaureate degree production failed to adequately consider the fact that continuation rates of baccalaureates to graduate school and doctoral completion rates historically have been quite responsive to market signals. In the Bowen and Sosa effort, allowing the student-faculty ratio to rise can eliminate the projected imbalance.

Having stated these limitations, I do not believe we should throw out the baby with the bath water. Estimates of future labor market conditions are valuable for planning and policy development, particularly in markets like those for scientifically trained personnel which require long lead times for adjustment because of the lengthy training periods for entry to these fields. It may not be desirable to rely solely on market mechanisms to alleviate market imbalances.

Another Approach

I might suggest a more fruitful way to illuminate the issue. One can ask, how rapidly do we want the population with degrees in these fields to grow over the next ten to fifteen years? Given the answer to this question, one might be able to estimate the average annual number of new degrees required to meet that growth objective. By comparing the required rate of degree production to the current rate, one could determine whether actions would be required to change this rate. I have undertaken to provide crude first cuts of such estimates.

I make some gross simplifying assumptions. I assume that all bachelor degree recipients are 21 years old, and all doctorate recipients 30 years old, at the time they receive their degrees. I also assume that they all immediately enter the labor force, and that they all leave at age 65. Based on these assumptions, I have generated

estimates of the current "working age" populations by cumulating past rates of degree production and subtracting out those who attain age 65. I then estimated required rates of degree production for alternative projected rates of population growth for the period 1985-2009.

For bachelor degrees, the required rates of degree production increase throughout the period, in part because of the retirement bulge and in part because an ever larger number of additional degree recipients are required to maintain any given compound rate of growth.The actual rate of degree production in 1989, roughly 180,000, would be able to support a rate of growth for this population of at least two percent until the mid-1990s, after which it will support growth of no more than two percent. Note, however, that under no circumstances would the 1989 rate of production result in a decline in this population.

There is a similar trend for required doctorate degree production. The actual 1990 rates for U.S. citizens and permanent residents will support a population growth rate of 1-2 percent per year in the 1990s, and 0-1 percent in the first decade of the twenty-first century. It may be unable to maintain the population in the second decade. Thus, higher rates of growth will require further reliance on new doctorates who are non-citizens on temporary visas. Adding 4,500 such people increases the rates of growth that can be supported by about one percentage point over the rates based only on citizens and permanent residents.

Presenting results in this way transforms the issue into one that focuses on the important policy question: what is the desired rate of growth for these populations? The answer depends on higher order policy objectives, including the rate of growth of the economy; the fraction of the economy devoted to science and technology (R&D); and the sectoral composition of both. The debate needs to focus on and resolve these questions before we can draw meaningful conclusions about future shortages or the adequacy of current rates of degree production. Clearly, we face significant problems only if the answers to these questions imply compound growth rates of more than two percent per year for either of these populations.

1. The views expressed in this article are those of the author. They do not necessarily reflect those of the National research Council or its parent institutions, the National Academies of Sciences and Engineering and the Institute of Medicine.

2. D. J. Braddock, "Scientific and Technical Employment, 1990-2005," *Monthly Labor Review*, February 1992, pp. 28-41.

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BOOK REVIEW

"Trends in Chemical Consulting," edited by Charles S. Sodano and David M. Sturmer. Published by the American Chemical Society, 1991. 165 pages. Paperback, $29.95.

Reviewed by Donald J. Berets, The Chemists Group, Inc., Stamford, Ct.

Consulting has become the end-game of professional careers for many chemists, especially those caught in the recent epidemic of organizational "down-sizing." Therefore, it was logical that "trends in Chemical Consulting should be the title of an ACS Corporate Associates annual symposium, held at the national meeting in Los Angeles in 1988. The proceedings of the 14 papers have now been published. The editors wisely arranged for the authors to update and expand their remarks, to maximize utility to chemists who either are, or are contemplating, consulting.

The papers range from excellent through instructive to a few that appear to have been included by error in an otherwise useful volume. The late Charles Kline's opening overview is an excellent summary of a surprisingly large ($1.5 billion/year) consulting services business, of which the chemical industry represents perhaps one-third. Kline presents the rationale for using (or not using) consultants, a veritable sales pitch, along with tabulations of major and minor consulting groups. Other chapters include information on how consultants should act, how much they should charge, how their employers should act towards them, etc. But this is not a coherent "how to" book. Rather, it is the presentations of 14 authors, encompassing their individual experiences, advice, and opinions from which much can be learned.

Some chapters are instructive, even if inadvertently so. Chemist and ex-Congressman Mike McCormack describes in detail the ponderous, bureaucratic way in which he and Clayton Callis formed a consulting group, with recommendations on items likely to be well beyond the scope of most readers, such as the importance of including attorneys skilled in corporate and tax law, general and professional liability insurance, and more. An editor's note indicates that this consulting group ceased before the book was published. The lesson: successful technical consulting requires flexibility and sensitivity to client needs rather than elaborate infrastructure.

The final chapter, by Robert Maizell, is an informative discourse on chemical information consultants, concisely covering what they do, how to find them, and how to be one. It ends a useful book on a very high note of professionalism.

Since "Trends" was published, the general business climate has not been kind to consultants. They are, as a class, easily dispensed with, in the short term. But in the longer run, the use of consultants will expand again, and books like this one are important for practitioners to know about and read.