THE LAST WORD

by Henry I. Miller and Frank E. Young

ISN'T IT ABOUT TIME WE DISPENSED WITH 'BIOTECHNOLOGY' AND 'GENETIC ENGINEERING'?

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Defining "biotechnology" or "genetic engineering" is an elusive task, indeed, perhaps because the terms do not represent natural groupings of processes or products. They connote something different to individual commentators, journalists, organizations, Congressional staffers, and members of the public. The terms are ambiguous, and represent the source of much confusion and little advantage. We would do well to return to more specific and descriptive terms among the myriad constituent processes and products that are now lumped arbitrarily as "biotechnology" or "genetic engineering."

The term "biotechnology" seems to have originated in the 1970s and has many definitions. One of the broader definitions, "the application of biological systems and organisms to technical and industrial processes," was coined by the Cabinet Council (now the Domestic Policy Council) Working Group on Biotechnology several years ago and clearly encompasses old and new processes and products. The processes range from fish farming to the production of enzymes for laundry detergents; from the genetic manipulation of bacteria that clean up oil spills to engineering those organisms to produce human pharmaceuticals. Conversely, the press often limits "biotechnology" to the newest, state-of-the-art manifestations (for example, "First Biotechnology Product Approved by FDA"). "Genetic engineering" is at least as much abused in this context ("First Field Test of Genetically Engineered Bugs Blocked by Litigation").

These usages are, at best, disingenuous. "Biotechnology" dates back at least to 6000 B.C. when the Babylonians and Sumerians used microorganisms in fermentation to brew alcoholic beverages. And "genetic engineering" actually dates from man's recognition that animals and crop plants could be selected to enhance desired characteristics. Advances in molecular genetics during the past half-century have led to the present sophisticated level of genetic manipulation of microorganisms. An excellent

example is the genetic improvement of *Penicillium chrysogenum*, the mold that produces penicillin. Several methods—including natural selection, chemical mutagenesis, and irradiation—have been used to increase penicillin yields more than 100-fold in 20 years. Similarly, the genetic improvement of agricultural crops has been astonishingly successful; in fact, a Nobel Prize was recently awarded for the genetic engineering of corn plants for human consumption. These are "biotechnology" and "genetic engineering" successes of monumental proportions. Recombinant DNA and RNA techniques provide still more precise and predictable methods for manipulating genetic material in useful ways.

Disenchantment with the rubric "biotechnology" is becoming wide-spread. A recent General Accounting Office (GAO) report, *Biotechnology: Analysis of Federally Funded Research* (GAO, Document #RCED-86-187, 1986), concluded, "[b]ecause of the inconsistent interpretation of the term 'biotechnology,'...[i]t may be useful, for the purpose of discussing possible regulatory approaches, to avoid the term 'biotechnology' and instead use more specific terms..." David Kingsbury, Assistant Director of the National Science Foundation, made the same point during a recent Office of Technology Assessment (OTA) conference that addressed research funding for "biotechnology."

GAO and Kingsbury are correct. There is a need for more precise communication in science and technology generally, and specifically for cleaning up the "biotechnology" and "genetic engineering" jargon. Reference to the appropriate constituents or subsets of these catch-alls would be more informative, clear, and useful: biochemistry, microbiology, agronomy, entomology, microbial ecology, bioprocess engineering, recombinant DNA probes, subunit vaccines, live attenuated vaccines, somatic cell gene therapy, therapeutic monoclonal antibodies... By using terms such as these, we would convey meaning more clearly—whether the intent was to laud progress, or to call for additional oversight, or to seek additional funding. Is that degree of verbal and literary discipline too much to ask?

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