

brane, a signal delivered by a lymphokine, B-cell growth factor (BCGF₁), and a signal delivered by interleukin-1 (IL-1), a lymphokine produced by macrophages. R. Dutton (University of California, San Diego) has identified a second lymphokine (BCGF₂), and T. Kishimoto and K. Yoshizaki (Osaka University, Japan) have identified an analogous human B-cell growth factor.

Dr. Howard's data indicate that BCGF₁ and IL-1 are antigen-nonspecific, synergistic cofactors for stimulation of B-cell proliferation. She has proposed a model for the activation and proliferation of B-cells that depends upon these two lymphokines. However, the model cannot be satisfactorily tested until definitive methods to determine the binding of lymphokines to receptors are devised.

Once B-cells have been activated and induced to multiply, other lymphokines are required for the development of immunoglobulin-secreting cells. Research by E. Vitteta and co-workers (Southwest Medical School, Dallas, TX) indicates that there may be a variety of T-cell derived factors that induce B-cells to secrete different classes of antibodies. Two of these differentiation factors, BCDF- μ and BCDF- γ , induce B-cells activated by antigens or mitogens to secrete IgG and IgM, respectively. A. Nakanishi recently identified two additional T-cell derived soluble factors, B15-TRF and EL-TRF, that are required for the development of immunoglobulin-secreting cells. They are apparently

antigen-nonspecific and their action depends on the presence or prior action of BCGF₁. Further research is required to resolve the identity of these lymphokines and to determine whether they also play a role in stimulating proliferation.

Continuing research into the molecular mechanisms that stimulate B-lymphocyte proliferation and differentiation is likely to yield many more lymphokines. There may be a large number of sequential reactions stimulated by different factors that have an important role in the development of B-lymphocytes. This research may make it possible to grow cloned B-cells *in vitro*, eliminating the necessity for tumor cell hybridomas to produce monoclonal antibodies. More importantly, this work may provide the basis for a physiologically based pharmacology that utilizes lymphokines to stimulate the patient's own immune system to combat disease.

References

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COSTA RICA MEETING REPORT

NEW COOPERATIVE EFFORT PLANNED FOR LATIN AMERICAN BIOTECHNOLOGY

The overall promise, limitations, and needs of biotechnology for human welfare in Latin America and the Caribbean were discussed at a recent meeting in San Jose, Costa Rica. The symposium, organized by the National Council of Scientific Research and Technology of Costa Rica, the Central American Institute for Research and Industrial Technology (ICAITI), and the Interciencia Association, a federation of Latin American scientific associations, brought together an interdisciplinary mix of participants. Scientists and biochemical engineers from both academia and technical institutes as well as science policy managers from Central and South America met with North American colleagues to prepare recommendations for the development of the basic and applied biological sciences in Latin America.

The severe problems in the econo-

mies of many countries in the region made the meeting an appropriate occasion for an evaluation of how to proceed given the current obstacles. A consensus quickly developed on two propositions. The first was the need to formulate biotechnology programs around specific national and regional priorities. For example, Carlos Rolz described the success of the ICAITI research center in Guatemala in developing microbial techniques for upgrading coffee wastes, an economically important problem in Central America. Secondly, it was concluded that the development of biotechnology in the region depends on "knitting" a network between the human and institutional resources that already exist in the region.

These resources are considerable. Nine countries in South America have formed a program for postgraduate training in the biological sciences. Jorge Allende of the Universi-

ty of Chile, director of the program, noted that it has organized 40 short-term courses, trained 676 investigators, brought 208 visiting professors from abroad, and supported 90 research projects in the region. Central America has ICAITI, a five-nation research center in Guatemala. Gustavo Viniestra pointed out that Mexico has 22 schools with programs in biochemical engineering and several outstanding research groups in molecular biology. The University of Costa Rica has a strong research program in virology, while Cuba has developed expertise in diversification of sugar cane utilization. Victor Yang, a chemical engineer from Brazil, described his country's national biotechnology program that is supporting research programs on alcohol production by fermentation, nitrogen fixation, and plant tissue culture.

While the meeting served as a useful forum for updating the participants on "state of the art" biotechnology, perhaps its most important function was to forge new inter-regional links. Dr. Allende proposed the establishment of a network of regional biotechnology centers organized along the lines of the postgraduate training program. The network would be administered by a board of scientists and government representatives, and funding would be awarded on the basis of a peer review system. The network would award annual contracts to established laboratories for projects such as production of restriction enzymes, establishment of gene libraries, and maintenance of stock cultures. These materials would be available to laboratories throughout the network. The proposal is being reviewed by six Latin American governments and several international development agencies.

The meeting in Costa Rica illustrated persuasively the need for inter-regional cooperation. Biotechnology is within the reach, to a greater or lesser extent, of all countries in Latin America. Under the "network" model, each country contributes to and benefits from the development of many programs.

The enterprise of science and technology tends to integrate disparate societies in a common effort; perhaps this time the effort can be successful, respecting the particular needs and idiosyncracies of each of the participating countries.

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