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The Locational and Economic
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Industry: A Preliminary Report

Edward J. Blakely with Suzanne Scotchmer
and Jonathan Levine

Biotech Industry Research Group
University of California at Berkeley
Institute of Urban and Regional Development

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February 1988

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THE LOCATIONAL AND ECONOMIC PATTERNS OF CALIFORNIA'S BIOTECH INDUSTRY:
A PRELIMINARY REPORT

THE SHAPE AND SIGNIFICANCE OF CALIFORNIA'S BIOTECHNOLOGY INDUSTRY

Biotechnology is one of the most important new industries in California and it may represent the next major wave of economic development for the state. Confidence in the future of the industry can be measured in part by the large number of communities seeking to become host to the new industry. Although there is little doubt that biotechnology has tremendous potential, whether this new industry has the same economic and/or employment potential of the earlier computer revolution is the subject of considerable speculation. There are estimates that the biotech industry is already a \$3.2 billion national industry which is still in its infancy. It is predicted by the turn of the century to become a \$100 billion dollar industry which will encompass a wide array of activities ranging from pharmaceuticals to metals and electronics.

Based on past experience, many communities believe that biotechnology represents the same type of high tech industry that microelectronics was in the recent past. Moreover, it is already evident that a number of California communities have the primary ingredients to host the industry in the form of major research facilities and a skilled research labor force.^{1/} As a result, communities both large and small throughout the state are seeking to attract biotech firms in the same manner they lured electronic and communications firms. The major problem for most communities in this pursuit is that policymakers and development specialists

are not knowledgeable regarding the size of the industry or its long-term potentials. This research report is a preliminary assessment on the present locational and economic attributes of the California biotech industry. The data developed is based on information gathered by the UC Biotech Industry Research Group (BIRG) combined with a special analysis of California data from the Arthur Young national survey of biotechnology firms, "Biotech '88," as well as interviews of experts in commercial firms and universities.

BIOTECHNOLOGY PRODUCTS AND INDUSTRIAL POTENTIAL

There are three basic processes used to develop biotechnology products. First, products can be made using genetically engineered organisms as substitutes for conventional methods of production such as chemical synthesis and extraction from tissues. These substances are produced using a fermentation process where nutrients and raw materials are supplied to living cells in a reactor vessel that converts raw materials into products. This process is used most frequently in the development of medical, pharmaceutical, and chemical products. Second, biotechnology may be used to produce unprecedented amounts of scarce biological compounds, of which certain regulatory proteins provide the leading examples. Third, biogenetically engineered new organisms are being developed to do such things as leach or concentrate minerals from ores, increase the extraction of oil from wells, and reduce the freezing temperature of plants. This method of biotechnology has found its greatest use in the

agriculture field. Scientists are using genetic engineering techniques to change the genetic constitution of micro-organisms, plants, and animals to make them more productive, more resistant to disease, and more resistant to environmental stress.

Current Biotechnology Product Emphasis

Development of Monoclonal Antibodies: These antibodies are used in research, chemical separation and purification, diagnostic tests, and treatment of disease. Monoclonal antibodies for diagnostic testing are popular product areas because they can be rapidly developed, tested, and brought to market. Human and animal pharmaceuticals have much higher costs associated with development and regulatory approval. Monoclonal antibody product development has occurred almost exclusively in the pharmaceutical industry.

Development of rDNA Products: Recombinant DNA research has focused on development of "gene expression products." DNA is introduced into the host organism where it can be expressed in the form of messenger RNA and protein. Products developed using rDNA techniques include tissue, plasmagene to break up blood clots, polio vaccine, hepatitis B vaccine, insulin, and human growth hormone. While many of these rDNA products have been in the pharmaceutical industry, others are being developed by new small emerging companies.^{2/}

STRATEGIC MARKET SEGMENTS

This report subdivides the many components of the biotech industry into several strategic market segments. A number of firms fit into more than one category. For the purpose of this report, the current dominant product orientation of each firm is used to classify each firm. The strategic market segments are as follows:

Diagnostics---are those human health care companies that design or develop products for a variety of highly accurate tests aimed at determining presence of various health or disease states.

Therapeutics--are those firms pursuing products that require extensive clinical testing for human or animal use, and that cure or reduce the effects or incidence of disease.

Agritech-----encompasses a large set of agricultural products used for animals, plants, or other environmental uses.

Suppliers-----produce the laboratory products that assist in developing technical instruments used in gene splicing and related equipment requirements.

Other-----refers to those firms pursuing so many interrelated areas that they are difficult to classify. There are no such firms in the California sample but about 9 percent of the firms in the Arthur Young national sample are so classified.

In order to bring products to market, many California biotechnology firms indicated that they are currently licensing products or joint venturing with large established companies.

These firms' strategy is based on the notion that it is more cost effective to subcontract the production of a biotechnology product until its commercial viability can be determined.

Therefore, the data reported indicates that the industry is in a very early stage of development. At some later period, the mix of firms, the links among firms, as well as some firms' product orientation may change substantially.

Several biotechnology industry representatives interviewed indicated that as companies move from the research and development phase with increased sales of commercially profitable products, they create their own production facilities in close proximity to their research and development laboratories. As the Arthur Young report, "Biotech '88," states,

Biotech firms prefer to manufacture in-house for a variety of reasons. Dominant among them is the existence of proprietary process technologies that confer a strategic advantage on the producer. 3/

Some companies indicated that they were currently doing the bulk of their production elsewhere in the United States. In addition to the entrance of larger companies into the biotechnology industry, foreign competition, particularly from Japan and Europe, is having an impact on the industry's development in the state. For example, by January 1984 U.S.-owned companies had signed 15 technology-transfer agreements with Japanese companies.4/ Japanese companies have entered the industry with the assistance of government financing. European emergence into the biotechnology arena has progressed more slowly because of a lack of venture capital to form new companies.

A recent report by the Stanford Research Institute International (SRI) indicated that the industry's production component could easily move out of California because the state is not positioned as a major manufacturing center of the pharmaceutical industry.^{5/}

GEOGRAPHY OF THE BIOTECHNOLOGY INDUSTRY IN CALIFORNIA

Biotechnology companies have located in areas traditionally identified as high technology centers, namely Santa Clara, San Mateo, Alameda, San Diego, Los Angeles, and Orange counties. (See Map A, Figure A.1.) Minor concentrations of the industry are emerging in Marin and Yolo counties in northern California and Ventura in southern California. Such clustering of biotechnology companies suggests that establishing an area's identity as a particular high technology node fosters the development of other such industries. Northern California accounts for more than 60 percent of the state's total biotech firms.

Locational Patterns of the Bioscience Research Centers in California

The constant exchange of new ideas and research information is essential to the continuous development of commercially viable biotechnology products. Closeness allows for the development of special social and professional relationships within the scientific community. One biotechnology representative stated that such relationships are often the primary factors for stimulating new ideas.

Biotechnology companies rely heavily on university research programs for original theoretical research and for clinical testing. All of the biotechnology companies interviewed maintained relationships in the form of research and development consulting contracts, or license agreements with 20 to 30 universities around the country.

Since California firms are so heavily involved in research, the geographic relationship between the location of biotech firms and major research facilities -- particularly universities -- to the industry is instructive. The major centers of research activity are concentrated in the same geographical areas as the firms as shown on Map A, Figure A.2. Firms have clustered around Stanford University in Palo Alto. This clustering is displayed on the map. A smaller number of firms, though larger in size and much better established, have located in the Oakland/East Bay area.

In southern California the pattern is much the same, with heavy concentrations of biotech firms near the campuses of the University of California at Los Angeles, Irvine (Orange County), and San Diego (at La Jolla).

Map A

Figure A.1
California Biotechnology Firms
by County, 1987

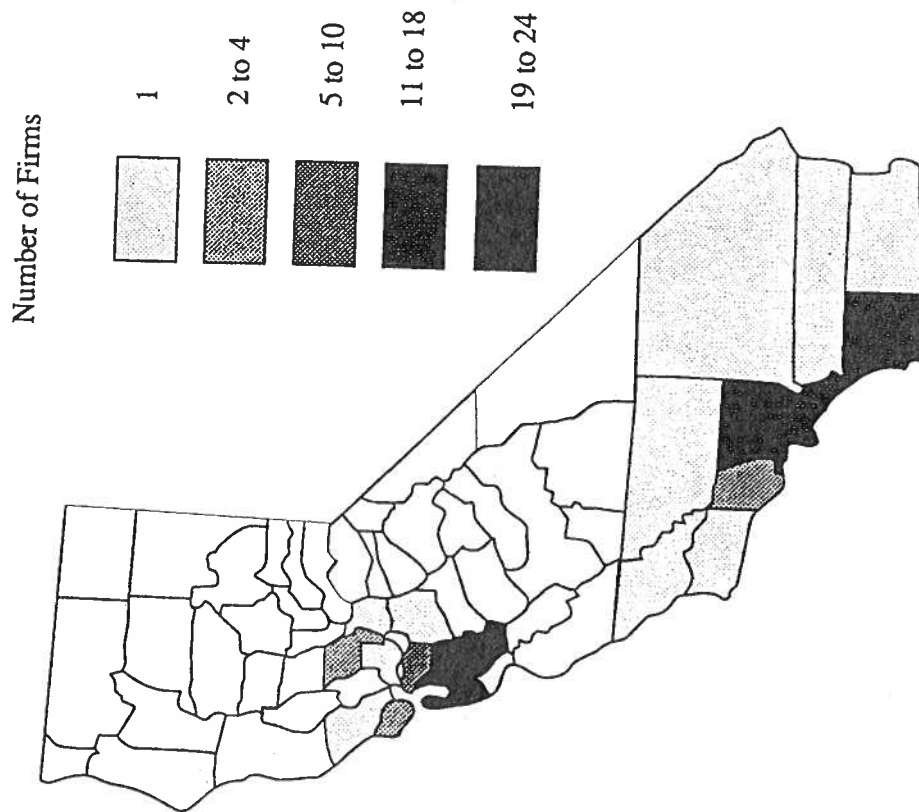
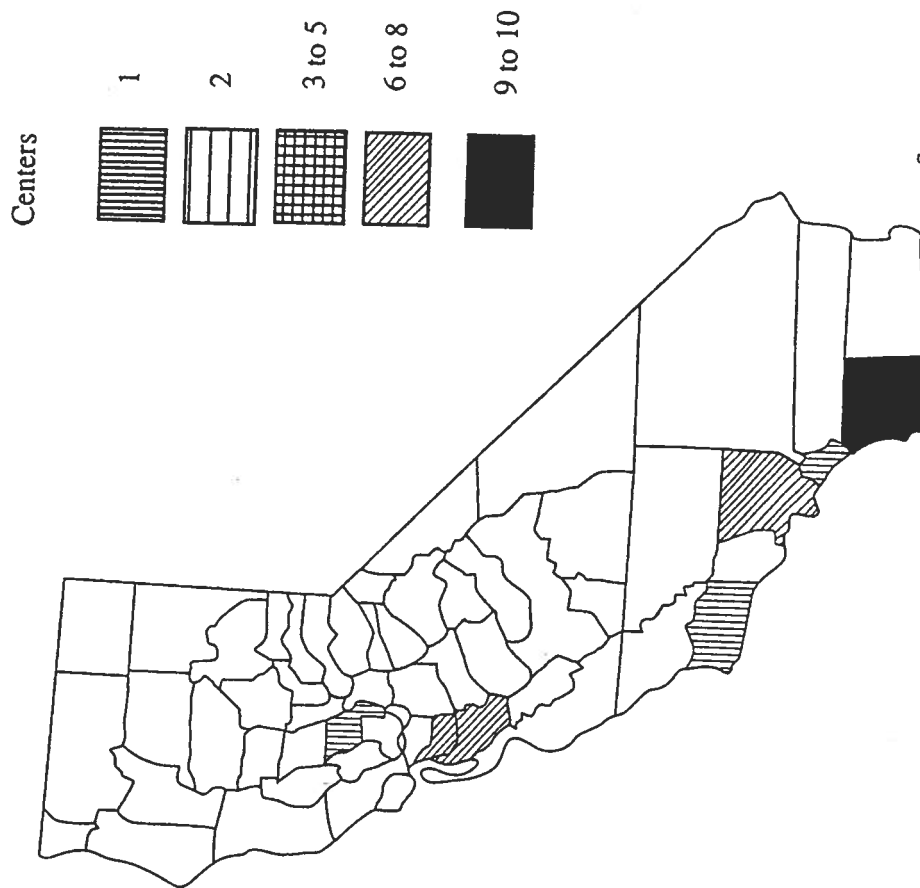


Figure A.2
Bioscience Research Centers
by County, 1987



Source: BIRG

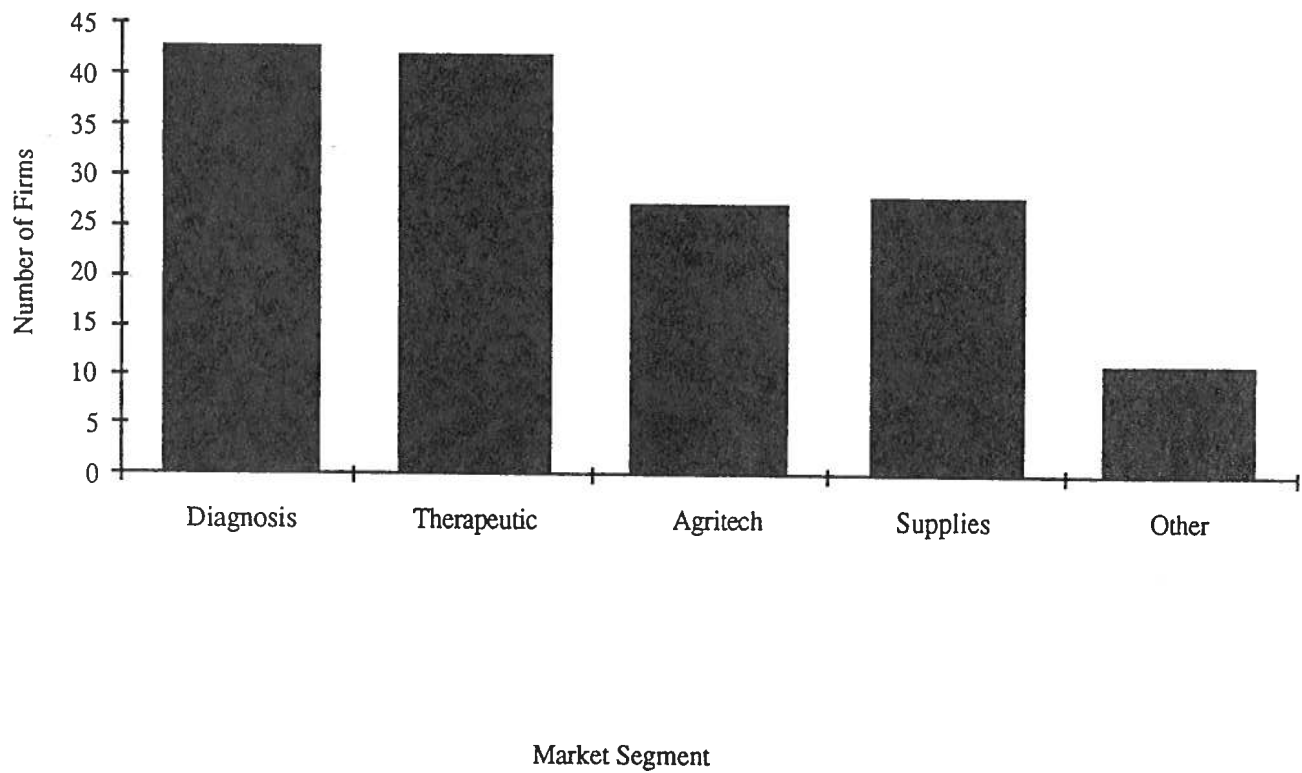
STRATEGIC MARKET SEGMENTS OF CALIFORNIA BIOTECHNOLOGY FIRMS

California biotech firms operate primarily in potentially the most lucrative areas of the field. As Graph 1 indicates, most of the state's firms concentrate on human diagnostic and therapeutic products. The other major area of concentration is in the plant and animal areas. Suppliers of equipment or machinery associated with biotech is the next most important area. With the exception of suppliers and a heavier concentration in some aspects of agricultural biotech, California firms mirror the national pattern. If the firms are analyzed by SIC code, the majority of firms are listed under six codes related to pharmaceutical, medical, and agri-vet products and services. Unfortunately, the SIC code is not particularly useful for understanding the state's biotech industrial pattern.

The principal difference between California and the rest of the nation is that California firms have a more pronounced emphasis on research as the product of biotech. Firms in the Northeast, for example, are more oriented to final product and sales, due in large part to the higher proportion of pharmaceutical firms in that area of the country. This pattern is unlikely to change in the short term since the entry cost of producing biomedical products for human or animal use is so high. In essence, it is more practical to license production than to engage in it unless the product requires considerable supervision by the research staff or the production of it will bring a greater return to the firm if it maintains total control over the product. At this juncture only Cetus and Genentech have the capacity to manufacture and market products on a worldwide basis.

Graph 1

California Biotech Firms by Market Segment



Source: BIRG Data, 1987

THE ECONOMIC PATTERN OF CALIFORNIA BIOTECH FIRMS

California biotech firms are the acknowledged scientific leaders in nearly all aspects of the new industry. To some extent the financial status of California firms is an indicator of the economic vitality of the industry. To date, full knowledge of the economic dimensions of the industry has been imprecise; this is due to the newness of the firms and the fact that few have reported much in the way of real earnings. Nonetheless, some national data has been collected on the economic pattern of biotech firms. These data, developed by the Arthur Young High Technology Group, in a disaggregated form for California, are instructive with respect to the current status of the biotech industry in the state. The national Arthur Young sample included 213 companies. The California sample described in this report was very similar in size and type of firm to the national sample (Chart A) and included 37 firms of the 125 known firms in the state. (See Appendix A, which is a list of California biotech firms.) The sample is representative of the mix of product types in the state as well.

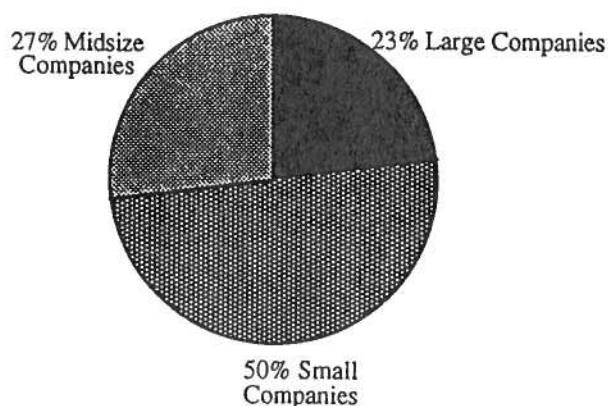
Chart A

Profile of Arthur Young Survey Participants

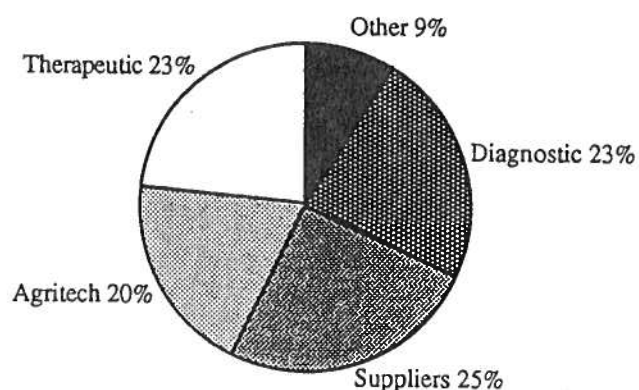
Questionnaires were sent to 924 biotechnology companies, representing the mid-1987 universe of firms in the United States. The financial data collected refer in approximately equal numbers to companies with fiscal years ending in 1986 and companies with years ending at December 31, 1986. As noted earlier, 213 firms, representing a 23-percent response rate, replied to the questionnaire. Financial data from public companies were supplemented by data from each company's annual report and SEC Form 10-K. The California data is a subset of the National information. Thirty-seven firms reported of California's 125 firms or 29-percent of the state's firms.

National Sample

Profile of Survey Participants
by Size

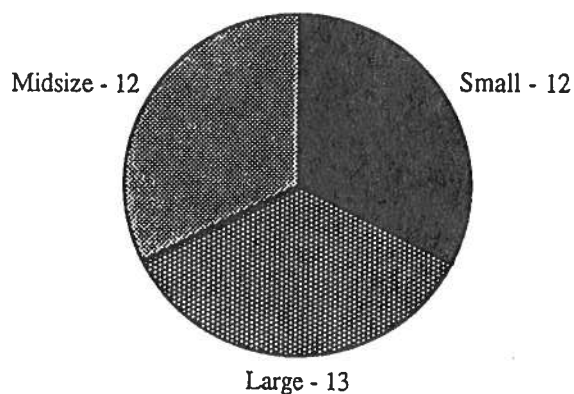


Profile of Survey Participants
by Market Segment

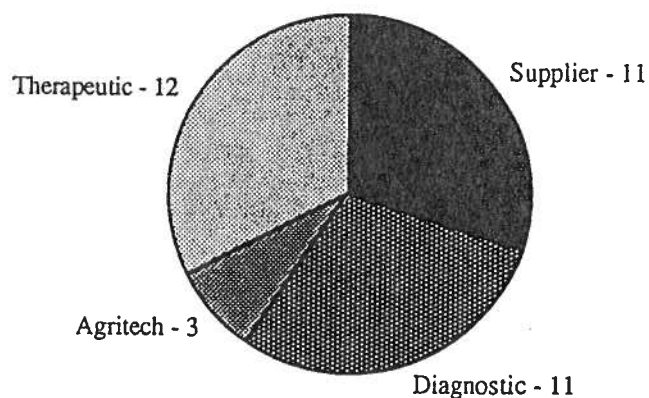


California Sample

Company Size



Market Segment



Small Firms = 1 - 50 (Employees)
 Midsize Firms = 51 - 135
 Large firms = 136+

Source: Arthur Young, 1987

California Biotech Company Revenues by Product Type

One of the more difficult and interesting questions posed by policymakers and investors is when and how biotech firms will make their money. It is not entirely clear that many of the products or services described by biotech firms are income generators even though they have social value. For example, a new vaccine that reduces the incidence of malaria may affect the lives of millions of people in subtropical areas but neither governments nor the potential clients have the resources to pay for this new drug or vaccine. On the other hand, some products that extend life, like heart drugs, may provide enormous financial returns. One thing is clear: the investment to make these discoveries is very great irrespective of the potential returns. Therefore, it is instructive to examine the current income stream of this limited sample of biotech firms as one indicator of their revenue potential.

Graph 2 shows clearly that the largest income for California firms is in supplying equipment or developing new equipment for the biotech industry. This California pattern is due to one of two factors, either one or both of which may be operative. First, California is the home of the electronics and related high-tech industries from which biotech companies purchase their equipment. Second, California as a leading producer of high-tech equipment creates a talent pool and knowledge infrastructure attractive to biotech firms. Also attractive to the firms is the greater access to venture capital than other areas of the nation.

Graph 2

California Biotech Firm Revenues

Figure 2.1

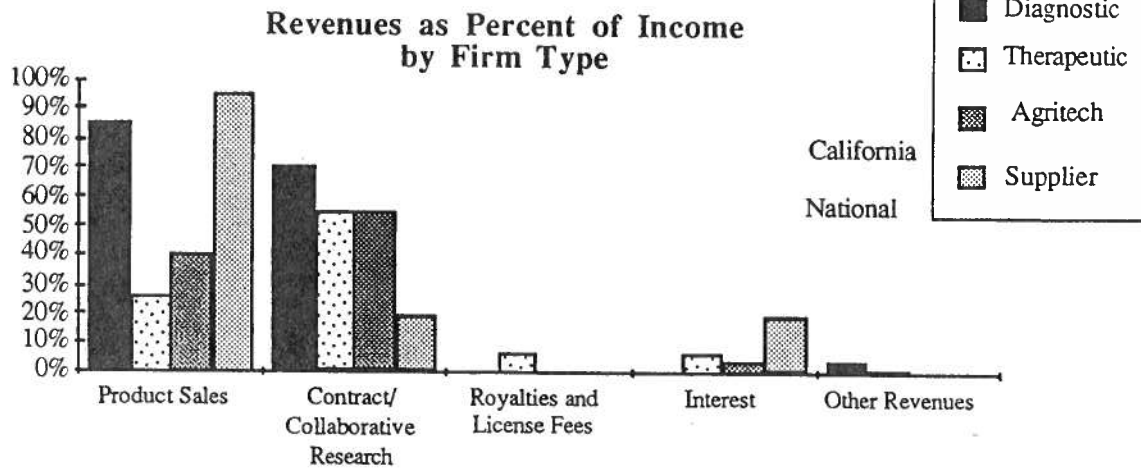


Figure 2.2

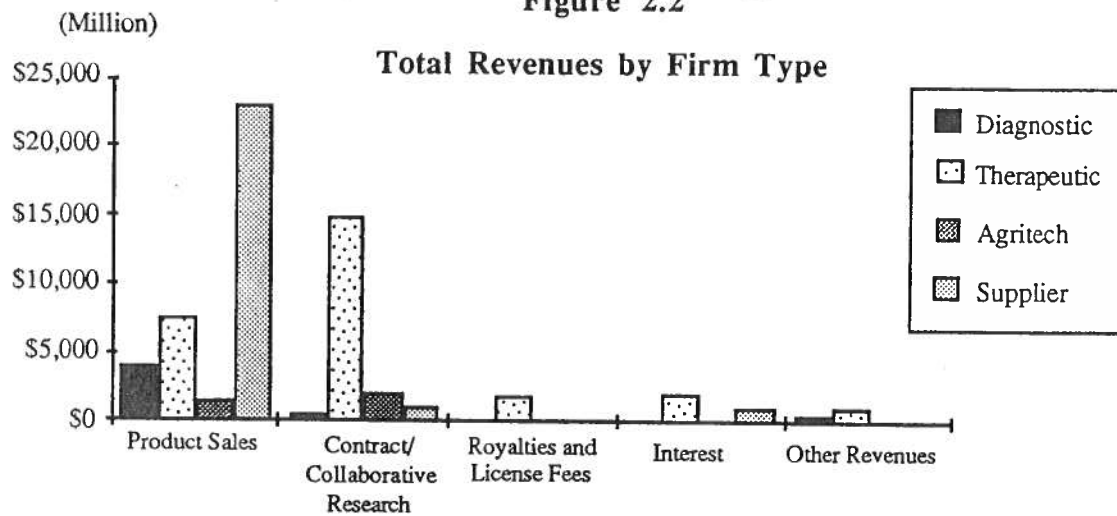
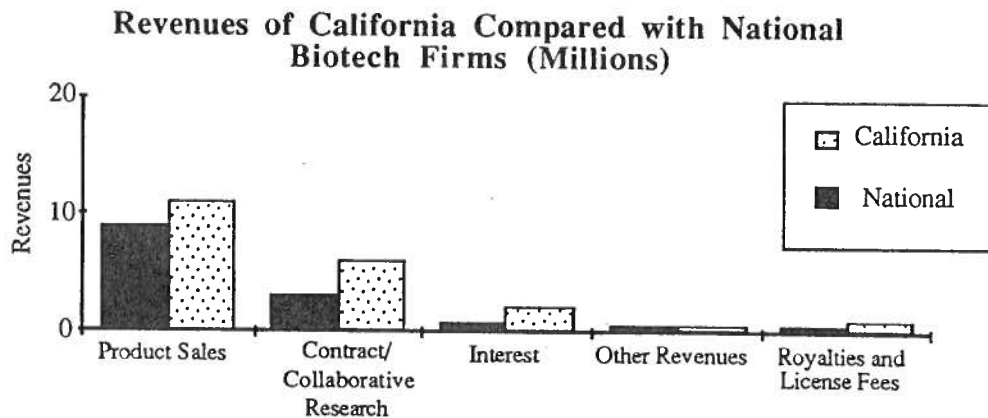
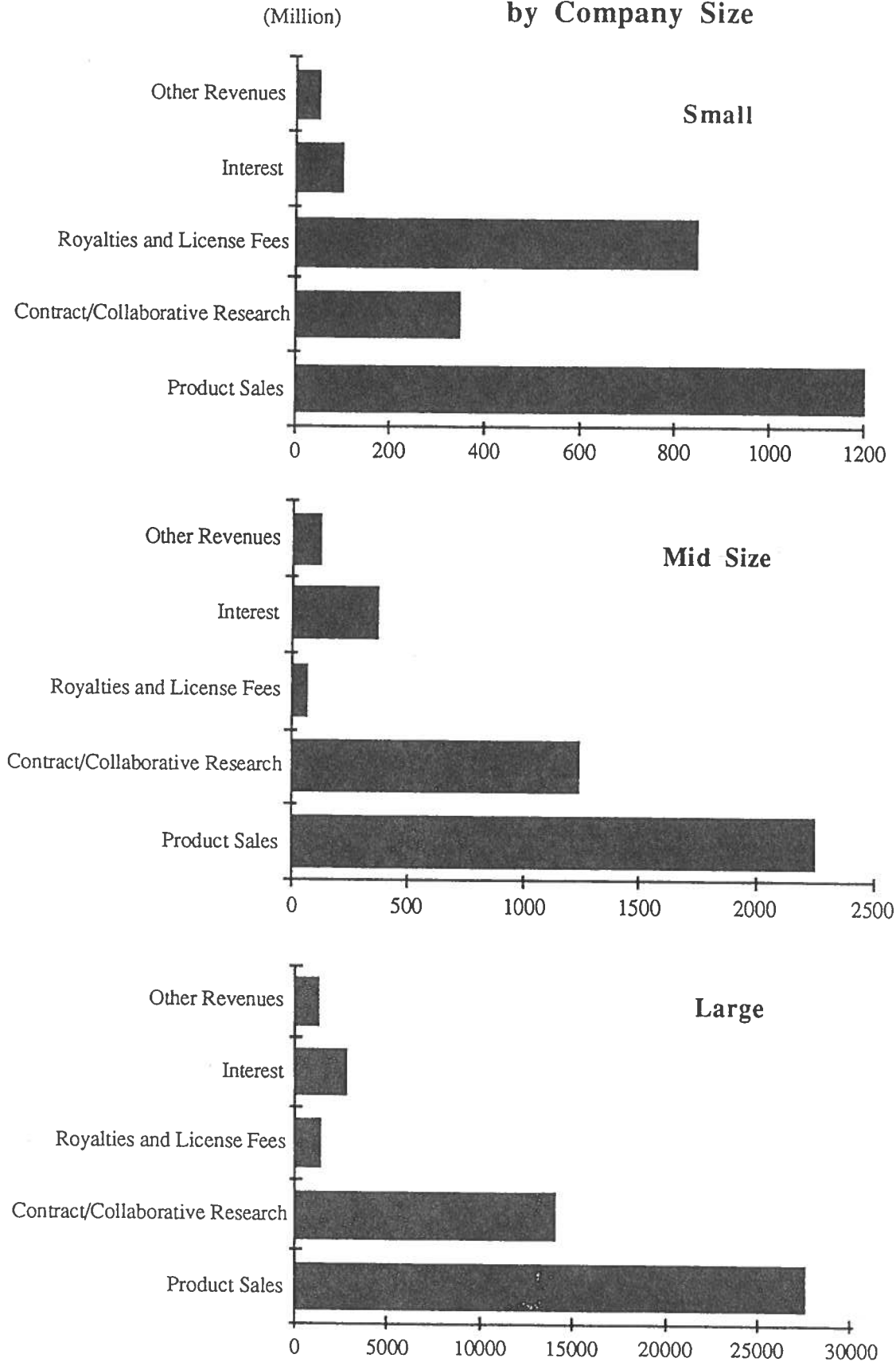


Figure 2.3



Graph 3

**Biotech Firms Revenues
by Company Size**



Source: Arthur Young, 1987

Another instructive perspective is the singularly small dollar income from product sales from most firms, as shown in Graph 3. Large and mid-size firms have the largest product sales. Income from collaborative and contract research accounts for a significant amount of all California firm income.

Company Expenses, R&D Revenues, and Profits by Product Type and Size of Firm

California biotech firms are so new that their current annual expenses may be very poor indicators of the pattern when they become more mature. The front-end costs of finding a product and developing it for the marketplace are still reflected in the company books. The largest expenses are in research and development for most California firms, followed by cost of product sales and administration, as noted in Graph 4. These data indicate that the therapeutic companies -- those involved in disease assessment and cure -- are still heavy R&D spenders. The California pattern is similar to the nation's biotech companies in this regard. What is most noteworthy is the fact that so little money is spent on marketing and sales by California companies. This is undoubtedly due to the fact most firms have not yet developed commercial products. A large or complex marketing and sales force is not called for if the primary product is a contract or license.

Graph 4

California Biotech Firm Expenses

Figure 4.1

Expenses by Percent of Total Cost
By Firm Type

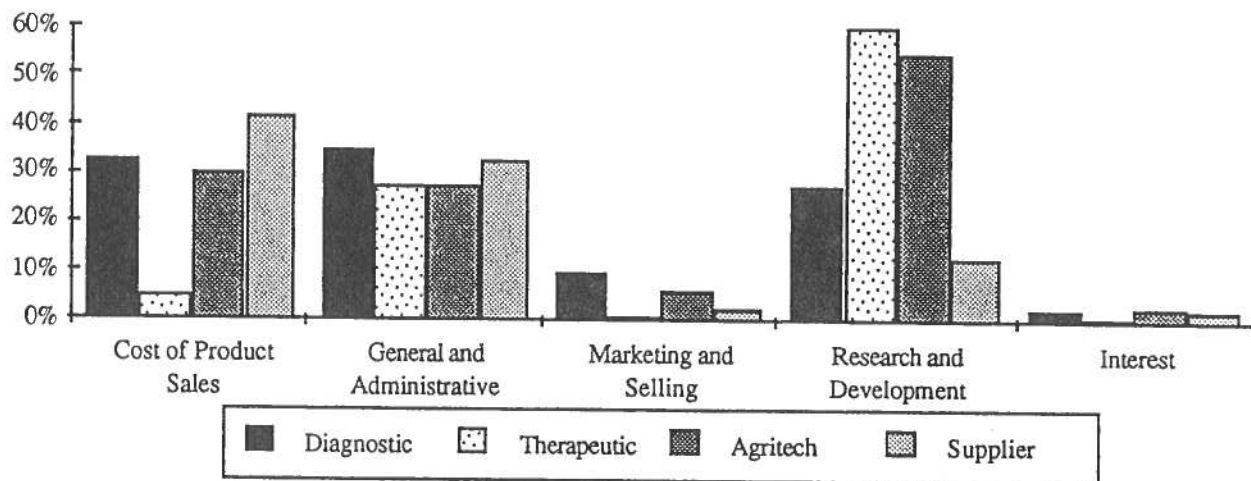
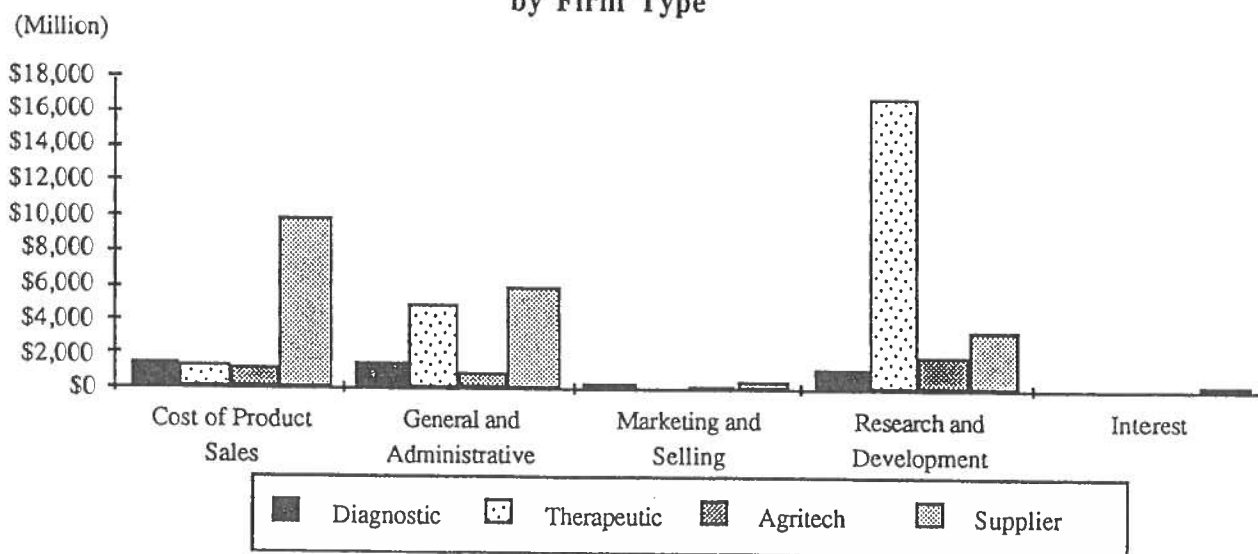


Figure 4.2

Total Expenses
by Firm Type



Source: Arthur Young, 1987

Since research and development represents such a significant portion of California biotech potentials, it is interesting to assess the relationships between R&D costs and revenues. As indicated in Graph 5, these two areas nearly balance each other in almost all California firms regardless of their size or type. This is understandable inasmuch as the cost of identifying new products is very high. If the results are sold, the company must re-invest much of its income into coming up with more breakthroughs. Moreover, firms realize this pattern is not productive in the long run so they attempt via their research efforts to identify a product they can manufacture and from which they can retain the long term income. As these data indicate, few firms have been able to find the balance between research expenses and income from this activity.

Several things can be inferred from these data. First, California is the nation's largest and most diverse R&D-oriented environment. The production side of the business is either not as attractive, as lucrative, or as easy to implement in this state. Moreover, California is building on its current high-tech advantages in electronics, computing, and scientific human resources and institutions in this industry. This is a familiar pattern for many California areas that are based on or oriented to technology. Finally, it seems apparent from these data that California biotech firms prefer to enter into alliances with other pharmaceutical, agrichemical, or biomedical firms in other states and perhaps other nations to produce and market their finished products.

Graph 5

California Research and Development Expenses vs. Income

Figure 5.1

Research Income by Firm Type

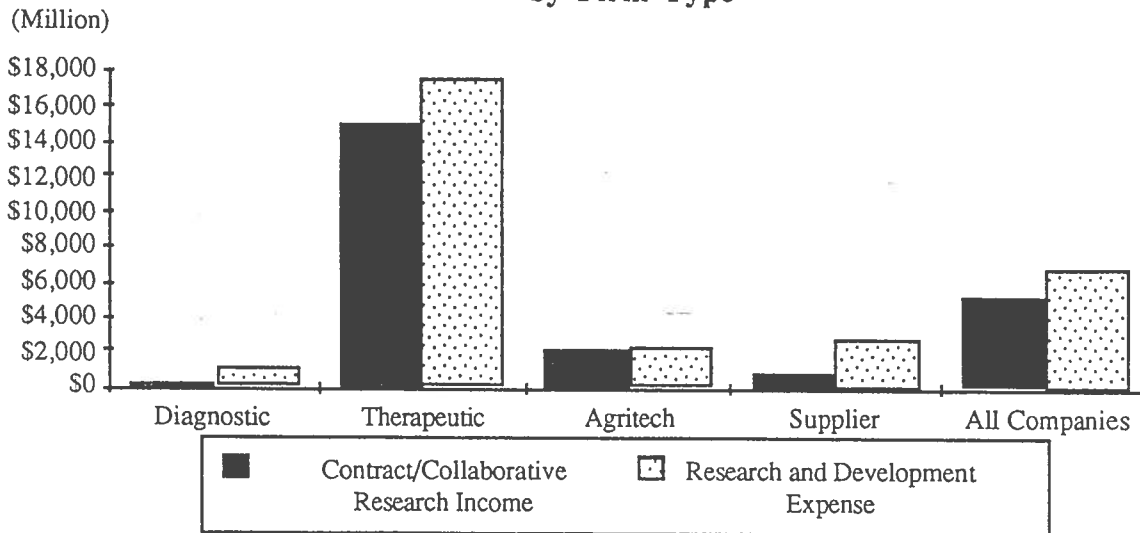
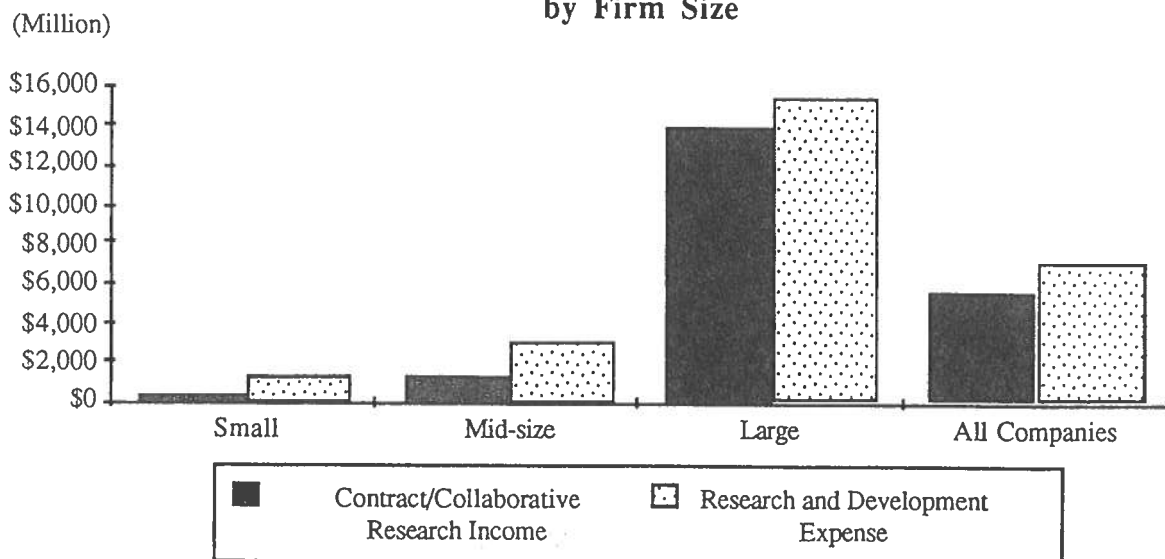


Figure 5.2

Research Income by Firm Size

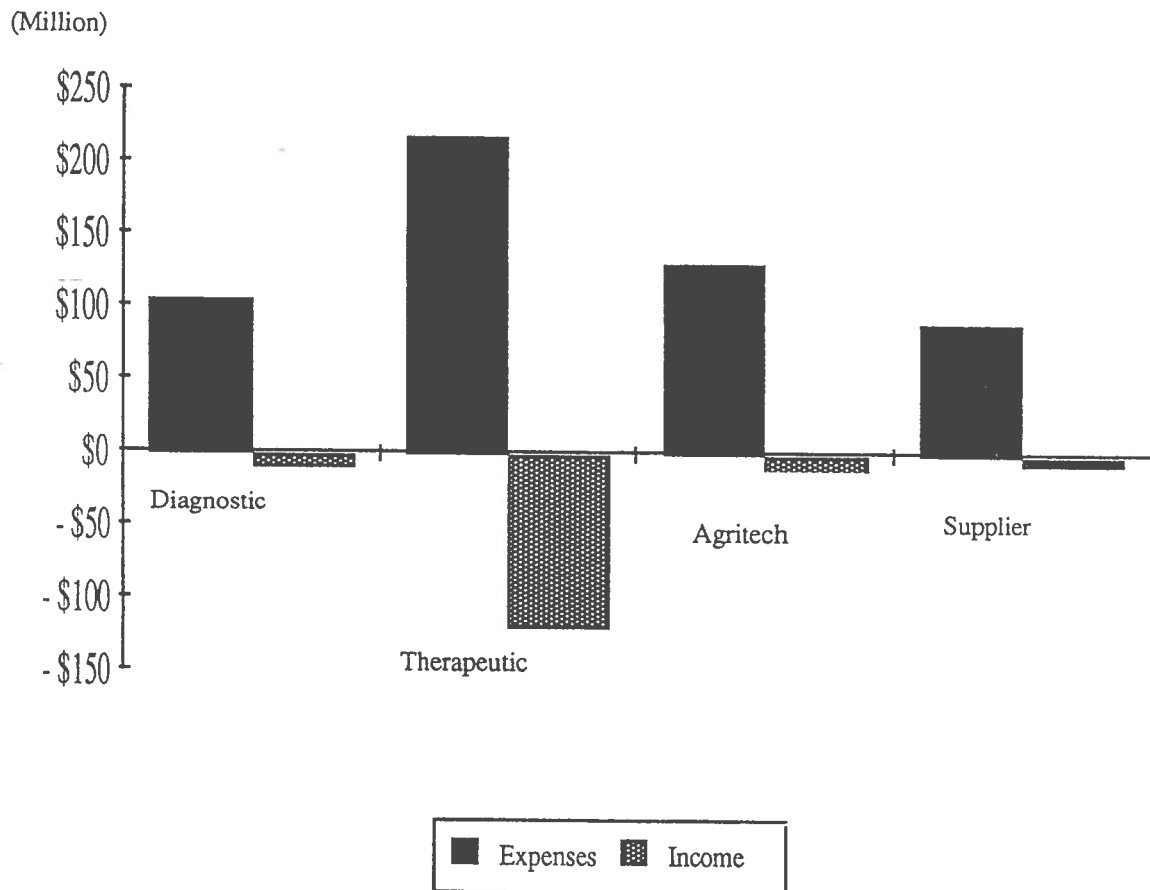


Source: Arthur Young, 1987

The balance sheets of the companies in each group as shown in Graph 6 clearly reveal that profitable products remain in the future for most of California's biotech companies. As this graph indicates, most firms are losing money on an annual basis, if investor income is not counted. In part, this is due to the cost of finding products. Biotech is not like computing where the first breakthrough can be easily copied and mass-produced for a large consuming public. Much of biotech research is not easily transformed into a usable and marketable product. In addition, products intended for human or animal use require years of testing before they can be put on the market.

Graph 6

**Profit and Loss
California Biotech Firms**



Source: Arthur Young & BIRG, 1987

SUMMARY

This is only a preliminary analysis of the locational and economic patterns of California's biotech industry. More research on the industry is required to answer the fundamental questions about California's biotech industrial base. This research is underway. The data reported here are preliminary but they may be indicative of the direction of the locational concentration and economic pattern of the industry.

The California biotech industry appears to be built on the same high-tech infrastructure as the computer, electronic, and aerospace industries. With respect to finance, the data are still spotty. However, the information available indicates that California biotech firms are primarily R&D-oriented and have little production capacity. It is well known that only a few firms in California have developed production capacity for their own products at this point. Most firms, if their revenue and expense data are indicative, appear to be knowledge-intensive environments with the primary goal of selling their science. Clearly, if most of California biotech firms elect research and development as their primary focus, they will not be large-scale direct employers. However, the link between equipment, scientific developments, and small-scale production will have wide-ranging impacts on all aspects of the state's economy. Moreover, the biotech firms that gain a firm foothold in the market will produce their own products locally, if for no other reason than to maintain a market position and to give their investors confidence in the ultimate value in the long term investment required to develop biotech products.

FOOTNOTES

1. For a more detailed discussion of biotechnology processes, see Steven Olsen, Biotechnology: An Industry Comes of Age (Washington, D.C.:National Academy Press, 1986.)
2. For a description of biotechnology products, see U.S. Congress Office of Technology Assessment, Commercial Biotechnology: An International Analysis (Washington, D.C., 1984.)
3. Much of the data reported in this study is based on information generously supplied by the Arthur Young High Technology Group and derived from special analysis of their report, "Biotech '88: Into the Marketplace" (San Francisco: The Arthur Young High Technology Group, 1988). The citation is from page 31 of the report.
4. Business Week "Biotechnology Comes of Age," Jan. 23, 1984, p. 89.
5. SRI International, Public Policy Center. Meeting on California's Competitive Challenge, Dec. 1985.

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Appendix R: California Biotechnology Firms by Major Product

SIC PRIMARY
CODE BIOCODE

I. Biocodes 100, 300 and 600: Agriculture, Food/Brewing Industry, Veterinary

Microalgae Aquaculture R&D	Boulder Creek	2879	101
Stauffer Chemical	Richmond	2879	101
Bio-Con	Bakersfield	2879	102
Mitech	Berkeley	2879	102
Biosis	Palo Alto	2879	102
Zoecon	Palo Alto	2879	102
Mycogen	San Diego	2879	102
Plant Genetics	Davis	2835	103
Idetek	San Bruno	3841	103
Chevron Chemical	Richmond	2870	105
Westbridge Research Group	San Diego	7391	105
RPCO Plant Cell Research Institute	Dublin	2879	107
Sungene Technologies	Palo Alto	7391	107
Phytogen	Pasadena	2836	107
Cell-Pril Industries	Manteca	2879	109
Calgene	Davis	2836	110
Plant Cell Research Institute	Dublin	2836	110
RPCO	Los Angeles	2836	110
International Plant Research Institute	San Carlos	7391	110
NIE Plant Tissue Culture Lab	San Mateo	2836	110
Tuflow Plant Laboratories	Santa Paula	2836	110
Advanced Genetic Sciences	Oakland	7391	111
Infergene	Benicia	2099	300
American Biogenetics	Irvine	2836	301
Genecor	South San Francisco	8911	302
Advanced Biotechnology Associates	San Francisco	2099	303
Immunovet	South San Francisco	2836	601
Amtech	Mountain View	2836	603
Bio-Genetics	South San Francisco	2836	603
Advanced Genetics Research Institute	Oakland	2836	607

II. Biocode 200: Biotechnology Suppliers

Bio-Response	Hayward	2836	201
Intelligenetics	Mountain View	7372	202
Molecular Design	San Leandro	5081	202
Fluor	Irvine	5081	203
Industrial Fermentation Genetics	Crockett	2836	204
Eugenics	Menlo Park	7391	204
Astra Scientific	Santa Clara	5086	204
Syngene	La Jolla	2869	206
B. Braun Instruments	Burlingame	2836	207
Billups-Rothenberg	Del Mar	3811	207
West Coast Scientific	Emergencyville	3811	207
Applied Biosystems	Foster City	3811	207
Spectrum Laboratories	Los Angeles	750	207
		50	
		3841	207

Invicta Biosystems
Multiple Peptide Systems
HP-Genchem
Vector Laboratories
List Biologicals
Molecular Devices
E-Y Laboratories
Biosar
Bachemgentec
Bio-Rad Laboratories
Separations Group
Beckton Dickinson/Immurocytometry Systems
Brunswick Technetics
Crown-Zellerbach
Herkel Research

Santa Fe Springs 5 2836 207
Solana Beach 3811 207
South San Francisco
Burlingame 18 3841 208
Campbell 10 2836 208
Palo Alto 7 2836 208
San Mateo 15 5161 208
San Rafael 75 3841 208
Torrance 37 2836 208
Hercules 1300 3832 209
Hesperia 310 3826 209
Mountain View 2836 209
San Diego 300 2836 209
San Francisco 2869 210
Santa Rosa 2869 210

III. Biocode 400: Human Diagnostics

Immunoconcepts
J. Brooks Laboratories
Calzyme Laboratories
Clineics
American Biogenetics
Cytotech
Minnesota Mining & Manufacturing Diagnostic Systems
Intek Diagnostics
Diagnostic Technology
Earl-Clay Laboratories
Hybritech
International Genetic Engineering
Tago
Sensor Diagnostics
Biolog
American Quallex International
Clonal Research
Genetic Replication Technologies
Clontech
Cooper Development Company
Xytronyx
Techniclone International
Gen-Probe
Dako
Syva
Microgenics
Duidel
Monoclonal Antibodies
Lucky Biotech
Molecular Biosystems
Peninsula Labs
Research and Diagnostic Antibodies
Immuchem
BioGenex Laboratories

Sacramento
San Diego 5 2835 400
San Luis Obispo 175 2836 400
Tustin 37 7372 400
Emerville 25 2836 400
San Diego 49 5161 401
Mountain View 135 2835 402
Burlingame 23 2835 403
Hayward 2835 403
Novato 2835 403
San Diego 950 2835 403
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Culver City 2835 404
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La Jolla 104 3841 408
Mountain View 135 3841 408
Emerville 5 2835 410
San Diego 30 7391 410
Belmont 50 2835 412
Berkeley 2835 412
Carson 70 2835 412
Dublin 15 3841 412

Beckman Instruments
Diagnostic Products
Rgen USA
NMS Pharmaceuticals
Syntex
Pacific Biotech
Nichols Institute
Breit Labs
Integrated Diagnostics
Suncor International
Enzyme Systems Products
Synbiotics

Fullerton 2835 412
Los Angeles 276 3811 412
Mountain View 2835 412
Newport Beach 52 2835 412
Palo Alto 3300 2830 412
San Diego 17 2835 412
San Juan Capistrano 2835 412
West Sacramento 2835 412
Berkeley 25 2835 414
Chatsworth 1350 2834 414
Dublin 6 2835 414
San Diego 85 2835 414

IV. Biocode 500: Human Therapeutics

Specialty Laboratories
Interlab
SPI Pharmaceuticals
Viratek
Biotherapy Systems
Antibodies
Alpha Therapeutics
IDEC
Cutter Biological
Salk Institute of Biotechnology/Industrial Assoc.
California Biotechnology
DNRX Research Institute
Liposome Technology
Alza
Collagen
Vestlar Research
Cygnus Research
Genentech
Genelabs
Behring Diagnostics
Scripps Laboratories
Codon
Interferon Pharmaceutical
Amgen
Triton Biosciences
Innovax
Applied Immune Sciences
American Biologicals
Xoma
Cetus
Medi-Physics
Berkeley Antibody Company
International Enzymes
The Peptide Laboratory

Los Angeles 37 2836 500
Thousand Oaks 3821 500
Costa Mesa 1056 2834 501
Covina 150 2834 501
Mountain View 12 2834 501
Davis 35 3841 502
Los Angeles 2836 502
San Diego 2836 502
Berkeley 800 2836 503
La Jolla 75 2836 503
Mountain View 130 7391 504
Palo Alto 65 2834 504
Menlo Park 65 7391 505
Palo Alto 422 7391 505
Palo Alto 230 2836 505
Pasadena 74 2836 505
Redwood City 37 2834 505
South San Francisco 900 2836 505
Redwood City 50 2834 506
La Jolla 2836 507
San Diego 2836 507
Brisbane 50 2834 508
Palm Desert 2836 509
Thousand Oaks 215 7391 509
Alameda 140 2836 510
Beverly Hills 2836 510
Menlo Park 2834 510
San Francisco 28 2834 510
Berkeley 140 7391 511
Emeryville 625 7391 511
Richmond 2834 511
Richmond 15 8071 511
Fallbrook 5 2835 512
Berkeley 2836 513

Hycor Biomedical
ImmuneTech Pharmaceuticals
Suntro
Zymed Laboratories
ICN Pharmaceuticals
Trimedne Biomedical
Hana Biologics
Chiron

U. Biocode 700: Other

Biohannus
Getty OI
Parsons
Kelco
Chevron
Petrogen
Aguroun Institute
Ocean Genetics
Bechtel Group
Cytoculture International

California Biotechnology Firms

Advanced Biotechnology Associates	San Francisco	13	2099	303
Advanced Genetic Sciences	Oakland	93	7391	111
Advanced Genetics Research Institute	Oakland	30	2836	607
Rgen USA	Mountain View		2835	412
Agouron Institute	La Jolla	74	2836	703
Alpha Therapeutics	Los Angeles		2836	502
Alza	Palo Alto	422	7391	505
American Biogenetics	Irvine		2836	301
American Biologicals	San Francisco		2834	510
American Bionetics	Emeryville	25	5161	401
American Qualex International	La Mirada	10	2869	404
Amgen	Thousand Oaks	215	7391	509
Antibodies	Mountain View		2836	603
Applied Biosystems	Davis	35	3841	502
Applied Immune Sciences	Foster City	750	3811	207
APCO	Menlo Park	28	2834	510
ARCO Plant Cell Research Institute	Los Angeles		2836	110
Astra Scientific	Dublin	100	2879	107
Bachemgentec	Santa Clara		5086	204
Beckel Group	Torrance	37	2836	208
Beckman Instruments	San Francisco		2869	705
Beckton Dickinson/Immunocytometry Systems	Fullerton		2835	412
Behring Diagnostics	Mountain View	310	2836	209
Berkeley Antibody Company	La Jolla		2836	507
Billups-Rotherberg	Richmond	15	8071	511
Biogenex Laboratories	Del Mar		3811	207
Biohumus	Dublin	15	3841	412
Biolog	Holtville	17	2870	701
Bioserch	Hayward		2835	404
Biosis	San Rafael	75	3841	208
Biotherapy Systems	Palo Alto	37	2879	102
Bio-Con	Mountain View	12	2834	501
Bio-Genetics	Bakersfield		2879	102
Bio-Rad Laboratories	South San Francisco		2836	603
Bio-Response	Hercules	1300	3832	209
Breit Labs	Hayward	76	2836	201
Brunswick Technetics	West Sacramento		2835	412
B. Braun Instruments	San Diego	300	2836	209
Calgene	Burlingame		2836	207
California Biotechnology	Davis	167	2836	110
Calzyme Laboratories	Mountain View	130	7391	504
Cell-Pril Industries	San Luis Obispo	175	7372	400
Cetus	Manteca		2879	109
Chevron	Emeryville	625	7391	511
Chevron Chemical	San Francisco		2869	701
Chiron	Richmond	350	2870	105
Clinetics	Emeryville	233	7391	518
Clonal Research	Tustin	37	2836	400
Ciontech	Newport Beach		2835	404
Codon	Palo Alto	17	2836	404
	Brisbane	50	2834	508

Collagen
 Cooper Development Company
 Crown-Zellerbach
 Cutter Biological
 Cygnus Research
 Cytoculture International
 Cytotech
 Dako
 Diagnostic Products
 Diagnostic Technology
 DNAX Research Institute
 Earl-Clay Laboratories
 Engenics
 Enzyme Systems Products
 E-Y Laboratories
 Fluor
 Genelabs
 Genencor
 Genentech
 Genetic Replication Technologies
 Gen-Probe
 Getty Oil
 Hana Biologics
 Henkel Research
 HP-Genenchem
 Hybritech
 Hycor Biomedical
 ICN Pharmaceuticals
 IDEC
 Idetek
 Immuchem
 Immunotech Pharmaceuticals
 Immunocore
 Immunovet
 Industrial Fermentation Genetics
 Infergene
 Inovax
 Integrated Diagnostics
 Intek Diagnostics
 Intelligenetics
 Interferon Pharmaceutical
 Interlab
 International Enzymes
 International Genetic Engineering
 International Plant Research Institute
 Invicta Biosystems
 J. Brooks Laboratories
 Kelco
 Liposome Technology
 List Biologicals
 Lucky Biotech
 Medi-Physics
 Microalgae Aquaculture R&D

Palo Alto	230	2836	505
Palo Alto	900	2834	404
San Francisco		2869	210
Berkeley	800	2836	503
Redwood City	37	2834	505
San Francisco		2869	705
San Diego	49	2835	401
Santa Barbara	37	2836	406
Los Angeles	276	3811	412
Hayward		2835	403
Palo Alto	65	2834	504
Novato		2835	403
Menlo Park		7391	204
Dublin	6	2835	414
San Mateo	15	5161	208
Irvine		5081	203
Redwood City	50	2834	506
South San Francisco	100	8911	302
South San Francisco	900	2836	505
Newport Beach		2835	404
San Diego	30	2835	406
Los Angeles		2869	701
Alameda	126	2836	517
Santa Rosa		2869	210
South San Francisco		3811	207
San Diego	950	2835	403
Fountain Valley	75	2836	513
Costa Mesa	1600	2834	514
San Diego		2836	502
San Bruno	14	3841	103
Carson	70	2835	412
San Diego	37	2836	513
Sacramento		2835	400
South San Francisco		2836	601
Crockett		2836	204
Benicia		2099	300
Beverly Hills		2836	510
Berkeley	25	2835	414
Burlingame	23	2835	403
Mountain View	74	7372	202
Palm Desert		2836	509
Thousand Oaks	37	3821	500
Fallbrook	5	2835	512
Santa Monica	57	2836	403
San Carlos	50	7391	110
Santa Fe Springs	5	2836	207
San Diego	5	2836	400
San Diego		2869	701
Menlo Park	65	7391	505
Campbell	10	2836	208
Emeryville	5	2835	410
Richmond		2834	511
Boulder Creek		2879	101

Microgenics	Concord	65	2835	408
Minnesota Mining & Manufacturing Diagnostic Systems	Mountain View	135	2835	402
Mitech	Berkeley		2879	102
Molecular Biosystems	San Diego	30	7391	410
Molecular Design	San Leandro		5081	202
Molecular Devices	Palo Alto	7	2836	208
Monoclonal Antibodies	Mountain View	135	3841	408
Multiple Peptide Systems	Solana Beach		3811	207
Mycogen	San Diego		2879	102
Nichols Institute	San Juan Capistrano	2	2835	412
NIE Plant Tissue Culture Lab	San Mateo		2836	110
NMS Pharmaceuticals	Newport Beach	52	2835	412
Ocean Genetics	Tiburon	10	2836	703
Pacific Biotech	San Diego	17	2835	412
Parsons	Pasadena		2869	701
Peninsula Labs	Belmont	50	2835	412
Petrogen	Santa Ana	5	2836	701
Phytogen	Pasadena	17	2836	107
Plant Cell Research Institute	Dublin	42	2836	110
Plant Genetics	Davis	90	2835	103
Quidel	La Jolla	104	3841	408
Research and Diagnostic Antibodies	Berkeley		2835	412
Salk Institute of Biotechnology/Industrial Assoc.	La Jolla	75	2836	503
Scripps Laboratories	San Diego		2836	507
Sensor Diagnostics	Culver City		2835	404
Separations Group	Hesperia		3826	209
Specialty Laboratories	Los Angeles	50	2836	500
Spectrum Laboratories	Costa Mesa	1056	3841	207
SPI Pharmaceuticals	Richmond	400	2834	501
Staufner Chemical	Palo Alto	40	2879	101
Sungene Technologies	San Diego	85	7391	107
Synbiotics	Chatsworth		2835	414
Syncor International	La Jolla	1350	2834	414
Syngene	Palo Alto		2869	206
Syntex	Palo Alto	3300	2830	412
Syntro	San Diego	80	2834	513
Syva	Palo Alto	750	3841	407
Tago	Burlingame	33	2835	404
Techniclone International	Santa Ana	7	7391	405
The Peptide Laboratory	Berkeley		2836	513
Trimedyne Biomedical	Santa Ana	60	3841	514
Triton Biosciences	Flamada	140	2836	510
Tuiford Plant Laboratories	Santa Paula	80	2836	110
Vector Laboratories	Burlingame	18	3841	208
Vestar Research	Pasadena	74	2836	505
Viratek	Covina	150	2834	501
West Coast Scientific	Emeryville		3811	207
Westbridge Research Group	San Diego	472	7391	105
Xoma	Berkeley	140	7391	511
Xytronyx	San Diego	14	2835	405
Zoecon	Palo Alto	280	2879	102
Zymed Laboratories	South San Francisco	20	2836	513

