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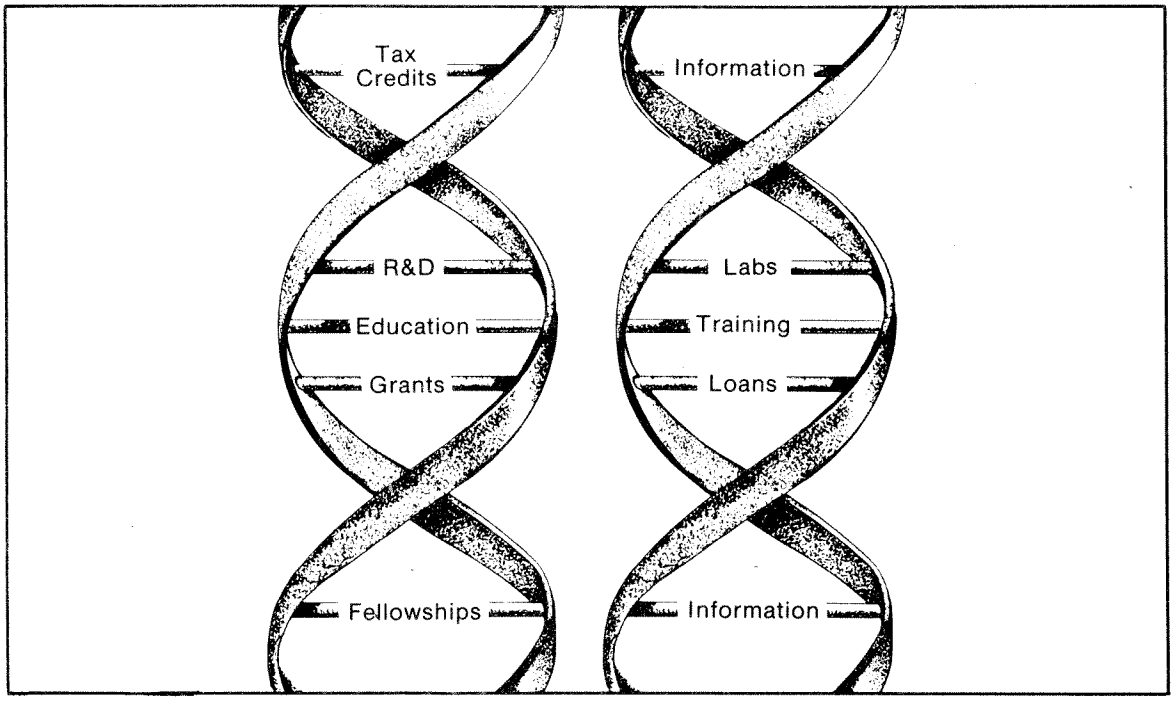
Silicon Valley II: A Review of State Biotechnology Development Incentives

California Senate Office of Research

SILICON VALLEY II:

A REVIEW OF STATE BIOTECHNOLOGY DEVELOPMENT INCENTIVES



Prepared by:
Senate Office of Research
Elisabeth Kersten, Director
August 1985

CALIFORNIA LEGISLATURE

Senate

STATE CAPITOL
SACRAMENTO, CALIFORNIA
95814

August 30, 1985

The Honorable Members of the California State Senate:

We would like to call your attention to the attached report, Silicon Valley II: A Review of State Biotechnology Development Incentives, which was prepared by the Senate Office of Research. The report focuses on the intense competition that is developing between the states to attract and encourage the growth of the biotechnology industry.

This exciting new industry has grown from nothing to over two hundred firms in less than ten years. Its continuing growth and prosperity is important to California for two reasons. First, it promises new jobs for our growing workforce and economic development for our cities. Secondly, advances in biotechnology will result in new products and processes that will improve health, increase productivity, and enhance living standards across the board. Biotechnology applications will affect virtually every sector of our economy as well, from agriculture to waste management.

The promise of this new industry, however, has not gone unnoticed by state development officials around the country. The attached report documents many of the very active steps that other states are taking to promote the development of biotechnology within their borders, and demonstrates the increasing sophistication of the economic development strategies that are being employed by those states.

While California is not in any imminent danger of losing its 35% share of the biotechnology industry, state policy makers need to be aware of its importance to California and the increasing competition that we are facing. With this background in mind, we also need to review the state's commitment of resources and funding to ensure that California will maintain its leadership position in biotechnology.

We would like to acknowledge the efforts of Assemblymen Sam Farr and Bob Naylor who authored Assembly Concurrent Resolution 170 last year. That resolution called for the attached report and a companion study by the Assembly Office of Research, Review of Federal and State Regulations Affecting the California Biotechnology Industry.

If you have any questions about the attached report, please contact the author, John Griffing, Senate Office of Research, (916) 445-1727.

Sincerely,

DAVID ROBERTI
President pro Tempore
of the Senate

JIM NIELSEN
Republican Floor Leader

ROSE ANN VUICH
Chair, Senate Committee
on Banking and Commerce

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PREFACE

The growing interest of other states in promoting the development of biotechnology has not escaped the notice of either state officials or private industry in California. Increasing concerns of California legislators and private representatives about the growing competition and regulatory climate for biotechnology culminated in the passage in August, 1984, of Assembly Concurrent Resolution No.170. The measure was authored by Assemblyman Sam Farr with Assemblyman Robert Naylor as principal coauthor. Senators David Roberti and Rose Ann Vuich were Senate coauthors.

ACR 170 called for two studies, specifically requesting:

1. "the Assembly Office of Research to conduct a study, to be completed by April 15, 1985, reviewing all existing, pending, and elapsed federal and state regulations affecting the California biotechnology industry"; and

2. "that the Assembly Office of Research and the Senate Office of Research also study incentives being offered by other states and countries to promote the development of biotechnology industry within those states and countries."

The first request was met with the publication of Review of Federal and State Regulations Affecting the California Biotechnology Industry, by James W. Rote, Assembly Office of Research, April 1985.

This report is in response to the second study request. A draft version was distributed to members of the Advisory Committee established pursuant to ACR 170, to Lieutenant Governor Leo McCarthy's Economic Development Commission, the California Economic Development Corporation, and other interested parties. The final version benefitted considerably from the comments received from various members of these groups. The author wishes to acknowledge their contributions, especially those from Norman Goldfarb and Nan Newell of Calgene, Assemblyman Sam Farr, Peter Staple of Cetus Corporation, Brian Cunningham of Genetech, Inc., and James W. Rote of the Assembly Office of Research. Any remaining errors and shortcomings in the report remain the responsibility of the author.

SILICON VALLEY II:

A REVIEW OF STATE BIOTECHNOLOGY DEVELOPMENT INCENTIVES

Prepared by:

John Griffing
Senate Office of Research

August 1985

EXECUTIVE SUMMARY

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During the last decade new discoveries and scientific developments involving recombinant DNA and cell fusion have given birth to a rapidly growing new industry called biotechnology. The number of newly established biotechnology firms now exceeds 200, and various estimates place 30-35% of them in California.

Several other states across the country have shown keen interest in the development of biotechnology and have instituted a number of programs to attract expanding biotechnology firms. In addition, some states have taken major steps designed to "grow the industry" rather than just entice a few plant locations. These steps include expanding state support for biotechnology research and development at state universities as well as in private firms, increased state funding for university biotechnology education and training programs, and the establishment of state programs to provide financial and technical assistance to biotechnology firms.

States with the most ambitious biotechnology programs -- such as North Carolina and New Jersey -- have also created biotechnology centers which offer a wide variety of incentives and assistance to biotechnology firms. In addition to the above noted programs, these centers provide the industry with improved access to university research and technology, technical and financial assistance, and incubator space and facilities. In some states the centers are operated by universities; in others, they operate as nonprofit institutions separate from any single university. In all cases, the centers strive to link the resources and research of universities to the needs of private industry. In addition, they emphasize interdisciplinary, intercampus research. Funding is typically provided through state, federal, and private industry sources.

The strategies that individual states are applying in the pursuit of biotechnology are a good deal more sophisticated and better funded than past state economic development strategies. While it is too early to evaluate the effectiveness of the various state efforts, the degree of sophistication, the levels of funding, and the fact that many feature public-private coöperation with substantial sums of private financing all suggest that these states will be successful in attracting biotechnology firms to and fostering the development of new biotechnology firms within their borders.

There are several reasons why the State of California may want to respond to the competitive challenge from other states. First, California is likely to lose plant expansions, new firms, and employment to other states unless it responds adequately. Secondly, the industry is in need of additional research and development, education and training, and other services of which state government is the principal provider. Third, advances in biotechnology will bestow an enormous range of benefits to society in agriculture, health, forestry, fisheries, pollution control and hazardous waste management, all of which are very important to the State of California.

The options open to the State to assist the industry are relatively straight forward: (1) increase biotechnology R&D; (2) expand education and training in fields related to biotechnology; and (3) establish programs to help the industry meet regulatory requirements and to increase public awareness of the nature of and benefits to the biotechnology industry. A summary of the state's options is presented on page 36.

CHAPTER I:

INTRODUCTION

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> Biotechnology, broadly defined, includes any technique that uses living organisms (or parts of organisms) to make or modify products, to improve plants or animals, or to develop microorganisms for specific uses. [1]

Background

While biological processes and organisms have been used for centuries, for example in baking, brewing, and farming, scientific breakthroughs in the last decade have revolutionized the field. New discoveries and developments in biotechnology, including recombinant DNA, cell fusion, and novel bioprocessing techniques, offer limitless potential for new and improved products, new processes for industry, and indeed, whole new industries. The new biotechnology may, in fact, be the most significant technological revolution of this century when judged in terms of its potential impact.

The range of industries which will be affected by new biotechnology products and processes is staggering. The first and most important area is medicine where the production of insulin, interferon, monoclonal antibody diagnostics, and various vaccines hold tremendous promise. In agriculture, researchers are engineering new crop species which will be resistant to stress, herbicides, and pesticides and will grow more rapidly. New micro-organisms are being developed to inhibit frost formation to reduce frost damage to plants. New organisms and techniques will lead to enhanced oil recovery, help control pollution, degrade toxic waste, and bring other environmental benefits. The chemical industry and food additives will be affected by the new biotechnology. So will electronics with the potential development of biosensors and biochips -- devices that would act as semiconductors using protein molecules.

Many of the promising applications of biotechnology, such as biochips, will not be realized for years, possibly decades. Nonetheless, the potential benefits are overwhelming and a new industry is rapidly emerging. Beginning in the mid-1970s, entrepreneurs from the scientific community began to establish new firms to capitalize on the breakthroughs in biotechnology. The pace of commercialization was particularly rapid in the United States, where in less than ten years more than 200 new biotechnology firms were established.*

The initial spurt of growth in the biotechnology industry has not yet yielded much in the way of job creation, production, or other economic development. Nonetheless, it has caught the attention of an increasing number of state economic development officials, governors, and legislatures. One reason for this attention is that the initial public offerings by two biotechnology firms set Wall Street records and received widespread publicity. Genentech's initial offering in 1980 set a record for the fastest rate of increase in the price of stock (from $35 to $89 in twenty minutes). In 1981, Cetus raised $115 million on Wall Street, a record for initial public offerings at that time.

A second reason for the increased interest of state officials was that the emergence of biotechnology as a potentially large new industry coincided with the rapid growth of new state initiatives

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*Various estimates show California with approximately 35% of these firms.

to promote, develop, and attract high technology businesses. Prior to 1980, only four states -- Massachusetts, North Carolina, Connecticut and Florida -- had programs for the development of science and technology-based industry. Today, at least 33 states have programs aimed at developing high technology industry. Five of the remaining 17 states are launching high technology development programs, and several others are in the planning stage.[2]

The rapid growth of state programs targeted at high technology industry can be explained by a number of factors. The tremendous growth of the electronics and computer industries in California and Massachusetts produced countless economic benefits for those states which, in turn, prompted economic development officials in many of the other states to try to duplicate that success within their own states. Another factor was economic hard times. Following the extended recovery from 1975-1979, the U.S. economy went through a series of ups and downs culminating in the 1982-83 recession, the most severe recession that the U.S. has experienced since the 1930s. On top of these short-term swings, the U.S. economy was (and may still be) undergoing a secular decline in the importance and strength of many of its basic industries, including autos, steel, and rubber, primarily as the result of increasing international competition. The tremendous declines in employment that occurred, particularly in the industrial heartland, led state officials to adopt or modify their economic development strategies in order to pursue new industry and jobs to replace the losses.

A third factor involves the development of federal initiatives to stimulate state programs. In 1979-80, for example, the U.S. Department of Commerce offered several million dollars in matching grants to state programs set up to provide financial assistance to firms engaged in developing innovative technologies. Four states -- California, Indiana, New York and Connecticut --

established innovation development loan programs under this initiative.

The new state programs targeted at high technology were, at least initially, outgrowths of traditional economic development programs. As such, the emphasis was on enticing business firms to expand or locate new facilities in their states. In other words, the early strategies were really marketing programs. While California did very little marketing at the time, it saw plenty of evidence of the marketing efforts of other states. A number of them sent delegations -- some led by governors -- into Silicon Valley to entice California firms to expand or relocate their facilities in their states.

During this period California lost a significant number of jobs and plant expansions (and some firms) to other states and countries. Some of those losses were widely and prominently advertised, such as the Dow Chemical petrochemical facility in Solano County and the transfer of production by Atari to Taiwan. Despite these losses, California has continued to generate new firms and jobs at a clip that has consistently outpaced the rest of the country for the past decade.

A number of reasons have been offered to explain California's continued economic success, particularly the success of its high technology sectors: (1) the excellence of its higher educational institutions, public and private, and the quantity and quality of the research and development work at those institutions; (2) an entrepreneurial climate that has fostered risk-taking and has encouraged entrepreneurs to move new products and processes out of the research labs; (3) the ability of the state to attract labor, particularly skilled workers and scientific and engineering personnel; and, (4) the availability of financing for new and expanding firms, primarily in the form of venture capital.

Although venture capital is an old form of financing new businesses -- some trace its roots to Queen Isabella's financing of Columbus's voyages -- it is only in the last few years that it has come to play a major role in economic development, particularly in California. In fact, California accounts for more than one-third of the venture capital that is raised in the U.S. and more than one-third of the deals that are financed with venture capital.[3]

The factors underlying California's success in developing high technology have been examined carefully by other states. As a result, state economic development programs have begun to show an increasing sophistication. These new state strategies display an increasing awareness of the impact of state and local initiatives on the creation of new businesses and the role that small businesses play in job creation.[4] The new strategies also reflect a shift in emphasis from marketing and "raiding businesses" to strategies which stress "growing their own businesses." It is in this vein that state development officials across the country have begun to look down the road to identify emerging technologies, such as biotechnology, in an effort to locate the next Silicon Valley within their own state borders.

Methodology and Limitations

Although studies of this type are frequently done using formal surveys of state programs, this method was not used in the preparation of this report. One reason is that surveys are of limited accuracy and usefulness unless they are followed up with extensive telephone and personal contacts. Time and resource constraints precluded any such extensive follow-up.

A number of surveys conducted by other organizations were, however, utilized in the preparation of this report. These were

useful for identifying programs specifically targeted to biotechnology and states with particularly active incentive programs. Follow-up correspondence and telephone contacts helped flesh out details regarding funding, functions, and other aspects of the programs related to biotechnology.

These surveys provided a useful starting point, but all suffered from a common limitation -- that of sorting out state biotechnology initiatives from those designed to promote economic development in general or even those more narrowly targeted to the development of high technology. A decision was made not to restrict the study to just those programs that have been established to foster the development of biotechnology. Such an approach would be too narrow in scope and would pass over a number of programs that have been initiated by states to foster the development of all or any new industries based on science and technology. Broadening the scope, however, made it more difficult to identify the appropriateness and importance of specific initiatives to biotechnology.

Another reason for the broader scope of this study is the lack of good information on <u>new</u> programs, which biotechnology incentives are, by definition. Some of these programs are, in fact, just proposals. Although they may have been advertised or publicized as if they were available, some have a number of legislative and executive tests to pass before they become a reality. Other programs have been enacted but are still in the early stages of implementation. Even where programs have been fully implemented, they have not been active for a period of time long enough to assess their effectiveness. Hence, this report provides less in

the way of formal evaluation and analysis of the programs targeted to biotechnology than it offers in description. Nonetheless, it does attempt to apply analysis to various categories and types of incentives, and to borrow lessons from the literature on state economic development efforts in general.

While it would have been useful to conduct a comparative analysis of the competitiveness of biotechnology firms on a state-by-state basis, such a project was beyond the scope and resources of this study. Therein lies another limitation of this report. This study focuses on the incentives that states are offering to attract, promote, develop, and retain biotechnology firms. Those firms, however, do not make decisions based solely on the incentives. Studies of business location decisions typically list 15 to 20 factors that are of importance to their choices. These factors include the cost and availability of labor, market size, transportation cost and access, quality of education, recreational opportunities, state and local taxes, etc. Comparing the competitiveness of different states in attracting and developing biotechnology firms on the basis of these factors is at best a monumental task.

This limitation of the study was commented on by two reviewers of the draft report. One cited the overall cost of doing business in California, suggesting that the State should not lose sight of this in considering the adoption of incentives to promote the development of biotechnology. The overall cost of doing business will become increasingly important over time, the reviewer noted, because a big share of the new biotechnology firms will eventually be acquired by larger, multinational firms. These latter firms are more sensitive to the differences in the cost of doing business in different states (and countries) and are more capable of shopping for the lowest cost locations than start-up companies are.

The other reviewer cited the state tax rate and the unitary tax, in addition to the overall cost of living, as barriers to staffing businesses in California which need to be addressed. In response, it should be noted that California's tax burden, as measured by total state and local taxes per $1000 of personal income, has dropped dramatically since 1978, primarily as a result of Proposition 13. California now ranks 16th among the states compared to fourth before 1978. Moreover, the state's use of the unitary method of corporate income taxation is likely to be changed soon. Senate Bill No. 85 (Alquist), which would enact a major reform in the unitary method, has passed the Senate and is pending in the Assembly.

Organization

A decision was made to organize and present the research findings on a program or incentive basis rather than comparing the biotechnology initiatives of each state with every other. The primary reason for this choice was that the overriding purpose of the report is to study the various types of incentive programs that are being offered in order to draw some conclusions and recommendations for California. Comparing and contrasting the various types of incentives facilitates that process.

The decision to focus on the types of economic development incentives set up a second choice problem -- what categories of incentives should be used? Since economic development incentives come in all shapes and sizes, the choice is not an easy one. Although various surveys exist, the categories differ from one survey to the next.

The most comprehensive analysis that has been conducted in this general area, Commercial Biotechnology: An International Analysis, was done by the Congressional Office of Technology Assess-

ment (OTA) and published in 1984. That report identified ten factors of potential importance in the international competitiveness of biotechnology. The ten factors in rough order of importance are:[5]

- financing and tax incentives for firms
- government funding for basic and applied research
- personnel availability and training
- health, safety, and environmental regulation
- intellectual property law
- university/industry relationships
- antitrust law
- international technology transfer, investment and trade
- targeting policies in biotechnology
- public perception

This list of factors served as the starting point for categorizing state biotechnology incentives for this chapter. Three adjustments to the list were subsequently made. First, the factors important solely to international comparison were eliminated. The primary purpose of the OTA study was to analyze the international competitiveness of biotechnology in the U.S. versus Japan, West Germany, the United Kingdom, Switzerland, and France. Hence, trade, technology transfer, and antitrust policies were important in the OTA analysis. These policies, however, tend to be national, varying from country to country, but essentially uniform across subnational jurisdictions such as states.

A second modification to the OTA list was the elimination of the regulatory category since this was the subject of a separate study requested by Assembly Concurrent Resolution 170. A final adjustment was made to accommodate novel categories of incentives that states are offering.

The resulting list contained the following six categories of incentives, around which Chapter II is organized:

- Financial assistance -- direct
- Financial assistance -- indirect
- Information and technical assistance services
- Research and development
- Education and training
- Technology centers

As the reader will no doubt discover, the list is still somewhat arbitrary, and the categories are not necessarily mutually-exclusive. Moreover, some state programs could be listed under one or more of the categories. In fact, some state programs are multipurpose and thereby fall into several of the categories. An effort was made to avoid double counting by sorting the programs on the basis of their primary function and listing them only once. Most of the multipurpose programs are described under the final category, technology centers.

CHAPTER II:

STATE BIOTECHNOLOGY INCENTIVES

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Financial Assistance - Direct

Direct financial assistance for business expansion is one of the most widely available tools of state economic development programs. Most states offer tax-exempt financing in the form of industrial revenue bonds which typically lower the interest costs to business borrowers by 25% to 35%.[1] Direct loans and/or loan guarantee programs are also offered widely. According to a 1983 Council of State Government's survey, at least 24 states offer such assistance.[2]

Although the industrial revenue bonds, direct loans, and loan guarantees offered by state economic development programs are generally available to biotechnology firms and other high technology related businesses, such financing programs were not designed with the technology-based firms in mind. Indeed, these programs preceded the birth of most modern high technology firms and were designed for general business firms. As such, they do not take into account the specialized needs of high technology businesses. Furthermore, the demand for such assistance far exceeds the available supply.

As state economic development strategies have shifted focus in the last few years, several states have established financial assistance programs targeted to high technology businesses. One oft-cited example is the Massachusetts Technology Development Corporation (MTDC), a quasi-public corporation founded in 1979. MTDC provides venture capital in the form of "seed capital" in conjunction with other private investors. Since its inception, MTDC has leveraged $50 million in private financing with $6 million of its own funds, and has invested in 27 companies.[3]

More traditional loan programs targeted to high technology firms have also been started in several states as a result of a pilot federal program in the late 1970s and early 1980s. Included in this category are the California Innovation Development Loan Program, the Connecticut Innovation Development Loan Fund, and the Corporation for Innovation Development in New York. These programs are evidence of the shift in development strategies that has occurred; their objective is to foster the development of new technology through loans to relatively young firms, rather than simply providing loans to the more traditional business recipients. The programs, however, have been hampered by a lack of funding -- initial capitalization for each corporation was only $1 to $2 million.

Financial Assistance -- Indirect

The lack of adequate funding for the innovation development loan programs is symptomatic of the reluctance of state governments to provide direct financial assistance to business firms. States have been less hesitant to offer indirect financial assistance, especially through tax incentives, which leave the actual financing decisions in the hands of private investors.

Since nearly every state offers one kind of tax incentive or another for business expansion, it would be difficult and of little use to catalogue those incentives here. Three recent tax incentives targeted to the development of high technology companies are, however, noteworthy. The State of Indiana allows a tax credit of 30% on individual investments in a venture capital pool that is administered by a state-chartered, privately-owned, non-profit Corporation for Innovation Development. The pool is privately funded with no state contributions.[4] Minnesota recently enacted a tax credit of 30% of the value of the technology transfer that occurs when a small business is spun off from a parent

firm as a means of encouraging additional technology development and more spin-offs.

The State of California took a novel approach to encouraging additional venture capital investment in startups and other small businesses when in 1981 it completely eliminated capital gains for investments in eligible "small business stock" held for three or more years. The enabling legislation, Senate Bill 690 by Senator Presley, took effect in 1982.[5] A bill to liberalize the benefits of this tax incentive, Senate Bill 1497 (Torres), passed the Legislature in 1984, but was vetoed by Governor Deukmejian.

Another potential source of indirect financial assistance for business development -- pension funds -- has now been made available by at least two states. Michigan recently enacted a law allowing up to five percent of its state pension fund to be used for risky investments. Pennsylvania now allows one percent of its retirement funds for such investments.[6] In California, a constitutional amendment to increase the percentage of state pension funds that could be used for risky investments failed to receive a majority vote of the electorate in 1982. This amendment would have allowed the State to invest up to 5% of its pension funds in the stocks of smaller companies (those with less than $100 million in assets) and of companies whose shares are not traded publicly (such as start-up businesses).[7]

Information and Technical Assistance Services

Perhaps the most ubiquitous of state-offered economic development incentives is the provision of general business information and related technical assistance. According to a 1983 survey by the Council of State Governments, 48 of the 50 states offered such services.[8] Site location information and assistance, one-stop permit assistance, labor force availability and characteristics,

energy cost information, etc. are common examples of the types of information and assistance that are provided to prospective business clients of state economic development offices. They are usually offered as part of a state's effort to recruit business firms to locate or expand in that state. In addition to state efforts, hundreds of local communities, often in conjunction with local chambers of commerce or other nonprofit organizations, provide similar services.

Although information and technical assistance services are generally available to all types of business firms, some states have begun to focus such efforts on industries which promise better than average long-term growth. The economic development agencies in California and North Carolina, for example, have targeted biotechnology as an emerging industry and have developed recruitment programs to encourage expansion and location of biotechnology firms in their respective states.

The California Department of Commerce held a one-day conference with biotechnology industry officials in 1984 to identify needs, site location factors, and expansion problems of the industry. Subsequently, the department prepared an "insert" for its recruitment brochures featuring biotechnology and showing how California can meet the needs of expanding biotechnology firms. The department also plans an intensive mailing and recruitment effort of the biotechnology firms that it has identified.

North Carolina has pursued a course similar to California's, although it has been more aggressive and has committed more resources to the effort. A novel aspect of its program has been an appropriation to the North Carolina Department of Commerce and the North Carolina Biotechnology Development Center to sponsor workshops and conferences to enhance the perception of North Carolina as a leader in biotechnology and to improve the under-

standing of biotechnology among all sectors of North Carolina society. This effort will continue if the North Carolina Legislature approves the recommendations of the Biotechnology Study Committee of the Legislative Research Commission. Following two years of study and hearings, the committee recommended a $200,000 appropriation to the Department of Commerce for the general promotion of biotechnology as part of a $70 million, 5-year, set of recommendations to enhance North Carolina's position in biotechnology.[9]

A number of states have moved beyond the information providing and recruitment activities and into technical assistance services. This seems to be especially true for states which have targeted high technology as part of their economic development strategies. New Hampshire has put together a Venture Capital Network consisting of two data bases; one on entrepreneurs and their products or ideas, the other on individuals wanting to invest in startups. The network program attempts to match willing investors with promising new ideas or products without any direct investment by the state in the technologies or firms.

Other states feature more ambitious technical assistance programs designed to address a wide variety of needs of small firms and start-up operations. Georgia, for example, has established an Advanced Technology Development Center at the Georgia Institute of Technology which "runs interference for entrepreneurs," helping them arrange for suitable bankers, venture capitalists, accountants, and law firms.[10] The Wisconsin Innovation Center, located in the University of Wisconsin business school at Whitewater, helps inventors evaluate the commercial feasibility of new product ideas. Connecticut has established a full service operation in the form of the Connecticut Product Development Corporation (CPDC), which was started in 1975. The focus of CPDC's activities is on new product development rather than busi-

ness startups, but it provides assistance in developing business plans, market identification and development, and financial feasibility analysis.

As an outgrowth of the technical assistance function, several states have set up new business "incubators" to encourage new business startups. The incubators offer office and laboratory space, usually at below market rents, technical and business assistance, and expensive equipment that can be shared by several aspiring entrepreneurs. Incubators are generally located on or adjacent to university campuses to encourage the transfer of technology to the private sector and the development of commercially viable new products, processes, and firms. North Carolina, however, has chosen to locate its incubators around the state as a means of spreading the new technology and economic development to all corners of North Carolina.

Two other states that operate incubator programs are Georgia and Pennsylvania. The former established one of the first state-sponsored incubators at the Advanced Technology Center at the Georgia Institute of Technology. Pennsylvania operates 16 incubators, more than any other state. During a recent two-year period, employment growth at the incubated companies in Pennsylvania averaged 200%.[11]

Most of the existing and planned incubators are "generic" in the sense that they are designed to provide assistance to and encourage the development of new technologies in any and all fields. However, the Massachusetts Biotechnology Research Institute has tentative plans to build a small business incubator as one component of the Massachusetts Biotechnology Research Park in Worcester.[12] The incubators in North Carolina are also "generic" and operate under the North Carolina Technological Development Authority. However, much of the impetus for the incubators came

from the Biotechnology Study Committee which was convened by the state legislature.[13]

Stimulating Research and Development

While most states have been reluctant to provide much in the way of conventional financial assistance to firms, they have been less hesitant to offer funding for research and development (R&D) activities. The primary reason appears to be that public financing of R&D, particularly in public universities, is an accepted, time-honored function of government. Moreover, R&D financing does not compete with the private sector in the way that conventional financial assistance might compete with banks, venture capitalists, and other private lenders.

As measured by the emergence of new programs, state support for R&D appears to be on the increase. Two reasons account for this. First, states which have suffered severe employment losses as the result of increasing international competition, have turned to new technologies as a means of arresting those losses. Secondly, states intent upon emulating the Silicon Valley model have recognized the need to build competitive R&D capabilities in their states. The success of the electronics and computer industries in California and Massachusetts was due in no small way to the quantity and quality of research work that was done at nearby universities. As a result, state economic development strategies no longer rely on luring the expansions of successful high technology firms. Sophisticated strategies now stress the capability of a state to "grow its own industry," which in turn requires the state to possess its own R&D capacity.

Although a number of states are increasing university funding for R&D in various high technologies including biotechnology, the new programs differ in three important respects. One, they fre-

quently provide grants for R&D work by private firms as well as by universities. Secondly, they emphasize joint funding, i.e. public and private contributions, more now it appears than in the past. Thirdly, the funding is often directed to a research institute established for specified purposes rather than to the university's budget.

An example of state support for private R&D is the Connecticut Product Development Corporation (CPDC) which was discussed earlier. The CPDC funds up to 60% of the costs of the R&D work necessary to turn a product idea into a prototype. The CPDC does not specialize in high technology nor does it finance conventional business activities. The emphasis is on developing new ideas into usable, useful products which will have economic significance for the state. The most unusual feature of CPDC's program is royalty financing in which the state receives a royalty of one to five percent on the sales of any product which it helps develop. The advantage of royalty financing to the firm is that it does not have to sacrifice any equity as it would with venture capital financing, nor does it have to meet the fixed schedule of interest and principal payments that conventional debt financing entails.

The State of Michigan has established the Michigan Research Fund which grants up to 75% of the costs incurred in developing products and processes that will help create jobs and diversify Michigan's economic base. Unlike the CPDC, Michigan's program targets four specific technologies: automated manufacturing, genetic engineering, health and medical devices, and food processing. A recent grant of $40,000 was made to Covalent Technology to develop in-home medical diagnostic kits using monoclonal antibodies.[14]

In 1982 Indiana set up a Corporation for Science and Technology to stimulate the development of science and technology. The nonprofit corporation is under the control of a board of directors representing state and local government, private industry, and education. Two recent grants were awarded by the Corporation for biotechnology research. $4.5 million was given to Purdue University to conduct biotechnology research on new and improved crop strains, to improve biotechnology training methods for students, and to create a science base that will simulate the growth of biotechnology firms in Indiana. The institute for molecular and cellular biology at Indiana University received $1.2 million to establish two research centers to produce specific antibodies for cellular research and to clone rare gene sequences for genetic research.[15]

North Carolina has embarked upon the most ambitious effort among the states to promote and develop the biotechnology industry. The cornerstone of that effort is the North Carolina Biotechnology Center (NCBC) which was founded in 1981 to serve as a catalyst for biotechnology development throughout the state. The primary goal of the NCBC is to "stimulate multi-institutional and multi-disciplinary research and education programs in science areas related to biotechnology." Approximately $1.5 million per year is provided to the NCBC by the North Carolina Department of Commerce to support its research programs. In addition, NCBC seeks matching funds from industry and the federal government on a project-by-project basis. For example, the U.S. Navy recently committed $675,000 for a three-year interdisciplinary research project in biotechnology materials.

One of the NCBC programs involves providing "seed money" grants to support promising new research and education initiatives in universities and small businesses. Grants range from $5,000 to $20,000 for up to 18 months and are awarded on a competitive

basis in response to a "request for proposals" put out by NCBC. Last fiscal year, $220,000 in grants was awarded. NCBC officials expect this year's total to increase slightly, although the final tally will depend upon the quantity and quality of the proposals that are submitted.

A similar grant program is operated by the North Carolina Technological Development Authority. The goal of this program is to stimulate entrepreneurial activity and technological innovation in the high technology industries, broadly defined. Nonetheless, there is some overlap with the NCBC grant program. For example, 20% of the 1983-84 proposals submitted to the Technological Development Authority were biotechnology-related.

North Carolina has also taken steps to build up its biotechnology research capacity in the University of North Carolina system. Based upon the interim recommendations of the Biotechnology Study Committee of the Legislative Research Commission, the North Carolina Legislature appropriated $2.96 million to the university system in 1984. One million dollars was earmarked for the recruitment and hiring of faculty and students, and two million was set aside for construction and renovation of laboratory facilities for use by the new faculty and students. The specific recruitment targets recommended by the Biotechnology Study Committee were: 4 world-class biotechnology scientists or engineers, 4 excellent junior professors in biotechnology, 8-10 post-doctoral fellows, and 8-10 graduate students.[16]

In December, 1984, the Biotechnology Study Committee issued its long-term recommendations which amounted to a proposed investment of $70 million in new funds over a 5-year period to promote bio-

technology research and development in North Carolina. Specific recommendations include:

- $24 million to the NCBC for its programs and "to expand its competitive basic and applied research grants to private and public institutions in the state and occasionally to private research entrepreneurs."
- $24 million to the University of North Carolina system to develop a world-class program in biotechnology research and education.
- $17.2 million to the University of North Carolina system to provide space for the new biotechnology programs.
- $2.7 million to be used as a one-third match for the construction of bioprocess engineering facilities.[17]

Although the North Carolina Legislature has not yet acted on the recommendations, biotechnology officials are optimistic that most, if not all, of the funds will be appropriated.

North Carolina's attempt to leverage private R&D dollars with public funding -- also known as "challenge grants" -- is becoming a more common feature of state efforts to stimulate R&D activity. California was one of the first states to employ this method when in 1981 it established the Microelectronics Innovation and Computer Research Opportunities (MICRO) Program at the University of California. The goals of the MICRO program are twofold: (1) to expand University-based research on problems of importance to helping California's electronics and computer industries maintain their international competitiveness, and (2) to expand graduate student education at the University in these fields. Research projects are jointly funded by the State and private industry, and each faculty member is responsible for obtaining a prior

commitment from an industrial firm to support at least half the cost of his or her project. Graduate student education is supported through research assistantships tied to funded projects and through Fellowships.

The State appropriated $1 million to the MICRO program in 1981-82, its first year of operations. The annual appropriation was increased to $2 million in 1982-83 and again in 1984-85 to $4 million. The private sector response to the program has been enthusiastic as judged by the level of private contributions. Each year the program has been oversubscribed, and each state dollar spent on research has leveraged an average $1.95 in private contributions of cash and equipment.[18]

Education and Training

The arbitrariness of separating state biotechnology initiatives into distinct categories is most evident in the case of education and training versus research and development. In most state programs, at least those which are university-based, the categories are really joint goals. Nonetheless, it is useful to make the distinction. Programs stressing education have different needs -- in degree if not in kind -- than those which stress research. Moreover, research programs can and do operate through private firms, nonprofit institutions, and other non-educational institutions as the previous section illustrated.

The importance of education and training to the emergence of high technology industries has been documented in numerous reports and studies. While university research may have generated the ideas for new products and processes, the educational programs have produced the entrepreneurs and the critical mass of scientists, engineers, and technicians necessary to the successful operating of modern technology-based companies. This is readily apparent

in the field of biotechnology and is one of the key factors in explaining the current lead the U.S. enjoys in the commercialization of biotechnology. However, as the Office of Technology study found out, "the U.S. does not have more than a handful of training programs for personnel in the more applied aspects of biotechnology, nor does it have government programs, such as training grants, to support training in these fields. The training of bioprocess engineers and industrial microbiologists will require greater interdisciplinary cooperation between engineering and biology departments within universities."[19]

As states have updated their development strategies to encourage the growth of high technology industry, education and training programs have received perhaps the most attention. One reason is that high technology firms have consistently ranked the quality of education and the availability of a skilled workforce high on their priority lists. Another reason is that education and training, even more than research support, have been traditional responsibilities of government. As a consequence, there has been little formal resistance to expanding education and training programs in support of high technology industry.

Virtually every state has done or claims to be doing something to expand or improve the science and technology departments at its colleges and universities.[20] Most of these efforts are generic to high technology, but a few are specific to biotechnology. For example, Maryland set up an Applied Molecular Biology program at the University of Maryland which graduated its first eleven students in 1984. The two-year Master's Degree program emphasizes biochemistry lab skills, DNA techniques, microbial genetics, immunology including hybridoma production, and summer internships with private industry. Funding is provided through the university budget from the state and from private industry contributions of scholarships, equipment, and laboratory products. Each

member of the graduating class received multiple job offers and starting salaries averaging $26,500.[21]

North Carolina's ambitious leap into biotechnology, described in part in the prior section, includes a strong educational component. The Legislature appropriated $3 million in 1984, as a continuing appropriation, to build the nucleus of a world-class educational and research capability in biotechnology. One million dollars was designated to hire four world-class technology scientists and engineers, four excellent junior professors, and approximately twenty postdoctoral fellows and graduate students. The remaining two million dollars was earmarked for office space and laboratory construction for the new faculty and students. If the long-term recommendations of the Biotechnology Study Committee are accepted, another $70 million will be appropriated in a five-year program emphasizing education and research. The bulk of the funds will be appropriated to the University of North Carolina system to expand biotechnology research and education programs and to build classroom and laboratory facilities. Another major share of the funding will go to the North Carolina Biotechnology Center which has as one of its primary goals the stimulation of multi-institutional and multi-disciplinary education programs in biotechnology sciences.

California has led the nation in the commercialization of biotechnology due to its strong basic research capabilities, an abundance of venture capital financing, and an entrepreneurial climate. While university programs have played a part in the basic research behind the new products and processes of the new industry, the needs of the industry are changing as it enters the commercialization stage. Production and marketing require more and in many cases different kinds of trained personnel. This is not to say that the need for highly trained scientists and engineers is any less; it is not. The need for all kinds of top

flight scientific research talent continues to grow. However, full commercialization and production of different biotechnology products does require a different mix of trained personnel than pure research.

In response to the growing interest in biotechnology and perhaps the increasing competition from other states, the University of California proposed the establishment of a new Biotechnology Research and Education Program as part of the Governor's proposed budget for 1984-85. Initial funding was set at $1.5 million per year, although this amount is expected to increase significantly in subsequent years.

In a background paper on the needs and goals of the proposed program, the university identified three major personnel needs: (1) highly skilled scientists for the biotechnology industry; (2) qualified faculty for the university to undertake innovative research; and (3) new professors to replace those faculty members who have left academia for private sector positions. The paper goes on to illustrate that the personnel needs are not due to any shortage of willing students.[22]

> "Nearly all campuses must turn away significant numbers of qualified students each year. San Francisco, for example, could only accept 18% of its qualified applicant pool of 500 in 11 biotechnology-related programs in 1983-84. Santa Barbara and Santa Cruz each turn away approximately 75 qualified students annually because of insufficient resources. Irvine, whose biotechnology graduate student pool in eight programs numbers approximately 280, would like to expand to 400 students if funding were available."

Technology Centers

This final category of state incentives is not a proper subset of incentives. However, the development of technology centers has been so widespread and so important that it warrants separate treatment.

Initially set up to support electronics, robotics, and other high technology industries, technology centers for biotechnology are proliferating. The centers typically offer a wide variety of incentives and assistance to biotechnology firms including research and development support, education and training, access to university research and technology transfer, technical assistance, and incubator space and facilities. In some states the centers are operated by universities; in others, they operate as nonprofit institutions separate from any single university. In all cases the centers strive to link the resources and research of universities to the needs and activities of private industry. Funding is typically provided by the state in conjunction with contributions from private industry. Most centers also actively recruit federal funds for research projects, facilities, equipment, and other programs of the centers.

Billed as the first state-sponsored initiative in biotechnology, the North Carolina Biotechnology Center (NCBC) is clearly the flagship of state technology centers. NCBC was founded in 1981 by the state legislature as a nonprofit corporation to encourage and facilitate closer interactions among researchers, universities, industry, venture capitalists and government. It is located in Research Park Triangle in proximity to a number of universities and schools of medicine, veterinary medicine, engineering, and agriculture. NCBC's goals and objectives are to:

- Stimulate multi-institutional and multi-disciplinary research and education programs in science areas related to biotechnology.

- Provide "seed" money" to support promising new research and education initiatives in universities and small business.
- Facilitate mutually beneficial collaboration between universities and industry.
- Promote development of new and existing companies in North Carolina through linkages among entrepreneurs, industry, scientists, financial institutions, and state and local economic development groups.
- Improve the understanding of biotechnology among all sectors of North Carolina society.

The list of programs and activities that are sponsored by the center is a long one and includes: a newsletter and various publications, workshops and conferences, a visiting scholars program which places industrial scientists and engineers in faculty positions, recruitment of biotechnology firms to North Carolina, research and development programs, and the Monoclonal Lymphocyte Technology Center. The state currently provides $1.5 million annually to the center's budget. Industry funding is sought on a project-by-project basis and to date has amounted to about the same as state funding. The center also recruits federal funding from NSF, NIH, and other sources. It is currently working with the U.S. Navy on a $675,000, three-year research project in biotechnology materials. NCBC is not doing the research itself, but is arranging the subcontracts and handling all of the paperwork. It charges no overhead.

As noted earlier, the Biotechnology Study Commission of the Legislative Research Commission of North Carolina recently recommended the investment of $70 million in additional funds for

a comprehensive long-term (5-year) program to promote biotechnology in North Carolina. The recommendations included:

- $24 million to the NCBC to help enhance the economic impact of biotechnology research, to promote biotechnology development throughout the state, and to expand its research grant program.

- $1.12 million to the NCBC to initiate construction of a new facility to carry out its increased responsibilities. Additional funds are to be sought from public and private sources.[23]

The State of New Jersey has launched a biotechnology program that parallels North Carolina's in scope and magnitude. The New Jersey plan, as with several other states, stems from the work of a state task force, in this case the Governor's Commission on Science and Technology. This bipartisan, blue-ribbon panel of industry and government officials held its first meeting in September 1982 and concluded its activities in June 1984. The Commission studied the composition of the New Jersey economy, examined the role and promise of high technology industry, appointed several task forces to delve more deeply into specific topics, and finally developed a set of recommendations -- unanimously supported by the commissioners -- regarding the future opportunities for job growth and economic development in New Jersey.[24]

The cornerstone of the Commission's recommendations was a $90 million bond act which was enacted by the Legislature and

passed by the state's voters in November, 1984. Key features of the bond act are:[25]

- $42 million for the establishment and construction of a network of advanced technology centers at the state's public and private institutions of higher education which may include, but are not limited to centers in biotechnology, food science, hazardous and toxics substance management, and industrial ceramics;
- $15 million for advanced technology centers in areas of future economic development;*
- $23 million for the construction and improvement of undergraduate technology and engineering facilities and equipment for higher technology job training and retraining programs to be apportioned equally among the county colleges, private higher education and four-year public higher education institutions;
- $10 million to be allocated by the State Board of Higher Education for necessary capital construction for community college engineering facilities.

Subsequent to its passage, four bills were introduced in the 1984-85 legislative session to enact specific provisions of the Bond Act. One of those bills, Senate Bill 1654, establishes the New Jersey Commission on Science and Technology to replace the former Governor's Commission which had expired. The new commission is to be a part of, but operate independently of, the New

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* The Bond Act specifies that the establishment of an advanced technology center shall include a commitment from industry to finance a percentage of the center's operating costs.

Jersey Department of Commerce and Economic Development, and its major responsibilities will include:[26]

1. to assist in the establishment and to coordinate the activities of the advanced technology centers;
2. to stimulate other forms of academic-industrial collaboration;
3. to supervise the process of awarding innovation partnership grants;
4. to stimulate technology transfer between institutions of higher education and industry;
5. to support research opportunities at academic institutions and other institutions that can advance economic development and employment; and
6. to encourage and coordinate activities to help entrepreneurs and inventors.

A second bill, Assembly Bill 1764, provides for the establishment of Advanced Technology Center in Biotechnology (ATCB). Both bills, AB 1764 and AB 1654, have passed both houses of the New Jersey Legislature and are expected to be signed into law by the Governor.

The ATCB provided for in AB 1764 is to be jointly governed by Rutgers University and the University of Medicine and Dentistry of New Jersey, although other public and private institutions of higher education are to participate in the work of the center. The functions of the center are:[27]

1. to establish programs to promote biotechnology research and industries;
2. to support and promote existing programs in biotechnology and ensure that all sectors of private industry have access to the personnel and programs of the center;

3. to make low-cost business incubation facilities available to new industry working in the field of biotechnology;
4. to promote technology extension services to business engaged in biotechnology-related applications; and
5. to make recommendations to the New Jersey Commission on Science and Technology (as provided for in AB 1654) concerning innovation partnership grants.*

The ATCB is slated to receive $20 million from the $90 million bond issue and an additional $20 million from Rutgers University and the University of Medicine and Dentistry of New Jersey under an independent bond issue. The money will help construct new facilities and supplement existing resources at other research institutions. For fiscal year 1985, the Governor's Commission on Science and Technology put in $1.2 million in operating funds for the center. An additional $600,000 will go toward the innovation partnership grants.[28]

Although the biotechnology centers in North Carolina and New Jersey represent the most ambitious efforts, a number of other states have established similar, if more modest, programs. These states include New York, Maryland, and Virginia. Their programs are briefly summarized below.

New York -- Through its Science and Technology Foundation, the State of New York has established several centers for advanced technology, two of which focus on biotechnology. The Cornell center specializes in agricultural biotechnology, and the center at the State University of New York at Stony Brook emphasizes

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* In the legislation, innovation partnership grants are defined as "matching grants to academic researchers performing applied research in emerging technologies at the state's public and private institutions of higher education which are of strategic importance to the New Jersey economy."29

medical biotechnology. The programs are jointly funded by the state and by private industry. The Cornell center receives $1 million annually from the Science and Technology Foundation, and so far has three corporate sponsors which have signed six-year contracts totalling $2.5 million each. The medical biotechnology center at Stony Brook has 11 corporate sponsors. The programs promote research productivity by concentrating researchers in one building, which also helps reduce costs by allowing expensive equipment to be shared, and they stress interdisciplinary research. Program funds are to be used for faculty research grants, recruiting faculty and setting up labs, centralized research facilities and specialty labs, educational programs for faculty and industry, industry-faculty exchange, and services and facilities to foster the establishment of small biotechnology companies.[30]

Virginia -- The Commonwealth of Virginia has established a Center for Innovative Technology to promote research, to foster industry-university cooperation, and to serve as a broker between industry and university regarding research needs and ongoing research activities. The center has a two-year budget with $19 million for joint industry-university research and development at the state's three principal research institutions -- the University of Virginia, Virginia Tech, and Virginia Commonwealth University. The program supports research and development in all technologies, not just biotechnology.[31]

Maryland -- Maryland has established a Biotechnology Institute at the University of Maryland that will serve as an umbrella organization for a Center for Advanced Research in Biotechnology. The center is being set up as a collaborative effort between the university, industry, and state, local, and federal governments to focus on biomedical, marine biology, and agricultural applications. The center, which is currently in the design phase, will

feature research facilities, a hookup to the National Bureau of Standards, and incubator facilities for new biotechnology ventures.[32]

Conclusions

Three conclusions emerge from the review of the incentives and other programs that states are providing in their efforts to attract and promote biotechnology.

(1) A number of states are aggressively pursuing the new industry in order to attract firms, to encourage the development of new firms, and to foster the diffusion of new biotechnology products and processes within their states.

(2) The strategies that states are applying in the pursuit of biotechnology are a good deal more sophisticated and better funded than past economic development strategies, which have been, more often than not, marketing efforts designed to encourage firms to locate new production facilities in their states.

(3) It is too early to evaluate the effectiveness of these biotechnology efforts by the states. A number of the incentive programs are actually proposals, while others are still in the start-up stage. The oldest programs are only three to four years old. Nonetheless, the degree of sophistication shown by the new programs, the levels of funding, and the fact that many feature public-private cooperation with substantial sums of private corporate financing all suggest that these states will be successful in attracting biotechnology firms to and fostering the development of new biotechnology firms within their borders.

CHAPTER III:

OPTIONS FOR CALIFORNIA

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At-a-Glance Options for Promoting Biotechnology

A. Provide Financial Assistance to Biotechnology Firms

B. Help Expand Biotechnology R&D Activity

1. R&D Tax Credit
2. Direct State Expenditures

    a. University R&D
    b. Matching Grant Program
    c. Grants to Small R&D Firms

C. Increase Education and Training Funding

D. Provide Technical Assistance and Information

1. Public Education
2. Regulatory Assistance

E. Establish One or More Biotechnology Centers

Should the State of California Respond?

One school of thought argues that the best thing that state government, indeed all government, can do is to stay out of the way and let the industry operate and prosper without any interference or assistance. Proponents of this view often cite the success of California's electronics and computer industries as evidence that high technology industry can flourish without government.

This view is, of course, oversimplified and glosses over the role that government has played in the development of high technology industries in this country. The federal government, and to a lesser extent, state governments, have funded much of the under-

lying basic research and development, provided education and training for scientific and technical personnel needed by industry, and helped in the development of the markets for a wide range of high technology products from military hardware to medical equipment.*

There are several reasons why a response from the government of California in support of biotechnology might be appropriate. First, as the previous chapter indicates, other states and countries are mounting a serious challenge in their efforts to develop a biotechnology industry within their borders. If California expects to maintain its share of this industry, it is likely that it will have to rise somehow to meet this challenge. Otherwise, it is likely to lose plant expansions, new firms, and employment to other states.

A second reason the State should consider responding is that the biotechnology industry is currently in need of additional research and development, education and training, and other services of which state government is one of the principal providers. A third reason is independent of the potential job development benefits that biotechnology holds in store. Biotechnology will be one of, if not the, dominant technology in the next two or three decades, and will bestow an enormous range of benefits to society in agriculture, health, forestry, fisheries, pollution control, and hazardous waste management, all of which are very important to the State of California.

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* Government regulatory policies have also often been a significant factor in influencing industrial development. Those who are opposed to government assistance for biotechnology development are typically in favor of less regulation as well. Since it is the subject of a separate report, recommendations regarding regulatory policy will not be treated here. [1]

State Options for Promoting Biotechnology

A. Provide Financial Assistance

Although a number of states have embarked upon programs to help provide financial capital for high technology startups and expansions, there is at this point in time no such identified need in California. As noted earlier, California leads the country in raising and committing venture capital, which is one reason that the biotechnology industry has flourished in this State. A second argument against providing public capital is that the State is probably not a better judge than private markets of the risks and benefits of biotechnology investments. Although some state programs have been successfully implemented, they are relatively small and unlikely to have much of an impact, if any, on the development of the overall industry.

B. Help Expand Biotechnology R&D Activity

Rather than provide financial assistance, the State could help fund additional research and development either through an R&D tax credit or through direct appropriations. This option would not only address an identified need of the biotechnology industry, it would help them to meet indirectly their needs for financial capital. The need for additional R&D has been articulated by the OTA study[2], in the incentives that other states are providing, in hearings before the California Assembly Committee on Economic Development and New Technologies[3], and in meetings of the task force established pursuant to Assembly Concurrent Resolution 170[4]. Given the importance of stimulating additional R&D, both the tax credit and direct expenditure approaches will be addressed.[5]

1. R&D Tax Credits

One way to increase biotechnology R&D would be to allow tax credits to firms reporting such expenditures above and beyond the deductions that are already permissible against their state corporate income tax liability. Such a tax credit would of necessity be available for R&D across the board, i.e., not restricted to R&D related to biotechnology.

By using tax credits to stimulate R&D, government interference in the actual research and development work of private firms could be avoided. In addition, it would circumvent the problems of patent rights and proprietary knowledge that arise under joint private-public R&D ventures. On the other hand, tax credits have several drawbacks, particularly at the state level:

- At the state level the incentive of a tax credit is diluted by loss of deductions against the Federal Income Tax. As a result, an approximate 50¢ incentive is provided to a firm for each dollar of state revenue loss (i.e., it costs the State $1 to give a 50¢ tax break).

- For young R&D intensive companies, which are generally unprofitable in their early years, a tax credit is of little or no value. Unless rebateable, a tax credit will favor established companies.

- There is little empirical evidence that an R&D tax credit will stimulate much additional R&D spending. One way to circumvent this would be to introduce a threshold test. For example, firms might be eligible for an R&D tax credit if, and only if, their R&D expenditures exceed their average R&D expenditures for the previous three years. Under such a rule, firms would be eligible for the tax credit only if they actually increased their R&D spending. This type of requirement is embodied in the federal R&D tax credit.

- Another difficulty with R&D tax credits relates to the definition of what constitutes R&D spending.

- Scope of coverage is also a problem with the simple R&D tax credit. A substantial portion of R&D expenditures is directed at product and package design and other marketing type goals. There are no justifiable economic grounds for subsidizing such activity, yet it is not clear how an R&D tax credit can be designed to exclude those activities.

- Another drawback to a straightforward tax credit for R&D expenses is the potential revenue loss to the State. According to estimates by the U.S. Treasury Department, the federal revenue loss from the 25% incremental federal tax credit is $700 million per year. If a similar credit were enacted in California, at say a rate of 10% rather than the federal 25% rate, it would reduce California's franchise tax and personal income tax by some $35 to $50 million per year, according to some estimates.

An alternative to the simple tax credit would be to grant tax credits to private firms for contributions to specified R&D centers, including but probably not limited to biotechnology centers. University-based research foundations would be the most likely recipients of such contributions, but eligibility could be extended to cover nonprofit industry research centers as well.

This type of tax credit nevertheless faces similar difficulties as tax credit based on in-house research. Dilution of state incentive due to the federal tax code remains a severe obstacle. The problem of defining acceptable R&D remains to some degree and might be complicated by requiring a list of acceptable institutions to receive corporate donations, as well as designating what the donations can be used for.

2. Direct State Expenditures

Direct state expenditures for basic and applied research is the only general alternative to state tax credits as a method of stimulating biotechnology R&D. Direct support can be provided in a number of ways.

a. The State could expand funding for university-based biotechnology research in priority areas. The 1985-86 state budget, for example, appropriated $1.5 million for a Biotechnology Research and Education Program at the University of California.[6] While not an insignificant amount, the ambitious efforts of other states suggests that the Legislature should consider substantially larger appropriations.

b. The State could institute a program of grants to universities and other nonprofit institutions to match research donations made by private firms along the lines of the Microelectronics Innovation and Computer Research Opportunities (MICRO) program at the University of California. The rate of matching could be flexible to reflect the priority given to the proposed project and the availability of federal funding. The university could act as the "broker" or entrepreneur between corporations and the state funding agency so that firms do not have to deal directly with state government.

c. The State could provide direct grants to research-intensive small firms to perform applied research in priority areas. This program would be modeled after the National Science Foundation's small business innovation program, in which small research firms receive initial grants for basic work in priority areas, and they are eligible for larger grants for development work if the research produces a product or process with significant commercial application. Several states, as noted in Chapter II, have established similar programs to foster additional research and development work in biotechnology and other areas.

Defining eligible research and development expenditures remains an issue with grants. Whether grants are provided to universities or directly to firms, someone or some institution must determine eligibility. In all three general cases, general categories might be defined and proposals solicited. Where the State is simply responding to university proposals, no necessary private participation occurs. If state funds are used to match private donations to research institutions, then within priority areas, the initiative lies with the private sector, with universities acting as intermediaries and entrepreneurs. Direct state grants to small research firms in priority areas would be directly responsive to private initiative, but would retain final approval in public hands.

A necessary result of direct grant programs is that greater targeting is purchased at the cost of public bureaucracy. Review necessarily entails staff, with greater staff being required as the size (and therefore impact) of the program grows. A program of matching grants might require the least staff if done relatively automatically, with only the eligibility being determined by public staff (this loses the priority setting, however).

The grant programs have a number of advantages over the tax credit:

- By providing grants either to nonprofit institutions or to young firms not yet facing tax liabilities, it would guarantee more research and development and prevent windfalls to the federal government.
- The program would preclude the need to develop a rigorous definition of R&D suitable for all firms.
- The program could be flexibly administered to reflect changing research needs and proposals.
- The direct costs of the program could be determined in advance by the Legislature, rather than depending on the uncertain R&D decisions of firms during the ensuing years.
- An advisory panel should be able to select appropriate R&D activities without being guided by a statutory definition sufficient for tax law.
- The advisory board format would create an excellent opportunity for the State, the business community and other constituencies to work together in formulating economic policy.

Grant programs have disadvantages as well:

- Non-market institutions like universities may absorb more of the research funds in overhead and poorly directed activities than would private firms.
- Direct provision of state funds creates potential complications in assigning patents.

- If not initiated at the request of private firms, publicly-funded research may end up on the shelf rather than leading to new commercial applications.
- Eligible research institutions must be defined; it may not be possible to provide state funds to private universities.
- Small firms may be reluctant to become "entangled" with either the State or universities.

While the MICRO program is not designed to foster biotechnology research and development, it is a model worth considering if the State of California is interested in expanding such R&D at the University. There are two key advantages to this type of program. First, state funding buys a lot more research because of the matching requirement. Secondly, the R&D work is directed at problems which industry has identified as important to its needs. The target of such a program would in all likelihood be "generic applied research," which has been singled out as an area that may become a bottleneck in this country's biotechnology commercialization efforts because of a relatively low level of government funding.[7] A related benefit of the MICRO model is that the skills and experience that students gain in working on such research projects are readily transferable to the private sector, because they are engaged in research activities that are on the cutting edge of industry needs.

Two questions need to be addressed before the MICRO program could be recommended as a model for expanding biotechnology R&D in the University. First, does the University have the capacity, in terms of research personnel, space, and equipment, to support additional research? Secondly, would the California-based biotechnology firms be willing and able to fund their share of the research and development work? Research capacity was a constraint, at least initially, when the MICRO program was established. Industry funding was not as indicated by its willingness

to exceed the minimum matching requirements. On the other hand, the electronics and computer industries are relatively mature compared to the still-emerging biotechnology firms. They are all producing and marketing products, and several have reached the ranks of the Fortune 500 largest industrial firms in the U.S. As a result, they have been in a much better position to finance outside research when compared with the biotechnology industry. The latter, of course, is still comprised of firms that are in the pre-production stage and are surviving on infusions of capital from venture capital firms or other sources. This situation suggests that the MICRO program model may be premature for the biotechnology industry.*

C. Increase Education and Training Funding

As the biotechnology industry has sprung forth from the university-based R&D efforts, it has been nurtured by the university-based education and training programs, although its needs for the latter may be increasing substantially as the industry moves into full-scale commercialization. Representatives from the industry have articulated their concerns about the availability of skilled personnel for both the scientific and engineering talent needed for R&D and trained technicians needed for production. The OTA study also emphasized the need for additional training and education. Nearly every state program targeted to biotechnology has stressed education.

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* The industry's willingness to participate in such a program would also depend upon the specific patent and licensing policies that would apply to such a program according to at least one industry commentator.

It is clear that if the State of California chooses to expand its efforts to promote and retain biotechnology, it should carefully evaluate and perhaps increase its support of biotechnology-related education and training programs. How it should do so is less clear, however. The choice is dependent upon what the state elects to do to stimulate additional R&D. Programs designed to expand biotechnology R&D, particularly those which are university-based, will also serve to enhance the education and training programs. In other words, the state can emphasize one or the other function, depending upon the particular needs of the state's universities and biotechnology firms, but should not exclude either.

One way in which the State could help the university, the biotechnology industry, and the students would be to establish an intern program whereby promising students from related disciplines (such as chemistry, molecular biology, etc.) would be placed in part-time or summer positions with biotechnology firms. Private firms would compete for top students and would pick up at least half of their salaries plus related expenses. The State would fund the balance of the required salaries plus a coordinator position for each participating campus. Such a program could provide valuable cross-fertilization between the university and private firms, expose students to the type of work that careers with biotechnology firms would entail, enhance students' education and training, and provide some needed technical skills for biotechnology firms.

D. Provide Technical Assistance and Information

The California Department of Commerce, like its counterparts in other states, is responsible for providing information and technical assistance and performing various other functions to promote and assist the business community. The Department's mandate

does not single out biotechnology for special assistance, but the Department has targeted biotechnology, among other industries, because of its potential economic benefits to the State.

The primary thrust of the Department's biotechnology program is a promotional campaign designed to encourage new and expanding firms to locate in California. An informational brochure has been prepared and distributed to biotechnology firms in the State, and the Department is prepared to offer its excellent site selection assistance to interested firms.

Two additional areas of assistance -- public education and regulatory assistance -- could also be made responsibilities of the Department. Both were identified as potentially useful expansions of state support by industry representatives in meetings of the ACR 170 advisory group and in comments received on the draft version of this report.

1. Public Education

Industry representatives argued that there is a need to educate the general public about the potential benefits of biotechnology applications. Improved public awareness would help foster a better climate for the growth of the biotechnology industry in California (in part by ensuring a reasonable regulatory environment) and would encourage the State to commit additional support for biotechnology R&D, education, and similar incentives.

A public education program of this sort, while unusual, is not entirely without precedent in California government. The Department of Commerce's Office of Tourism is dedicated to promoting a single, albeit ubiquitous, state industry. To some extent the California Department of Food and Agriculture and the California State World Trade Commission promote their respective "industries" and thereby help provide public education. The former

Solarcal Office in the Business, Transportation and Housing Agency was dedicated to promotion and education with respect to the solar energy industry. The California Energy Commission and Governor Brown's Office of Appropriate Technology served similar functions for the alternative energy industry.

While it might not be necessary to establish a formal office to serve this function for the biotechnology industry, it would be relatively simple and straightforward to require the Department of Commerce to provide public education related to biotechnology. Funds to support this function could be redirected from the Department's existing budget, or a modest budget augmentation could be provided. An alternative to using the Department of Commerce would be to assign the responsibility to a biotechnology center, about which more will be said in the next section.

2. Regulatory Assistance

Most, if not all, of the existing and potential products of biotechnology are subject to strict and complex regulation. The regulatory process is less of a burden, however, for the older and larger firms in related fields such as pharmaceuticals, than it is for the new biotechnology firms. The larger firms have the experience and the resources to deal more effectively with the requirements of regulation. The new biotechnology firms, as industry representatives pointed out at meetings of the ACR 170 advisory group, need some assistance in dealing with the regulatory maze if they are going to survive and grow. This recommendation is bolstered by the important role that new and small businesses play in job growth and innovation.

The responsibility for providing regulatory assistance could be assigned to the Department of Commerce or included as a responsibility of any California Biotechnology Center that might be

established. The Department's Office of Business Development is already responsible for similar activities, which include:[8]

> "...[acting] as liaison between the business community and all departments of state government on issues affecting business development...[and aiding] business concerns in their relationships with appropriate federal and state agencies..."

Legislation could be proposed giving the Office of Business Development responsibility for providing regulatory assistance specifically to firms in the biotechnology industry. In lieu of that, a modest budget augmentation could be provided to the Budget Act to accomplish the same objective.

In either case, one additional staff specialist should suffice because the primary responsibility of the Office would be to function as a contact point and clearinghouse with respect to regulatory assistance. In addition, the Office could develop a regulatory "roadmap" and make it available to small biotechnology firms, particularly start-up operations. The suggestion about developing a "roadmap" came out of discussions of the ACR 170 advisory group and was widely endorsed by members of that group.

In addition to providing technical assistance on regulatory matters facing biotechnology firms, the Office of Business Development (or whichever agency was given the responsibility) could serve as an advocate for the industry during regulatory discussions within state government. They could also act as an advocate for the industry on federal regulatory issues important to the industry. Given the significance of the biotechnology industry to California's economy, it would be a natural role for the Governor and the Department of Commerce to assume.

One such federal regulatory issue was raised by several members of the ACR 170 advisory group -- export controls. The U.S. Food

and Drug Administration restricts the export of certain "unapproved new drugs" even when such drugs are not restricted by the importing country. These regulations encourage U.S. manufacturers to locate production capacity outside the United States beyond the reach of the U.S.F.D.A. In addition, they give foreign-based competitors an advantage over U.S. firms.

The U.S.F.D.A. may not be the only federal agency to restrict biotechnology exports from the U.S. Both the U.S. Department of Defense and the U.S. Department of Commerce are considering regulations to restrict the export of sensitive biotechnologies in order to prevent them from going to the Soviet Union and Warsaw Pact nations. Similar trade restrictions have been applied against U.S. manufacturers of high technology products, such as computers and semiconductors. These trade restrictions have, according to a number of U.S. industry spokespersons, been applied in an overly-broad and strict manner and have resulted in the loss of jobs, sales, and market share for U.S. firms.

A state regulatory assistance office could help ensure the development of federal export regulations that were "fair" to California. In fact, the California State World Trade Commission represents the interests of California exporters before the U.S. Congress, the Office of the U.S. Trade Representative, the U.S. Department of Commerce, and other federal agencies. The Commission should work with representatives of California's biotechnology firms to help them make their case for reasonable export controls. This could be done in conjunction with the Office of Business Development if that Office were to be given the responsibility for providing regulatory assistance to the biotechnology industry.

E. Biotechnology Centers

Another option open to state policymakers for promoting the development of biotechnology in California is the formation of one or more biotechnology centers. The proposed University of California Biotechnology Research and Education Program is a step in this direction. The most ambitious state biotechnology programs, such as those in North Carolina and New Jersey, have been built around the establishment of biotechnology centers. The centers are multipurpose institutes created to foster interdisciplinary research, intercampus cooperation, and private-public collaboration, all in support of biotechnology. The centers are usually also responsible for providing technical assistance and information and, in some cases, financial assistance to newly-emerging biotechnology firms. Some of the centers are organized through an existing university, while others have been established as nonprofit entities affiliated with, but independent of, any particular campus. Most of the centers receive funding from state and federal sources and private industry.

Several factors account for the widespread interest in using biotechnology centers as an incentive program. First, as noted above, they combine several incentive programs such as expanded education and training and increased support for research and development activity. Secondly, funding from federal and private sources is typically available to augment state contributions. For example, the National Science Foundation recently announced funding awards for the establishment of six miltidisciplinary engineering research centers, including a $20 million grant for a Center on Biotechnology Process Engineering at the Massachusetts Institute of Technology. NSF plans to fund additional centers next year provided Congress approves its $25 million budget request for fiscal year 1986.

A third attractive feature of the biotechnology centers is the emphasis on interdisciplinary research. Biotechnology research projects typically require scientists and engineers from several different disciplines, and some observers feel the key to research progress is not just in additional research and development funds, but in encouraging scientists from different disciplines to cooperate on research projects. One of the comments received on the draft version of this report was that the Legislature, if it chooses to appropriate additional funding for university research and development, should work with university officials and/or conduct hearings to ensure that the funding will stimulate more interdisciplinary cooperation. If the Legislature should opt for one or more biotechnology centers, interdisciplinary cooperation could be easily built into the structure and the programs of the centers.

A final noteworthy feature of biotechnology centers is that they do provide a mechanism for increased cooperation between the universities and private industry. While the University of California was given high marks for its research and education programs, a number of industry representatives suggested that cooperation could be improved, particularly in light of the significant improvement in university-industry relations that is occurring in other states. One specific area that was cited was transfer of technology from the university to the private sector. In the view of one observer, the university's capabilities are being underutilized. All too often inventions and innovations in the university are not reaching the marketplace (or are doing so only very slowly) because of university policies. This observer believes that university-industry cooperation could be improved and more technology could be transferred to the private sector without compromising the integrity of the university or its primary functions of research and education.

While there are some advantages to using the biotechnology center as a model for promoting the industry, none of the existing programs has had enough experience to render any unequivocal verdict. The State of California may find that supporting each of the purposes separately may be just as effective as supporting them as a package. Moreover, the biotechnology industry in California has shown only modest interest in biotechnology centers. In the words of the report of the Assembly Committee on Economic Development and new Technologies:[9]

> "One proposal which was expected to receive greater support but which did not was the concept of establishing one or more biotechnology research parks or centers, to compete with other states for the location of biotechnology companies. Almost uniformly the witnesses urged the state to place its resources in other areas, such as research and training programs."

Nonetheless, it should be noted that, based on the comments on the draft version of this report, there does appear to be growing interest in the industry for one or more biotechnology centers. The level of private support hinges on the amount of funding that will be available from the State and federal sources, the structure and purposes of the center, and the specific area of concentration of any proposed center.

Conclusions

The principal conclusion that emerges from this study is that the State of California should carefully review its commitment of resources and funding to the rapidly expanding field of biotechnology. The reasons are twofold. One, biotechnology promises enormous rewards in terms of jobs and economic development, but more importantly in terms of new products and processes that will improve health, increase productivity, and enhance living standards across the board. Secondly, that the growing competition from and the increasing sophistication of the biotechnology

development programs of other states will, unless California takes preventive steps, be successful in cutting into California's share of this industry.

This is not to conclude that the State is in imminent danger of losing the industry. California currently has approximately 35% of the biotechnology firms that have been established in the last decade. Furthermore, the excellence of the state's universities, the availability of financing, and a healthy entrepreneurial climate should keep the industry in relatively good shape. Nonetheless, as the biotechnology revolution moves from the R&D labs into full-scale production, California's comparative advantage at incubating new firms diminishes in importance. New production facilities are apt to be spun off to other locations following the pattern of the electronics and computer industries. To counter those losses, the State needs to ensure that it retains its share and that new products, new firms, and new jobs continue to be developed.

Keeping California's incubator going will not be as easy as it once was. Other states have learned from the past successes of Silicon Valley and Route 128 outside Boston, and they are developing biotechnology strategies that are a great deal more sophisticated. These strategies are now aimed not only at the expansion plans of California firms, but at the heart of the state's past successes -- the talent in its universities, its education and training programs, and its R&D capabilities.

The options for the State of California are relatively straightforward: (1) increase biotechnology R&D; (2) expand education and training in fields related to biotechnology; and (3) assist the industry to meet regulatory requirements and increase public awareness of the nature of and benefits of biotechnology.

These recommendations do raise a number of questions which must be addressed by policy makers and/or additional research:

(1) What is the best method for stimulating more biotechnology R&D? The choices include dedicated appropriations to the University of California; a matching grants program for jointly-funded research at the University of California, in private universities and/or private firms; or the establishment of a Biotechnology Center.

(2) To what extent should state funds be allocated to R&D versus education and training programs?

(3) What is needed in the way of new facilities and equipment for biotechnology-related R&D and education programs?

(4) Should the State play a role, and if so how, to encourage the development of those biotechnology products that have widespread social benefits (such as vaccines and other health-related products) but are less profitable, and will therefore not be developed, if at all, until later?

FOOTNOTES

FOOTNOTES

CHAPTER I - References

1. Commercial Biotechnology: An International Analysis, (Washington, D.C.: U.S. congress, Office of Technology Assessment, January, 1984), p.1.

2. "Trouble in Mecca: New Programs Threaten Established Strongholds," Kathleen de Laski, High Technology, January, 1985, p.24.

3. A Profile of Venture Capital Activity in California, Michael Kieschnick, Office of Economic Policy, Planning, and Research, Department of Economic and Business Development, State of California, July 8, 1982.

4. Technology, Innovation and Regional Economic Development: Encouraging High-Technology Development - Background Paper #2, U.S. Congress, Office of Technology Assessment, Washington, D.C., February, 1984, p.12.

5. Office of Technology Assessment, Commercial Biotechnology, op. cit., p.263.

Chapter II - References

1. "Industrial Revenue Bonds: A Cost-Benefit Assessment," Robert E. Patterson, Economic Development Commentary, National Council for Urban Economic Development, July, 1981, Washington, D.C., p.3.

2. Economic Development: A Survey of State Activities, Robert J. Reinshuttle, The Council of State Governments, Lexington, KY, 1983, p.18.

3. "The High Tech Sweepstakes: States Vie for a Slice of the Pie," Herb Brody, High Technology, January, 1985, p.16.

4. Census of State Government Initiatives for High-Technology Industrial Development, Office of Technology Assessment, Washington, D.C., May, 1983.

5. State Policies to Stimulate Research and Development, John Griffing, State of California, Senate Office of Research, Sacramento, February, 1984, p.24.

6. Brody, op. cit., p.17.

7. Senate Constitutional Amendment No. 21, Resolution Chapter 38 (1982), State of California, pp.2-3.

8. Reinshuttle, op. cit., pp.10-11.

9. North Carolina Biotechnology Center Newsletter, Vol. II, No. 1, Winter 1984, North Carolina Biotechnology Center, Research Park Triangle, North Carolina, p.2.

10. Brody, op. cit., p.18.

11. Ibid, p.18.

12. "The Business of Biotechnology: Regional Activity Lures New Companies," Vicki Glaser, Bio/Technology, December, 1984, p.S2.

13. North Carolina Biotechnology Center Newsletter, op. cit.

14. Brody, op. cit., p.18.

15. Genetic Engineering News, October, 1984.

16. Biotechnology: Report to the 1983 General Assembly of North Carolina, Biotechnology Study Committee, North Carolina Legislative Research Commission, Raleigh, June 7, 1984, p.4.

17. Biotechnology Development: Report to the 1985 General Assembly of North Carolina, Biotechnology Study Committee, Legislative Research Commission, Raleigh, December, 1984, pp.9-19.

18. The Microelectronics Innovation and Computer Research Opportunities Program: Progress Report, 1984-85, University of California, January 31, 1985.

19. Office of Technology Assessment, Commercial Biotechnology, op. cit., p.15.

20. Brody, op. cit., p.23.

21. Glaser, op. cit., p.54.

22. Statement of Long Term Challenges and Needs: UC Biotechnology Research and Education (Draft), University of California, March 29, 1985, p.18.

23. Biotechnology Development: Report to the 1985 General Assembly of North Carolina, Biotechnology Study Committee, Legislative Research Commission, Raleigh, December, 1984, pp.9-11.

24. Report of the Governor's Commission on Science and Technology, State of New Jersey, Governor's Office, December, 1983.

25. P.L.1984, Chapter 99, (Approved July 25, 1984), New Jersey State Legislature, 1984.

26. Assembly Bill No.1654, (Official Copy Reprint), State of New Jersey, 1985.

27. Assembly Bill No.1764, (Official Copy Reprint), State of New Jersey, 1985.

28. Glaser, op. cit., p.S10.

29. Assembly Bill No.1764, (Official Copy Reprint), State of New Jersey, 1985.

30. State Initiatives in Technological Innovation, National Governor's Association, Washington, D.C., 1983; Brody, op. cit., p.19; and Glaser, op. cit., pp.S5-6.

31. Brody, op.cit., pp.22-23.

32. NBS Update, U.S. Department of Commerce, National Bureau of Standards, February 13, 1984, Washington, D.C.; and Glaser, op. cit., P.S4.

Chapter III - References

1. Review of Federal and State Regulations Affecting the California Biotechnology Industry, Jim Rote, Assembly Office of Research, Sacramento, April 1985.

2. Office of Technology Assessment, Commercial Biotechnology, op. cit., p.14.

3. The Future of the Biotechnology Industries in California, Economic Development and New Technologies Committee, California State Assembly, June 28, 1984.

4. Assembly Concurrent Resolution No.170 (Resolution Chapter 130, 1984, State of California. [Attached as Appendix.]

5. This section draws extensively from two sources, Griffing, op. cit., Chapter 4; and John Griffing and Michael Kieschnick, State Policies to Stimulate Industrial Research and Development, California Department of Economic and Business Development, Sacramento, July, 1980.

6. University of California, op. cit.

7. Office of Technology Assessment, Commercial Biotechnology, op. cit., p.14.

8. California Government Code, Section 15333.

9. Economic Development and New Technologies Committee, op. cit., p.6.

UNCITED REFERENCES

"Wisconsin University Makes a Biotech Power Play," Chemical Week, February 20, 1985.

"University of Texas Facing Cuts in Its Budget," Wayne King, New York Times, March 17, 1985.

State Activities to Encourage Technological Innovation, (Report prepared for National Governors Association Task Force on Technological Innovation), Michael Kieschnick, Office of Economic Policy, Planning, and Research, State of California, August, 1981.

Michael Kieschnick, "Taxes and Growth: Business Incentives and Economic Development," in State Taxation Policy, Michael Barker, editor, Duke University Press, 1983.

Leonard Lund, Factors in Corporate Locational Decisions The Conference Board, New York, 1979.

APPENDIX

APPENDIX

Assembly Concurrent Resolution No. 170

RESOLUTION CHAPTER 130

Assembly Concurrent Resolution No. 170—Relative to biotechnology.

[Filed with Secretary of State August 31, 1984.]

LEGISLATIVE COUNSEL'S DIGEST

ACR 170, Farr. Biotechnology.

This measure requests the Assembly Office of Research to conduct a study, to be completed by April 15, 1985, reviewing all existing, pending, and elapsed federal and state regulations affecting the California biotechnology industry so that the Legislature can make informed decisions on how to promote the biotechnology industry while protecting public health and safety and the environment.

WHEREAS, California is the intellectual center of the nation's biotechnology industry; and

WHEREAS, Approximately 35% of the nation's biotechnology companies, including the leading companies, are headquartered in California; and

WHEREAS, California companies have already developed products, such as human insulin and proinsulin, and interferon, which have the potential to alleviate human suffering and illness; and

WHEREAS, Biotechnological research is vital to California's agricultural industry, offering prospects of increased production, vaccines for animal diseases, disease resistant food crops, drought resistant plant strains, and more nutritional foodstuffs; and

WHEREAS, The United States Patent and Trademark Office has received in recent years nearly one thousand patent applications based on biotechnological research; and

WHEREAS, The biotechnology field is growing more competitive, particularly with respect to Pacific Rim and European countries where, according to the Congressional Office of Technology Assessment, private and public companies sometimes benefit from government subsidies; and

WHEREAS, The State of California should explore appropriate methods of assisting the state's biotechnology industry; and

WHEREAS, Numerous federal and state agencies, including the National Institutes of Health and Environmental Protection Agency, the State Department of Food and Agriculture, and the State Department of Health Services, administer environmental and health regulations affecting biotechnology research and applications; and

WHEREAS, These regulations have successfully protected without incident the public's health and safety and the environment during

the previous decade of research and commercialization of biotechnology; and

WHEREAS, The manner in which these regulations apply to future biotechnology research and applications is currently unclear, and therefore may potentially create undue and costly delays in the commercialization of many socially beneficial biotechnology products as well as potentially threaten public health and safety; and

WHEREAS, The federal government, through the White House Cabinet Council Working Group on Biotechnology, is currently developing recommendations to coordinate federal regulations as they affect the biotechnology industry; and

WHEREAS, There is a need to expeditiously develop at both the state and federal levels a rational application of existing regulations to provide uniform, flexible, and nonduplicative protections for human health, safety, and the environment, while at the same time removing unnecessary disincentives to research and commercialization of biotechnology; and

WHEREAS, There is a need for California to represent its unique state's interest before appropriate federal bodies acting on matters affecting the promotion and regulation of the biotechnology industry; and

WHEREAS, There is a need for further study of current federal and state regulations affecting the biotechnology industry before conclusions can be drawn regarding such regulations; now, therefore, be it

Resolved, That the State of California views the biotechnology industry in California as one which represents new economic growth, new jobs, new research opportunities, and new means to better the health of both individuals and the state, and as an industry which fully deserves the encouragement of the state whenever and however; and be it further

Resolved, That the Legislature requests the Assembly Office of Research to conduct a study, to be completed by April 15, 1985, reviewing all existing, pending, and elapsed federal and state regulations affecting the California biotechnology industry so that the California State Legislature can make informed decisions on how to promote the biotechnology industry, while at the same time protecting public health and safety and the environment; and be it further

Resolved, That the Assembly Office of Research and the Senate Office of Research also study incentives being offered by other states and countries to promote the development of the biotechnology industry within those states and countries; and be it further

Resolved, That representatives of the biotechnology industry, environmental organizations, agriculture, and the Legislature are to be identified by the Assembly Committee on Economic Development and New Technologies, the Assembly Office of Research, and the Senate Office of Research to serve as advisors on this study; and be it further

Resolved, That because the Governor's Office is currently surveying the existing state authority to oversee the biotechnology industry, with an eye toward assisting the industry, while protecting the health and safety of all Californians, it is the intent of the Legislature to take these efforts into consideration in this study and to subsequently work in concert with the Governor; and be it further

Resolved, That the Chief Clerk of the Assembly transmit this resolution to biotechnology companies, organizations, and other interested parties in California, as specified by the Assembly Committee on Economic Development and New Technologies.