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EDITORIAL

Jobs, Technology, and Change

Last June, presidential candidate Governor Bill Clinton promised to create 8 million jobs. As part of an effort to achieve that goal, he has stated that his administration will seek to regain world industrial and technological leadership. On 18 September, a relevant policy statement was released entitled, Technology: The Engine of Economic Growth. Some of the initiatives mentioned in the 22-page document include a variety of efforts to encourage the private sector to increase their investments in research and development (R&D), plant and equipment, and worker training. Government would take many useful initiatives, such as giving tax breaks for R&D, fostering precompetitive technology development, and supporting industry-led consortia. Other changes involve redirection of efforts of the National Laboratories and better management of technology among agencies of the federal government.

The Democratic party in the past has been in effect antibusiness. Governor Clinton seems to take a different view. “In a global economy in which capital and technology are increasingly mobile, we must make sure that the United States has the best business environment for private sector investment. Tax incentives can spur investment in plant and equipment, R&D, and new businesses. Trade policy can ensure that U.S. firms have the same access to foreign markets that our competitors enjoy in the U.S. market.” A further quotation states: “Although the United States has negotiated many trade agreements, particularly with Japan, results have been disappointing. I will ensure that all trade agreements are lived up to...Countries that fail to comply with trade agreements will face sanctions.”

The small business sectors would be assisted in getting access to better technology. America’s 20 million small businesses account for 40% of the gross national product and half of job creation. Some states have had extension programs to help them, but the U.S. effort has been small in comparison with those of Japan and Germany. The new administration document called for establishment of 170 manufacturing centers that would help small and medium-sized manufacturers to choose the right equipment and to learn new production techniques. Both large and small companies need to be aware of technology being developed in other countries. The document states: “...we must also develop a strategy for acquiring, disseminating, and utilizing foreign technologies.”

In its discussion of federal laboratories, the technology document is less than enthusiastic. A notable exception is the mention of the National Institute for Standards and Technology. For that institution a doubling of the budget is proposed. But for others, the following statement is made: “America’s 726 federal laboratories collectively have a budget of $23 billion, but their missions and funding reflect the priorities that guided the United States during the Cold War.” A change in priorities is contemplated with federal laboratories previously engaged in defense research expected to engage in technology development for commercial usages. “Federal labs which can make a significant contribution to U.S. competitiveness should have ten to twenty percent of their existing budget assigned to establish joint ventures with industry.” Later, the following appears: “Industry and the labs should jointly develop measures to determine how the technology transfer process is working and review progress after 3 years. If these goals have not been met, funds should be redirected to consortia, universities and other organizations that can work more effectively with industry for results.”

The document mentions Vannevar Bush and his report, Science—The Endless Frontier, and its role in making the United States a world leader in science. However, it states bluntly: “Today the United States faces a new environment.” The success of the Japanese industry in capturing U.S. markets is cited, followed by: “...it did so, not by devoting massive resources to basic research, but by stressing incremental improvements in existing technology, rigorous quality control...R&D results flow quickly around the world, but production know-how does not.”

A final quotation: “I will give our Vice President Al Gore the responsibility and authority to coordinate the Administration’s vision for technology and lead all government agencies, including research groups, in aligning with that vision.”

Will the vision that is implemented be that expressed recently by Clinton, or that expressed earlier in a book by Gore?

Philip H. Abelson
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Left-Handed Comments

We write from the not always equivalent perspectives of organic chemistry and biochemistry to express our mutual dismay that it is considered big news that mirrors appear to work as well in one of our fields as in the other (Cover, 5 June; "Total chemical synthesis of a D-enzyme: The enantiomers of HIV-1 protease show reciprocal chiral substrate specificity," R. C. del. Milton et al., Reports, 5 June, p. 1445; Corrections and clarifications, 10 July, p. 147). It was, after all, only this spring that the American Chemical Society celebrated the centenary of the demonstration by Emil Fischer, the father of biochemistry, that the principles of van't Hoff-LeBel stereochemistry could be used to establish the detailed structures of the carbohydrates (1). Perhaps more dismaying is the revelation that there was serious doubt not too long ago about whether enzymes would be subject to rules of symmetry ("On the other hand . . .", G. A. Petsko, Perspectives, 5 June, p. 1403). This suggests a survival, in some circles, of the idea of vitalism, supposedly demolished by the work of (among others) Friedrich Wöhler, one of the fathers of organic chemistry, 150 years ago. Our field-fathers must be spinning in their graves, presumably in opposite directions, to conserve parity.

Contrary to the impression given by figure 3 of Milton et al. (which was produced by computer manipulation of a drawing for the L-enzyme), the enantiomeric folding of the D-enzyme has not been directly demonstrated. It is, instead, deduced from the observation that the D-enzyme shows optical and enzymatic properties chirally reciprocal to those of the L-enzyme. This being so, can it then be any surprise that these properties are chirally reciprocal?

If the folding is as exactly enantiomeric as the reversed computer graphics would suggest, it might be significant that that must have happened without the intervention of any agent of biological origin. For those of us who already believe that enantiomers will behave in chirally reciprocal ways, the absence of such intervention would seem assured, not only by the experimental care described in note 22 of Milton et al., but by the fact that any biological agent effective in producing the folding of the "normal" protein would necessarily be wrong-handed when it came to doing the same with the "abnormal" one.

The precision with which this enantio-enzyme has been prepared brings us closer to the day when we must address the viability of enantiolife in the test tube, in the current biosphere, and in the times when life was getting started. Clearly, enantiolife will be as viable as "normal" life in vitro; a claim for de novo biogenesis will be considerably more credible if it is based on building blocks enantiomeric to those found in the biosphere. Although escaped enantiolife would have a built-in immunity to attack from "normal" life, it might have a tough time finding nutriment unless it were achirorotrophic or developed racemases and invertases. Would be synthesizers of life based on amino acids and nucleic acids need to consider these matters in detail before getting started. Such organic or biochemists should prepare for trouble not only with the public and politicians but with their peers as well.

It has been plausibly argued that the "weak interactions" (which make the universe inherently chiral) could affect the self-replication of chiral substances in a cumulative fashion and thus produce the current condition of chirality in the biosphere (3). The parity-violating energy difference (PVED) between enantiomeric peptides that contain n amino acid residues has been estimated to be on the order of n x 10^-17 kilocalories per mole. If the PVED between enantiomeric bond conformations is similar in size, then a protein of only 198 residues would be at least ten orders of magnitude too small for the cumulative PVED to be large enough to favor a conformational difference at just one backbone bond—the minimum requirement for an observable difference in properties.

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2. Idem, p. 4.
the Dominican Republic, as well as in Mexico and Central and South America, yet this is not the closest living relative to H. protera. According to Jean Langeheim, a paleobotanist at the University of California, Santa Cruz, the extinct tree's closest ancestor (H. verrucosa) is actually found in East Africa and Madagascar.

—Virginia Morell

A Career in Industry

It was most refreshing to see the discussion of industrial careers in the Careers '92 section of Science (18 Sept.). It caused me to remember the climate I experienced while at the University of California, Berkeley (1965–1970). My fellow graduate students and most professors felt that industrial careers were for those who could not do real science or could not get an academic position, or both. They could not understand why I might want a career in industry. But since I had industrial experience gained between receiving my baccalaureate degree and entering graduate school, I knew there were very good scientists and engineers doing real science in industrial positions and that their work was enhancing the quality of life for society at large. Moreover, I knew that truly competent scientists and engineers could use the problem-solving skills gained in their university experience to address problems of great breadth and complexity having technical, financial, and social dimensions.

I have greatly enjoyed working in industry. I highly recommend it to young scientists and engineers who want good opportunities to develop depth and breadth of knowledge and experience.

W. Robert Richards
9025 East Kenyon Avenue,
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Corrections and Clarifications

In Joe Alper's 25 September article "Everglades rebound from Andrew" (News & Comment, p. 1852), the species name of Melaleuca quinquenervia was misspelled and the tree was described incorrectly as "an Australian eucalypt." The Melaleuca are a distinct genus and are commonly referred to as paperbarks.

The article about the viral hybrid SHIV by Joseph Sidroski and his colleagues that was reported in Jon Cohen's News & Comment article "Monkey-human viral hybrid is new weapon in AIDS fight" (24 July, p. 478), appeared in the July issue of the Journal of Acquired Immune Deficiency Syndrome, not the June issue, as stated.
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Grimes, as "the burgeoning area of organic superconducting materials." These remarkable substances become superconducting at temperatures ranging from below 1 K to as high as 45 K. The major focus of the book is on the series of charge transfer salts, largely related to bis(ethylenedithio)tetrathiofulvalene, colloquially known as ET, within which the highest superconducting transition temperature is below 13 K. The fullerenes, which have much higher transition temperatures, are included in the title but are a late addition to the book, confined to a brief appendix.

In contrast to the implication of the series editor's comment, the total number of known organic superconductors is in fact rather small, there currently being fewer than 40, of which more than half contain ET as the donor and most of the remainder have donors that are closely related to ET. For the reader interested in this special class of compounds, the synthesis, structure, and properties of all these materials are given in exhaustive detail. The synthetic and experimental methods for the preparation of the compounds and crystals are well described, and stereo views of and crystallographic data for most of the compounds are included. More than 120 of the 400 pages are devoted to references; many of the physical properties of prototypical compounds are tabulated; and previously published experimental measurements of the electron spin resonance, vibrational, and optical spectra of these compounds are presented. In all, the book is a valuable compendium of the organic superconductors known at the time of publication.

The authors state clearly that the book focuses on the chemical aspects of the organic superconductors, and this is abundantly evident in the text. Indeed, they trace the origin of organic metals to 1911 to the work of McCoy and Moore, who studied amalgams of substituted ammonium ions. This early work focused on the chemical similarities between such organic moieties and the elemental alkali metals; and though such physical properties as crystalinity, metallic lustre, and electrical conductivity were discussed, no conductivity measurements were reported. In a strange twist, the authors then go on to credit the discovery of the first organic superconductor in 1981 as the realization of "the most speculative suggestions of McCoy and Moore." I believe this is historically incorrect. I could find no such speculation in the McCoy and Moore paper and, indeed, this paper even predated Onnes's discovery of superconductivity.

Granted the omission of the physics of the materials, the perspective of the book is narrower still. In the preface, for example, it is stated that "only superconductive organic materials that can be synthesized in the laboratory are discussed." Surely this is an overstatement. I believe the authors really mean that only those materials that have been synthesized and found to be superconducting are discussed. For these, they do provide a comprehensive overview. But they do not go beyond these compounds. They draw little insight from what has been learned. No lead is given as to what other classes of organic compounds might become superconducting, or what other areas of organic chemistry might be of potential interest to the field. As a result the book fails to capture the excitement that has characterized the field for several decades.

I believe it was Akamatu, one of the pioneers of organic semiconductors, who stressed that the term "organic" as applied to conductive compounds means more than simply that the compounds are composed of carbon. It reflects the ability of such molecules to be organized into a unified, organic whole. This is all the more important for organic superconductors where the macro-molecular structure plays so important a role. We see little of this here, except in the last chapter. In this chapter an effort is made to give a theoretical treatment of the superconductivity from a chemical perspective and relate it to structure. This is refreshing, but it is a far cry from a theoretical treatment of the entire phenomenon that might be assumed from the book's title. Such a treatment would involve some of the most advanced concepts of condensed-matter physics, and this is not to be found in this book.

In summary, Organic Superconductors is a useful compendium of chemical and physical properties of the currently known organic superconductors written by a group of experts intimately involved in their study. It is of limited scope and narrow in its view but gives one a snapshot of the present status of this field.

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