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Genetic engineering: one leg of a three-legged stool

Genetic engineering, recombinant DNA, plasmids, protoplasts, clones — these are all terms that symbolize the revolution taking place in the biological sciences. A few key discoveries have led to a breakthrough in our understanding of the biological genome and our ability to alter it, which may equal in significance the development of nuclear energy in the physical sciences.

Only a few years ago plant breeding was limited to crosses between species and occasionally between genera. Today there seems to be almost no limit to the range in donors and recipients of genetic information. It is indeed a revolution, and a welcome one, which will provide us with both medical and agricultural opportunities much needed by our increasingly crowded world.

But research in these areas is expensive. It often means additional training of scientists, altering facilities, buying new equipment, and costly ongoing purchase of the necessary expendable and highly specialized supplies. Fortunately, federal, state, and private sources of research funds have recognized the value and expense of such studies and are moving to help provide the necessary dollars to ensure their success.

Less relief is in sight, however, for two critically important but less glamorous research activities necessary to reap the benefits of genetic engineering — conservation of genetic resources in natural populations, and developing, then field-testing the products of genetic experiments. In the scientific community, the question of gene resources and their conservation is viewed with mounting urgency. Although not generally recognized by the public, it is perhaps one of the most important natural resource issues facing us today.

Every time we lose a species, we lose irretrievably the biological potential of the genetic resources of that species. With each loss, the genetic material that might provide solutions to present and future problems is gone. An adequate gene resource conservation program is to genetic engineering as a library is to knowledge. They both are sources of the past, the present, and the future, and both are equally essential to the development of their counterpart.

A gene conservation effort for important agricultural crops was designed and initiated by the U.S. Department of Agriculture over 15 years ago. But, faced with constant budget constraints, this program is way behind schedule with only a few of the planned conservation centers presently established. Many private and state organizations carry out limited conservation programs, but there is no coordinated national program to ensure that these genetic libraries are maintained.

Recognizing the vulnerability of existing genetic materials of importance to agriculture and biology in California, the University of California has prepared and presented to the State a coordinated program for gene resource conservation. If funded, this program could be implemented during 1985.

Because of its agricultural abundance and favorable climate, California has accumulated genetic resources that are unique and diverse. Of the more than 200 domesticated plant and animal species forming the backbone of California's agricultural economy, only a few are native to the state. Thus, the continued success of our agriculture depends on biological resources whose origins are outside the state and country.

California's effort to establish gene banks, however, can only be the beginning. It is essential that other major agricultural states and the U.S. Department of Agriculture work together with key industry groups to develop a well-coordinated and adequately funded national program in gene resource conservation.

The same is true for a second major activity related to genetic engineering, the field-testing and development of new biological materials, which has become increasingly difficult to support adequately at both state and federal levels. The dependence of genetic engineering on these less glamorous and more traditional features of research in agriculture often seems obscured from justification for budget support.

We are challenged to justify these supporting research activities through a cohesive and logical plan. There is strong evidence that investments in agricultural research, unlike many other publicly funded programs, yield handsome rates of return soon after their initial investment.

With these facts and figures, renewed effort must be made to acquaint reluctant executive and congressional representatives about the need and opportunities that exist in this new frontier of research in agriculture.

We need to remind them that there are three components in creating new food sources: first, conservation of our genetic resources to provide the building blocks; second, the new and exciting field of genetic engineering; and, third, field evaluation, testing, and education. These components are inextricably interdependent.

The risk of not conveying a convincing argument for support of these three elements of plant and animal improvement is to waste the many millions of dollars we spend on developing elaborate techniques to clone genes and reconstruct genetic resources of our agricultural commodities, and to deny these improvements to production agriculture and the consuming public.