sorptive capacity is proposed a model to hich R&D both generlearning, the development of this model may ultimately be as valuable for the prescriptive analysis of organizational policies as its application may be as a positive model of firm behavior.

An important question from a prescriptive perspective is, When is a firm most likely to underinvest in absorptive capacity to its own long-run detriment? Absorptive capacity is more likely to be developed and maintained as a byproduct of routine activity when the knowledge domain that the firm wishes to exploit is closely related to its current knowledge base. When, however, a firm wishes to acquire and use knowledge that is unrelated to its ongoing activity, then the firm must dedicate effort exclusively to creating absorptive capacity (i.e., absorptive capacity is not a byproduct). In this case, absorptive capacity may not even occur to the firm as an investment alternative. Even if it does, due to the intangible nature of absorptive capacity, a firm may be reluctant to sacrifice current output as well as gains from specialization to permit its technical personnel to acquire the requisite breadth of knowledge that would permit absorption of knowledge from new domains. Thus, while the current discussion addresses key features of organizational structure that determine a firm's absorptive capacity and provides evidence that investment is responsive to the need to develop this capability, more research is necessary to understand the decision processes that determine organizations' investments in absorptive capacity.

Case III–3
Advanced Drug Delivery Systems: ALZA and Ciba-Geigy (A)

Mark W. Cunningham, Reinhard Angelmar, and Yves Doz

In midsummer 1977, the management teams of Ciba-Geigy's Pharma Division in Basle, of its U.S. division in Summit, New Jersey, and of ALZA Corp., of Palo Alto, California, had to decide whether to cooperate in the development and commercialization of pharmaceutical products using Advanced Drug Delivery Systems (ADDS) and, in the event of a positive decision, what form such cooperation should take.

In order to allow an understanding of the context of this decision, this case reviews key aspects of the pharmaceutical industry in 1977, presents the ADDS field, and profiles briefly the two companies: ALZA and Ciba-Geigy.

The Pharmaceutical Industry: Recent Evolution

The worldwide pharmaceutical market in 1977 was worth around $48 billion, the largest geographical market being the United States with some 16 percent, followed by Japan with 11 percent (see Exhibit 1). Worldwide sales of pharmaceutical companies in current terms had been growing at an average rate of 12 percent since 1960, and 15 percent since 1970. The average rate of return on net worth over the last 15 years had been 18 percent, which was considerably above the average for other major industries (11 percent). The financial performance of several of the leading companies was well above this figure.

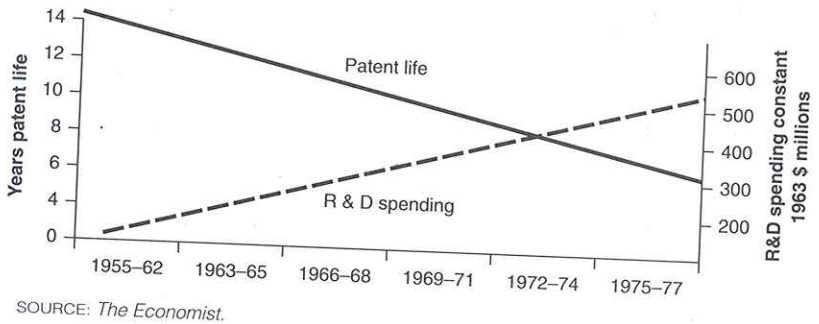
However, there were indications that the future might not be quite as rosy. Valuable new drug discoveries, which had been the main motor for

EXHIBIT 1 Worldwide Pharmaceutical Market

	1977 ($ millions)	Percent of World Total	Sales per capita (dollars)
United States of America	$ 7,800	16.3%	$36
Japan	5,400	11.3	48
Federal Republic of Germany	4,100	8.5	67
France	2,900	6.0	55
Italy	1,800	3.8	32
Brazil	1,500	3.1	14
Spain	1,200	2.5	33
United Kingdom	1,200	2.5	21
Argentina	900	1.9	35
Mexico	800	1.7	13
Others	20,400	42.5	
Total	$48,000	100.0%	

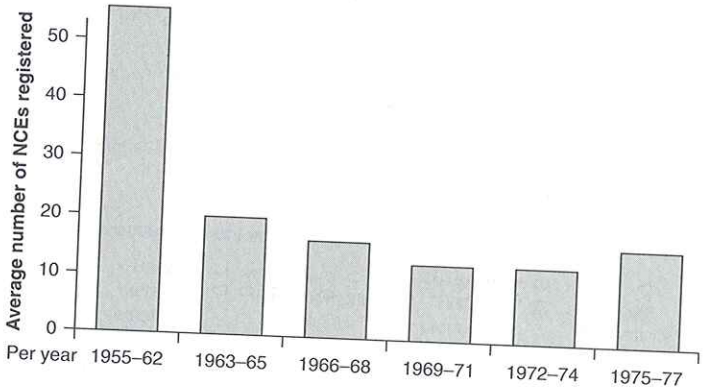
EXHIBIT 2 U.S. Pharmaceutical Industry Performance

A. Patent Life and R&D Expenditure



SOURCE: *The Economist.*

B. Registration of New Chemical Entities



SOURCE: *The Economist.*

growth, had become rarer, the development process much longer and more expensive, and the lucrative period of patent protection correspondingly shorter (see Exhibit 2).

Though there were nearly 10,000 companies in the ethical drug business worldwide, 90 percent of sales were made by the hundred largest. The top 25 companies shared less than 50 percent of sales and the largest individual market share was 3.5 percent. Exhibit 3 shows the top 15, their country of origin, and the importance of pharmaceuticals in group sales. Exhibit 4 shows the areas of activity of leading pharmaceutical companies and their R&D profile.

Product innovation was the main key both to profitability and to growth, but new drug discoveries remained partly serendipitous. Companies' labs screen for activity and toxicity large numbers of natural and synthetic substances which, because of their molecular characteristics, are thought to have a potential use in one or another therapeutic area. This primary screening is usually done on animals. Only about 1 in 1,000 of the chemicals so tested proves sufficiently active and nontoxic to deserve trials on human beings.

The product development process was very slow, with anywhere between 1 to 10 years of research (developing and screening chemical substances), and around 9 years for preclinical and clinical trials leading up to the application for registration. Then three more years of trials were likely to be needed for registration (see Exhibit 5). By the mid-1970s, estimates of the average R&D expenditures per new drug actually introduced by a major pharmaceutical company, taking into account the very high dropout rate during clinical tests, ranged between $25 million and $80 million.

The serendipitous nature of discovery and the need to spread risks and to smooth out the activity

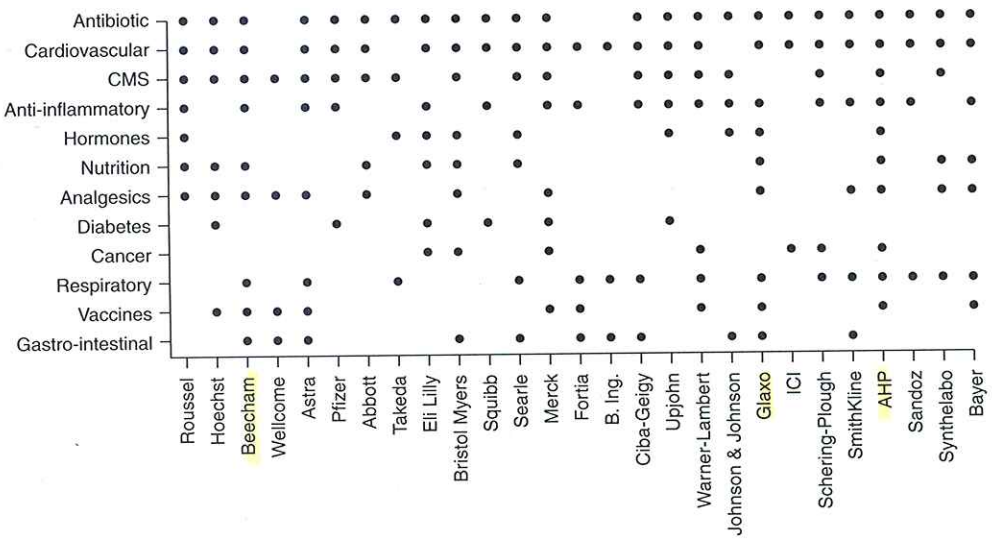
EXHIBIT 3 Leading Pharmaceutical Companies, 1977

	Country	1977 Pharmaceutical Sales ($billions)	Pharmaceutical as a Percent of Group Sales	World Market Share	Percent of Sales in Home Country	Percent of Sales from Top Four Products
1. Hoechst-Roussel	Federal Republic of Germany	$1.6	16%	3.3%	67%	—
2. Merck & Co.	United States of America	1.4	84	2.9	45	49
3. Bayer	Federal Republic of Germany	1.3	13	2.7	69	—
4. Ciba-Geigy	Switzerland	1.2	28	2.5	2	22
5. Hoffman La Roche	Switzerland	1.2	51	2.5	10	—
6. American Home Products	United States of America	1.1	39	2.3	31	37
7. Warner Lambert	United States of America	1.0	40	2.1	43	36
8. Pfizer	United States of America	1.0	50	2.1	51	50
9. Sandoz	Switzerland	0.9	48	1.9	5	—
10. Eli Lilly	United States of America	0.9	53	1.9	37	60
11. Upjohn	United States of America	0.7	66	1.5	37	53
12. Boehringer	Federal Republic of Germany	0.7	77	1.5	69	—
13. Squibb	United States of America	0.7	50	1.5	33	38
14. Bristol Myers	United States of America	0.7	30	1.5	31	—
15. Takeda	Japan	0.6	65	1.3	6	—

SOURCE: U.N. 1979 report and ADL Insight.

EXHIBIT 4 Drug Companies

A. By Sector



SOURCE: Annual reports.

B. Selected R&D Characteristics of Leading Pharmaceutical Companies

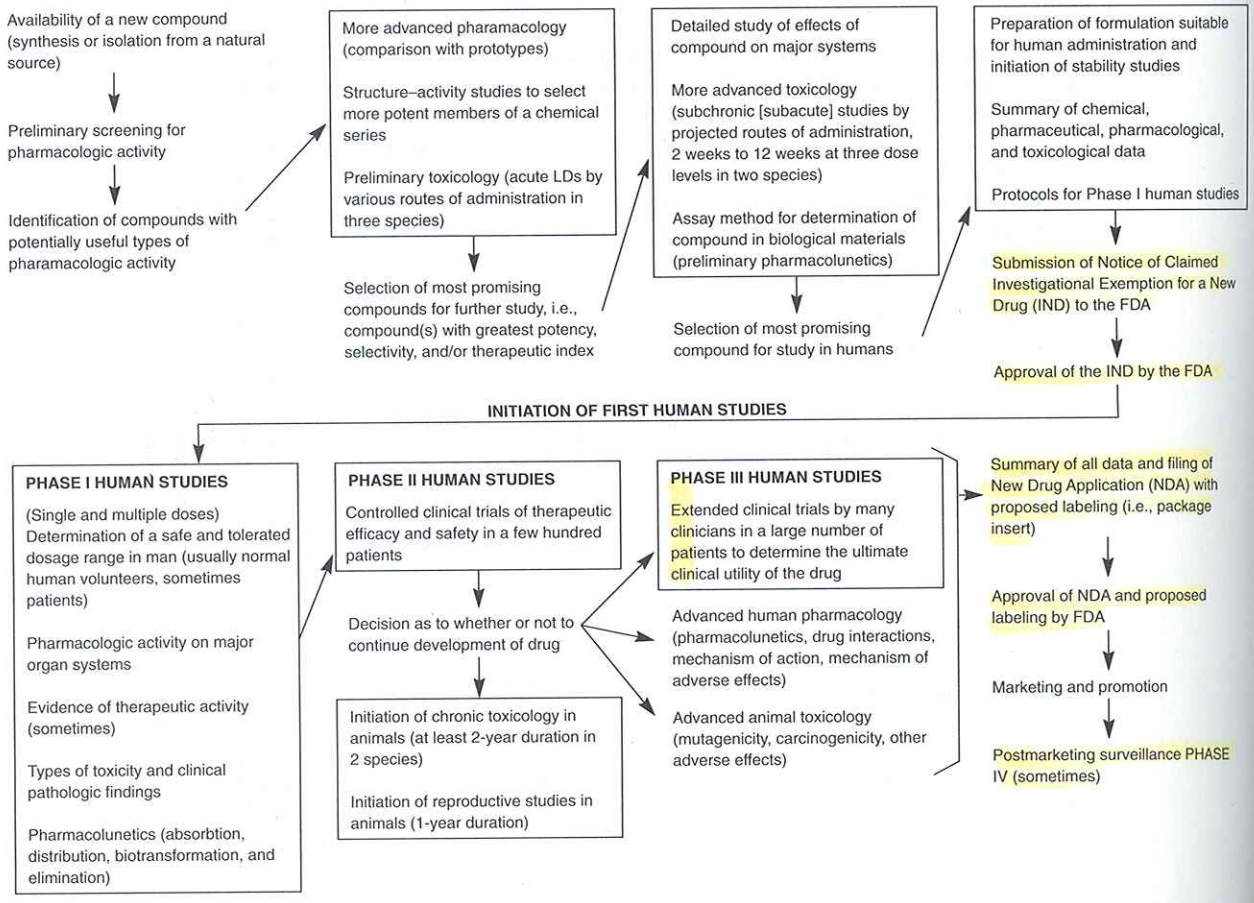
	Basic research emphasis	Development emphasis	Historic productivity	Recent productivity	Licensing relationships
Maximum:			2	3	1
Abbott	•	•	+	+	+
American Home		•			+
Ciba-Geigy	•	•	+		+
Johnson & Johnson	•	•	+	++	+
Lilly	•	•	+	+	+
Merck	•	•	++	+++	
Pfizer	•	•		+	+
Roche	•		+		+
Schering-Plough	•	•	+		+
SmithKline	•	•		++	
Squibb		•		+	+
Upjohn	•			+	+
Warner-Lambert		•	+		+

SOURCE: ADL Impact.

of development groups created economies of scale in pharmaceutical R&D. R&D spending amongst leading companies varied from 5 percent of turnover to over 12 percent, with an industry average of 8 percent (up from 7 percent in the 1960s). Companies could be divided into two main groups: those which depended heavily for growth and profits on product innovation; and those which relied on process skills to produce me-too products rapidly and cheaply, and on marketing skills to sell them. Ciba-Geigy, Merck, Eli Lilly, and most of the other top companies belonged to the first group.

Despite the slowdown in successful introductions, the industry still judged that the prerequisite for success was a large and well-focused R&D program and was increasing spending in this area. Companies were concentrating their efforts on a smaller number of indications with proven market potential and trying, where possible, to build on their existing expertise. It seemed likely that the smaller compa-

EXHIBIT 5 Development Process for Typical Pharmaceutical Product



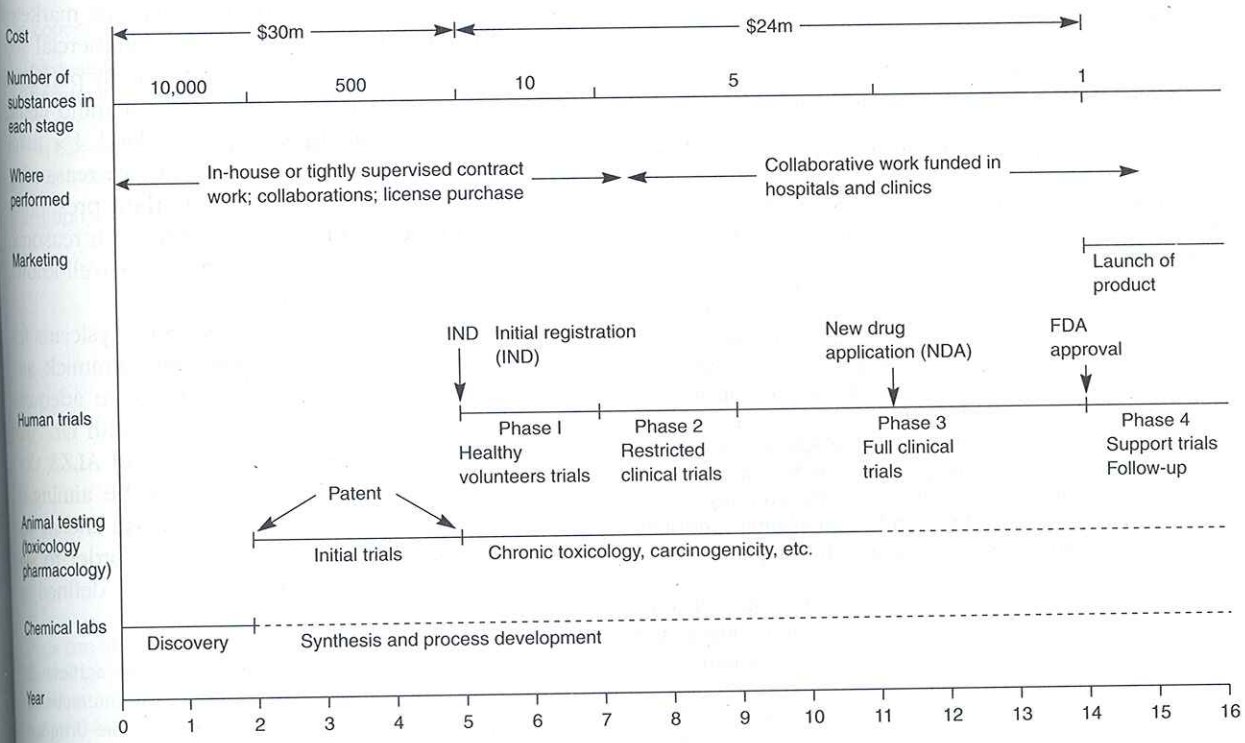
SOURCE: Frank G. Standaert, Department of Pharmacology, Georgetown University Schools of Medicine and Dentistry, Washington, D.C.
FROM: Bezold, "The Future of Pharmaceuticals"

nies would continue to have a high success rate in discovery, but that they would be forced by the costs of development to seek partners and licensees to exploit their discoveries.

Marketing costs were estimated to average 12 percent of turnover. Doctors were the key in ensuring the success of new drugs since neither the patients nor the actual buyers or payers (hospital administrators, health plan officials) knew much about them. Many drug companies ran separate sales forces (detailers) for different therapeutic areas or target groups. It was felt that detailers could not be expected to promote a full range of several hundred products. Thus, drugs suitable for hospital use might be promoted by one sales force, those for general practitioners' prescription by a second, and those for self-medication by yet another. The sales forces of Ciba and Geigy had not been combined when the two companies merged, and it was usual also for sales forces to remain separate when a large company acquired a smaller, specialized one.

Marketing and the establishment of a differentiated position for brands became increasingly important. While patents could prevent direct reproduction of a drug, they did not stop the competition issuing a slight chemical modification with similar action. Generally speaking, the first product into a new area, or the first to achieve a significant improvement (such as better efficacy, lesser side effects, easier formulation into oral form, etc.) over existing products in an established one became the physicians' drug of choice. This pattern increased both the risks and potential rewards of the R&D process. A good product reaching the market too

EXHIBIT 5 (*continued*)



SOURCE: Wardell: Hansen.

late might not even cover its development costs. The potential of a product was thus intimately tied to the progress being made by competitors working on the same problem. Late entrants could try for a coattails effect identifying themselves with the leader and relying on marketing muscle for sales. However, generally, an attempt was made to differentiate with a different dosage form, or by claiming a wider range of applications.

The importance of first entry and the need to spread costs of development over a wide sales base led all the major ethical drug companies to establish overseas subsidiaries. These had their own marketing and sales organizations and many formulated and packaged products, though the production of active ingredients was usually centralized to achieve economies of scale. The subsidiaries generally operated with a considerable degree of autonomy.

The three Basle-based Swiss companies (Ciba-Geigy, Hoffmann-La Roche, and Sandoz) sold 95 percent of their product abroad, exporting the majority of their active ingredients from headquarters. U.S. companies still served mainly their domestic markets but were internationalizing rapidly. Japanese suppliers remained so far almost entirely domestic.

Advanced Drug Delivery Systems (ADDS)

The active ingredient of a pharmaceutical product cannot usually be administered in its natural state. It has to be combined with a delivery vehicle or dosage form such as a pill, syrup, and the like (Exhibit 6). Most conventional drug delivery methods have the same limitation: they do not permit the physician consistently to reach and maintain the optimum level of active ingredient (AI) in the pa-tient's blood and tissues (Exhibit 7). Until the 1930s the dosage form was largely the province of the pharmacist who formulated active ingredients and inert materials into pills, liquids, and ointments, whereas the pharmaceutical companies concerned themselves with the discovery and production of active ingredients.

With the therapeutic explosion of the next two decades and the downstream integration of the

EXHIBIT 6 Conventional Delivery and Dosage Forms

1. *Oral forms* (pills, capsules, syrups, powders, etc.) are easy to apply and are generally well accepted by patients. Their main disadvantages are that they affect and are affected by the properties of the individual's gastrointestinal (GI) tract and that their active ingredients are often rapidly metabolized by the liver. They are generally only suitable for drugs with long half-lives (resistance to metabolism), and because of their rapid metabolism in the liver they often have to be applied in much larger doses than the intended treatment area really requires.
2. *Parenteral forms* (injections, infusions) are largely used for drugs which have too short a half-life for oral dosage or are not absorbed by the GI tract. Many antibiotics fit into this category. This form has the great disadvantage that it is not generally suitable for self-medication and is restricted to hospitals and clinics in the main.
3. *Topical forms* (ointments, creams, liquids) are for external application generally, treating such surface conditions as wounds, burns, and eczema. However, where a drug permeates the skin easily, it can be used to treat internal conditions (nitroglycerine ointments for angina and various bronchial treatments).
4. *Rectal forms* (suppositories) have a more uniform absorption than oral products without their effect on the stomach, but they are not well accepted by patients in a large part of the world.
5. *Inhaled forms* (atomizers) are generally used for respiratory complaints; although the lungs provide easy access to the blood stream, they are also fragile.

pharmaceutical companies, the delivery vehicle began to get more attention. Companies were looking for ways to differentiate their products, and it was felt that an increase in convenience to the user would not only do this but also improve compliance and therefore efficacy of treatment.

Marketing departments were asking for once-a-day treatments and while most of research's efforts in this area went into searching for drugs with longer active lives (resistance to metabolism), many of the large pharmaceutical companies also worked on slow-release delivery systems. They established pharmacokinetics departments to study the absorption, distribution, metabolism, and excretion of drugs. These functions were still very imperfectly understood. Most prior research had concentrated solely on the empirical observation of the effects of drugs.

Several slow-release systems were developed. Such systems were generally expensive to produce and their success in the marketplace had been very mixed. Ciba-Geigy had one in-house–developed slow-release product, Slow-K, which had been a major success, turning a commodity chemical into a high-margin product.

Many of the slow-release formulations marketed since the mid-1960s had not been commercial successes because there was no very strongly perceived need for them. Patients often did not mind taking medication several times a day; indeed, for many short treatments, they found this more reassuring. Doctors saw no reason to change their prescribing habits, and the detailers saw no particular reason to push slow-release at the expense of a well-known traditional form of the same drug.

While many pharmacologists and physicians felt that slow-release was a marketing gimmick and that conventional delivery systems were adequate for therapeutic needs, others agreed with Dr. Alex Zaffaroni, the founder and president of ALZA Corporation, who said that one should be aiming to achieve complete control of the release and movement of the drug within the body in order to satisfy the "Laws of Minima" which he defined as follows:

> The physician's objective should be to achieve the desired results with the "minimum of interaction of therapeutic agents with body tissues." The drug with the shortest practical half-life should be chosen; the formulation should contain as few other substances as possible; the application site should be chosen to reduce the number of tissue compartments traversed on the way to the treatment site; dosage should be as low and as infrequent as possible.

Dr. Zaffaroni said that "therapeutic systems" should be developed to allow control of the rate of release of a drug as well as its quantity. The release profile for such products would be similar to that shown in Exhibit 8.

Though in its broadest sense an advanced drug delivery system (ADDS) could be said to be any new delivery vehicle offering improvements over existing methods, the term will be applied here only to those which could be used in "therapeutic systems" as defined by Dr. Zaffaroni. Though ALZA seemed to have the largest number of systems at an advanced stage of development (Exhibit 9), a number of other companies were known to be working along similar lines. Dr. Zaffaroni felt that the commercial potential of optimized delivery systems, or ADDS, was enormous:

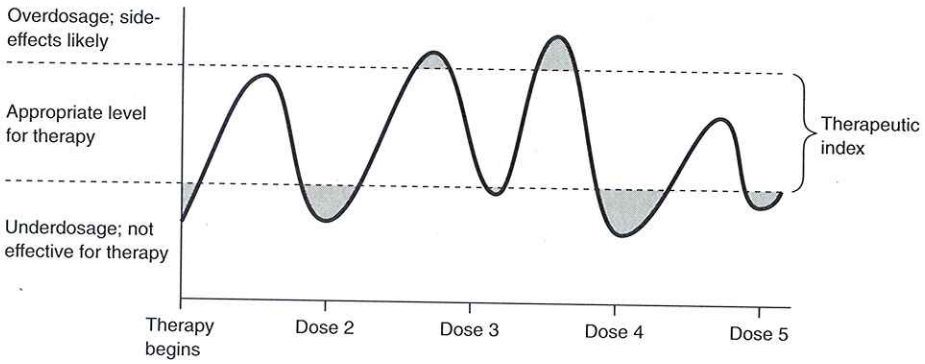
1. They would permit the use of some substances which were currently too toxic or short-lived for commercialization.

EXHIBIT 7 Drug Concentration in Blood and Tissues

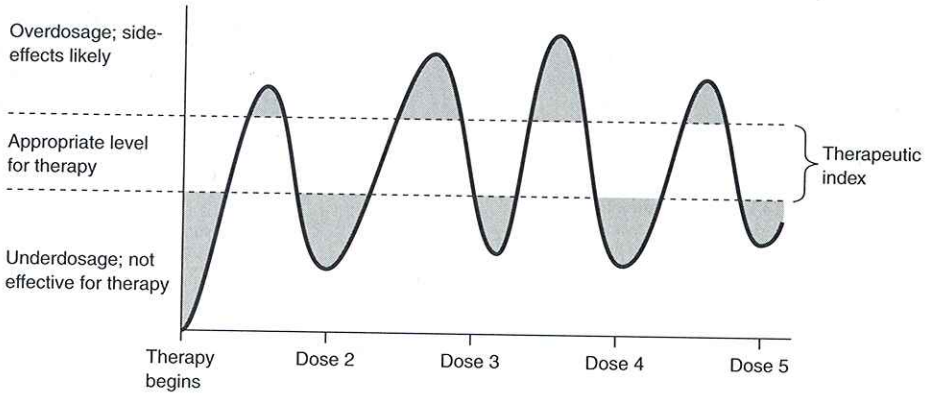
The concentration of the drug in blood and tissues varies greatly over time and depends on several factors:

1. The quantity of active ingredient (AI) administered and frequency of dosage.
2. The rate of breakdown of the carrier material, which varies from patient to patient.
3. The rate of absorption of the AI (also variable).
4. The half-life of the AI (the time it takes the body to metabolize and deactivate the drug): the shorter the half-life, the larger the dose or more frequent its application.

The graph below shows the typical concentration in the blood of a drug administered four times daily in conventional form.



Drugs can be positioned on a therapeutic index which is defined as the relationship between the minimal curative dose and the maximal tolerated one. Where the index is wide, as in the figure above, such variations may be acceptable, if not optimal. Where it is narrow, as in the graph below, large fluctuations cannot be permitted; toxic side effects occur when the concentration is too high, and the drug is ineffective when it is too low. The usual solution to this problem is to increase the frequency of dosage, but this often causes patient compliance problems, particularly in long-term treatments.



Many drugs of proven activity have been rejected in preclinical and clinical tests because their narrow therapeutic index caused toxic side effects when they were applied in conventional oral or parenteral form.

2. They could be used to repackage or improve existing products, extending their effective life and diminishing the ill-effects of loss of patent protection.
3. They could add value to generics through differentiation.
4. They could open up for commercialization markets in which patient compliance was a serious problem (e.g., contraception in the Third World).

However, there were still a number of medical, commercial, and technical question marks hanging over ADDS.

The validity of the "Rules of Minima" was by no means accepted by the pharmacological establishment, though to the layman they seemed to make sense. There were worries that a steady release rate for a drug might more easily lead to tolerance in the

EXHIBIT 8 **Drug Concentration: Comparison of ADDS and Slow-Release**

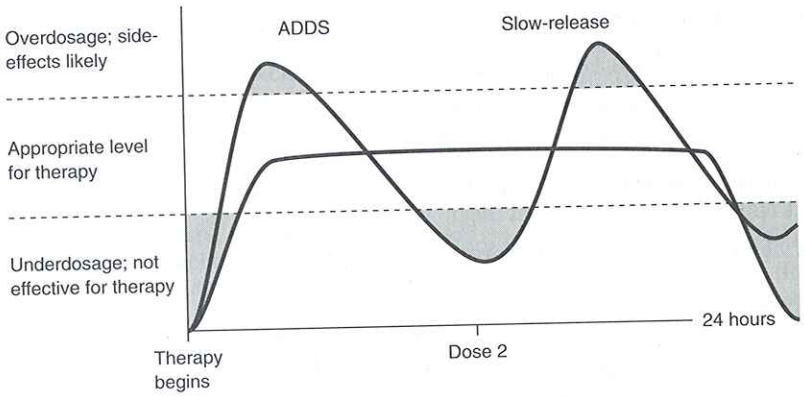


EXHIBIT 9 **ALZA Systems**

Appearance of, and diagrammatic cross-section through, the OCUSERT (4 times the actual size)

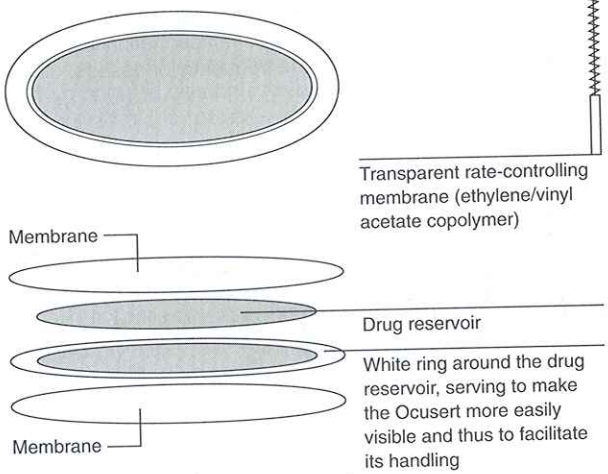


Diagram of the TRANSIDERM

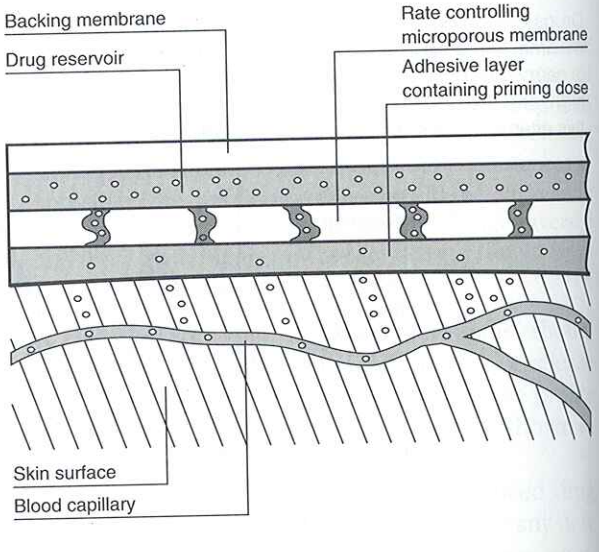


Diagram of the OROS

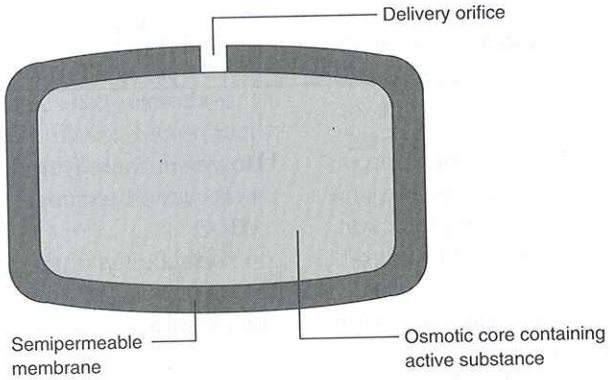
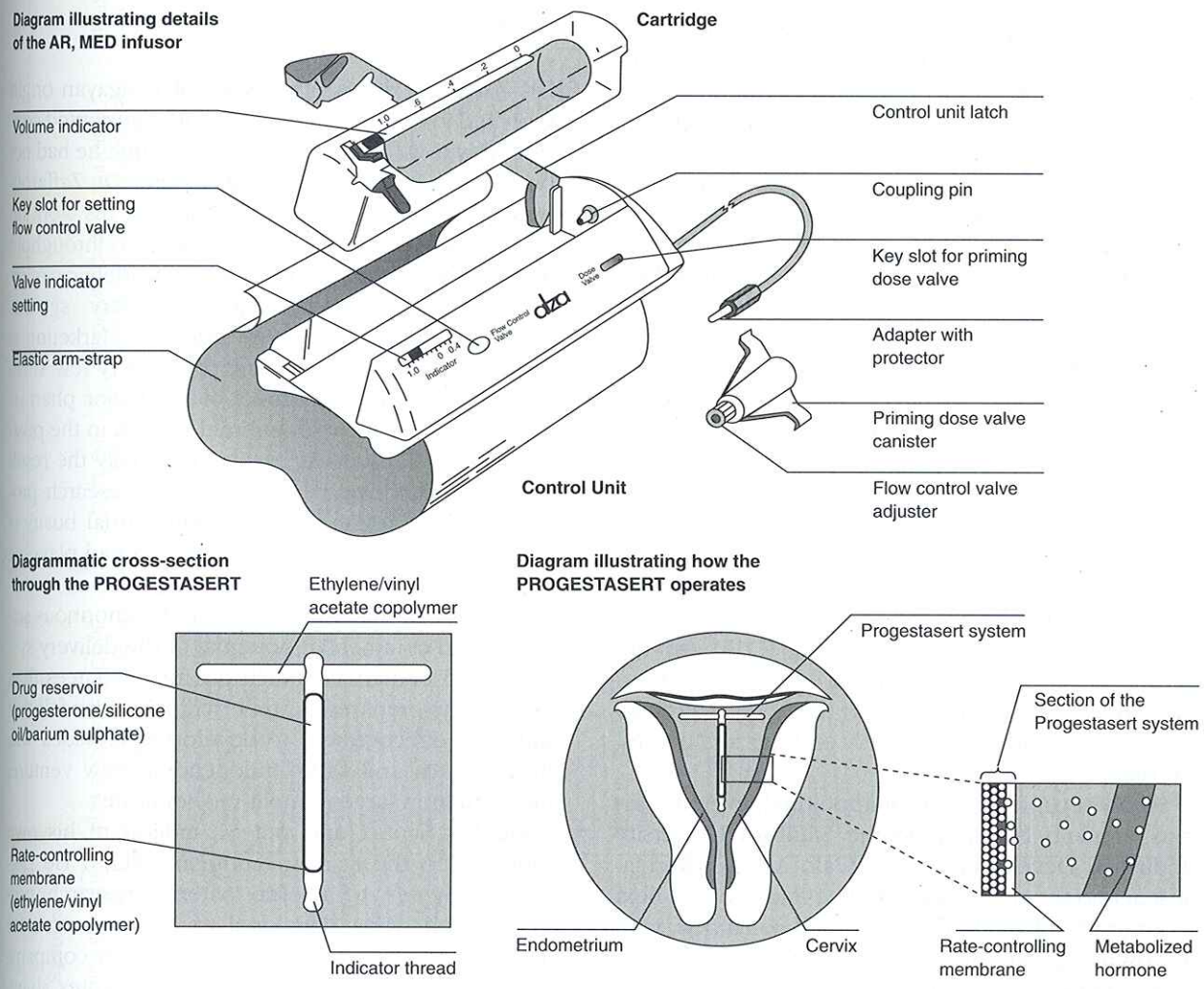


EXHIBIT 9 (*concluded*)



body and therefore to larger and larger doses, or to ineffectiveness. Many felt that the therapeutic index of the vast majority of drugs was sufficiently wide for conventional delivery vehicles to be acceptable, and that the potential for ADDS was therefore limited.

There were also doubts about the practicality of designing sophisticated delivery vehicles and then trying to squeeze drugs into them. The absorption characteristics and modes of action of most drugs were imperfectly understood. Achieving true control of their release might well require custom designing of the system for each individual case.

ADDS were very much more expensive to produce than conventional forms; the production and packaging of pills, ointments, syrups, and injectables formed a very low proportion of overall cost. Techniques were generally well known, and techniques were standard throughout the industry. In the case of ADDS, the delivery vehicle generally cost more than its contents.

Registration was likely to be relatively easy to obtain for systems including established drugs since the efficacy of the latter would already have been proven. The main problem would be proving efficacy superior to that of the industry standard in order to justify a higher price.

The pharmaceutical industry's main areas of expertise were the synthesis and efficient production of active chemicals. The compounding of the final product was a relatively simple process. ADDS would require a new type of development and production know-how: familiarity with polymers, plastics, adhe-

sives, molding systems, and so on. Engineers would find themselves in the front line for the first time and the expertise required was not easy to acquire.

Commercial potential was equally uncertain. Many of the ADDS devices would require the patient and physician to learn new application methods (the main exception to this was ALZA's OROS), though they offered greater convenience thereafter. The medical establishment was generally thought to be conservative and slow to accept new forms of treatment. The very low acceptance rate for ALZA's Progestasert and OCUSERT, both of which had therapeutic and user advantages, seemed to confirm this view. The introduction of a radically new system is best achieved through a well-trained and product-specific sales force. However, this is only economic for extremely high-volume products.

ALZA Corporation

ALZA was founded in 1968 by Dr. Alejandro (Alex) Zaffaroni. ALZA's mission, essentially unchanged from the start, was described by the 1976 annual report as follows: "ALZA is devoted to the creation, development, and marketing of therapeutic systems for precisely controlled delivery of drugs and natural substances."

ALZA occupied nine well-appointed, even luxurious, modern buildings in the Stanford University Industrial Development Park, Palo Alto, California, just across the street from Hewlett-Packard and next door to IBM. Each building was self-contained, with its own cafeteria and social facilities, to promote close personal contacts among subgroups. The whole was surrounded by landscaped grounds complete with sculptures which often served as an outside meeting room and canteen.

While the company had, until now, functioned mainly as a research organization financed by capital, it had recently launched three products, and its declared intention was to become an integrated pharmaceutical company handling its own production and marketing. The emphasis had, thus far been on the development of systems, on the assumption that once these were perfected, generic or proprietary compounds would be found to fill them.

ALZA's technology was largely unique in 1977, and there was no other company or research center with a similar mix of materials, engineering, and pharmaceutical expertise. The company's projects and products and their principal features are summarized in Exhibit 10.

Origins of ALZA

Dr. Zaffaroni was a biochemist of Urugayan origin who had joined Syntex in 1951 and contributed considerably to its meteoric growth. Though he had not been active in research for many years, Dr. Zaffaroni was still well-known and respected for his work on hormones. He had excellent connections throughout the pharmaceutical industry and in academic circles.

Dr. Zaffaroni had initiated delivery systems research while head of Research and Marketing at Syntex. Syntex had been one of the very few small companies to join the ranks of the major pharmaceutical groups through internal growth in the post-war period. Its success had been equally the result of a highly innovative and succesful research program and an aggressively entrepreneurial business policy, in both of which Dr. Zaffaroni had played a significant role.

He had become convinced that the enormous scientific and commercial potential of the delivery systems field demanded much greater resources than Syntex was prepared to underwrite. He also felt that the most effective way to develop a new idea was from scratch and as an independent new venture, rather than in large company laboratories.

He left Syntex and put $2 million of his own money into the start-up company ALZA. He persuaded Syntex to release patents, research programs, and some personnel to him in return for about 25 percent of the equity of the new company. These shares were later distributed to Syntex shareholders as supplementary dividends.

Using contacts developed while at Syntex, Alex Zaffaroni had assembled a first-rate team of 90 researchers and technicians by 1970. Among them were such ADDS pioneers as Dr. Higuchi, for whom ALZA financed a Development Institute at the University of Kansas. He had also recruited a team of well-known scientists from leading universities to form a Board of Scientific Advisors and to act as consultants to ALZA.[1]

Dr. Zaffaroni was a charismatic and paternalistic leader who managed to inspire not only loyalty and enthusiasm in his employees, but also a sense of mis-

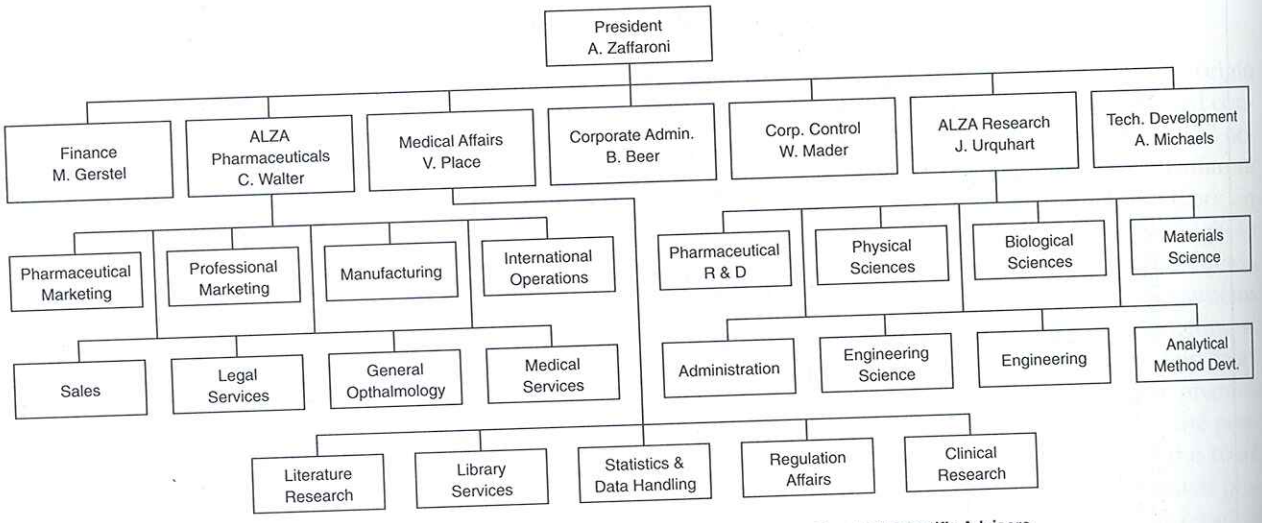
[1]One of these was Dr. Robert Woodward, professor of science at Harvard. He was also a member of the Ciba-Geigy board of directors and head of a research institute funded by Ciba-Geigy.

EXHIBIT 10 Principal Features of ALZA P

EXHIBIT 10 Principal Features of ALZA Drug Delivery Systems

SYSTEM	POTENTIAL USE LENGTH OF ACTION	COMPETING METHODS LENGTH OF ACTION	ALZA PRODUCT & THERAPY	CORE TECHNOLOGY	DATE OF INTRODUCTION	COMMERCIAL POTENTIAL	PRINCIPAL ADVANTAGES	PRINCIPAL DRAWBACKS
Ocusert Eye-insert with reservoir and rate-controlling membrane	Glaucoma, Trachoma, Conjunctivitis, other infections 1 week +	Eye drops, ointments, systemic medicines. Surgery 3 hrs. to perm.	Ocusert Pilocarpine Glaucoma	Polymer membranes	1975	Glaucoma $20 m market. Others big but not known	Controlled delivery. Smaller dose, fewer side effects. Patient compliance	Expensive. Doctor and patient need special training
Intra-uterine device Drug or hormone release through membrane	Contraception Menstrual control 1 year	The "pill", other IUDs, surgery, diaphragms, etc. 1 day to perm.	Progestasert Contraception	Polymer membrane	1976	Contraception $500m + worldwide	Reduced menstrual problems. Reduced hormone intake. Patient compliance	Expensive. Doctor must be trained. Ectopic pregnancies. Strong competition
OROS Oral steady release drug in semi-permeable membrane	Almost all systemic drugs suitable for oral use. 1 day	Microcapsules, matrix slow-release. Regular pills 4 hrs to 1 day	None as yet. Prototype	Polymer membrane. Osmosis	1980? If suitable drug found	Impossible to quantify. Thought to have biggest potential	Steady release unaffected by acidity changes. Less irritation. Patient compliance	Expensive. Need for 24 hr. dose unclear. Many competitors
Transiderm Patch stuck to skin containing reservoir and rate-controlling membrane	Anti-nausea; angina, hormonal imbalance, many others. 3 days–2 weeks	Ointments, creams, adhesive patches. Without rate control 4 hrs. +	None as yet. Prototype	Polymer membrane. Adhesives	1979? If trials scopolamine successful	Very large	Steady release drug. By-passes liver. Treatment easily stopped. Patient compliance	Not suitable for all drugs. Relatively expensive
Chronomer Injectable bio-erodible polymer containing drug	Diabetes, hormonal imbalance, narcotic antagonists contraception Up to 1 year	Implants. Depot injections. Erodible polymers. Up to 1 year	None as yet. Still basic research	Biodegradable polymers. Drug inclusion	1983?	Very large	Long-term steady release. Can be removed. Patient compliance	Not yet known
Portable intra-venous infusor	All treatments that need infusion. Cancer chemotherapy, anaesthetics Up to 12 hrs	Static drip on pole. Mechanical pumps (heavy) Several hrs.	AR/MED. Infusor Purchaser decides use	Elastomers	1976 in prototype form	Limited	Portability, ease of use	Expensive. Small-scale production
Osmotic Minipump Implantable drug reservoir and release mechanism	Basic biomedical research in animals. Toxicology studies Up to 7 days	Injections, medicated food, external infusion implanted polymers 4 hrs, to 1 yr.	ALZET. Potential for all medical & veterinary research	Osmosis	1976	Small	No true alternative for steady release research. Ease of use.	

EXHIBIT 11 Partial Organization Chart for ALZA Corporation—1977



Executive Committee

Dr. Zaffaroni (President)
Mr. Walter
Mr. Gerstel
Dr. Place
Dr. Urquhart
Mr. Stern (Secretary)

Board of Directors

Dr. Zaffaroni	:	ALZA
Mr. Cutler	:	Attorney
Dr. Forrester	:	Prof. of Management, MIT
Dr. Michaels	:	Chief Engineering Advisor
Mr. Palevsky	:	Private Investor, Ex-Chairman, Xerox
Mr. Peterson	:	Ex-President, Bank of America
Dr. Place	:	ALZA
Mr. Stern	:	ALZA
Mr. Walter	:	ALZA

Board of Scientific Advisors

Dr. Barany	:	Prof. of Pharmacology, Upsala Univ.
Dr. Eagle	:	Director Cancer Einstein School of Medicine
Dr. Flory	:	Professor, Stanford University
Dr. Folkman	:	Prof. of Surgery, Harvard
Dr. Higuchi	:	Prof. of Chemistry & Pharmacy, Kansas Univ.
Dr. Kornberg	:	Prof. of Biochemistry, Stanford Univ.
Dr. Scrimshaw	:	Prof. of Nutrition & Food Science, MIT
Dr. Selye	:	Director Institute of Experimental Medicine & Surgery, Montreal Univ.
Dr. Wiesner	:	President MIT
Dr. Woodward	:	Donner Prof. of Science, Harvard

SOURCE: ALZA documentation.

sion as great as his own. He believed in hiring the best people and giving them the best possible conditions to work in. He was particularly concerned to foster an entrepreneurial spirit in ALZA and he encouraged initiative on the part of his employees. Strong emphasis was placed on the generation of ideas and on creative development of them, and budgetary control was not tight. Cost considerations came very far down on Dr. Zaffaroni's list of priorities. Though he now concentrated chiefly on strategic issues, Dr. Zaffaroni continued to be involved in the decision-making process at almost all levels.

ALZA Organization

Dr. Zaffaroni was both chairman of the board and president (CEO) of the company; five of the nine directors were nonexecutive appointees. The management committee which ran the company consisted of the heads of research, medicine, production, and finance, and Dr. Zaffaroni and the company secretary. A partial organization chart for ALZA can be found in Exhibit 11.

Almost all the key scientists and managers had held their positions since the founding of the company. Many of those in positions of responsibility were still in their 20s or 30s. The atmosphere was informal with an open-door policy running right to the top, and the hierarchical structure was very ill defined. Wages were not exceptionally high and there were few performance-linked bonuses, but many employees benefited from stock options.

Research was generally carried on by multidisciplinary teams whose members also belonged to departments organized along functional lines. Research was considered the core of the company, and in 1977 it accounted for 220 of the 550 ALZA employees. These included a large number of materials engineers and polymer chemists. The medical department, concerned mostly with the clinical trials necessary for registration of products, employed another 30 people.

ALZA Pharmaceuticals had been formed in 1973 as a subsidiary which would combine the manufacturing, marketing, and sales functions.

Manufacturing acquired a new 67,000-square-foot facility in the industrial park and with the pilot plant had acquired 150 process workers and technicians by 1975. The capacity acquired was expected to be sufficient to meet demand into the 1980s. This function was run very much as a separate unit with little contact between research and manufacturing below executive level.

The marketing department concentrated at first on raising awareness of the eye-insert OCUSERT, publishing scientific papers, sponsoring symposia on glaucoma, and producing training films and literature. A field force was trained not only in opthalmic applications of ADDS but also in other potential fields and in membrane technology. Between 1974 and 1976 a similar program was followed for Progestasert, a contraceptive device launched in 1976. By 1976 ALZA had a direct field sales force of 70 representatives and regional managers. The majority specialized in contraception, which was the larger market and which was prescribed by a greater number of doctors.

ALZA Operations 1968–1977

Between 1969 and 1976 ALZA raised $73 million in capital. Of this, $12 million came from companies interested in distribution of ALZA products or in ALZA research contracts (e.g., Merck). Of the rest, $37 million came from private placements and warrants, and $26 million from publicly offered stock. The only major stockholder was Dr. Zaffaroni, who in 1977 held roughly 13 percent of the 7.8 million shares.

In 1970, ALZA was predicting the launch of the first product (unspecified) by 1972. It could be OCUSERT, Progestasert, or an unnamed product for cattle. By 1972, ALZA was still far from a launch, development times having been underestimated. No new launch date was given.

In 1973 the first new drug applications, for OCUSERT and Progestasert, were presented to the U.S. Food and Drug Administration (FDA) and by the end of 1974 the production facilities for these were largely in place. The establishment of the latter before approvals had been obtained was a calculated risk. ALZA needed to get products into the marketplace as quickly as possible not only to provide revenue but also to maintain the company's credibility in the stock market.

Approval for OCUSERT came in 1974 and it was launched in 1975. Progestasert was approved in 1975 and launched in 1976. Both products enjoyed a high degree of interest in the medical press and both appeared to perform up to expectations in all respects except sales volume. ALZA had no doubt that the products were significant technical advances over existing systems and felt that the warm reception given to them by those asked to test them would translate into industrywide acceptance.

In any event, the sales which had been expected to put the company into profit in 1977–78 were well below estimates. Sales of $2.8 million were registered in 1976, and around $6 million in the year ending June 1977. However, there were indications that a high proportion of the latter sum consisted of sale-or-return consignments filling the distribution pipeline. Far from rising, it seemed that the real sales trend was downwards.

The initial resistance to new concepts had turned out to be much stronger than expected. The Progestasert device had to be inserted by physicians, and though the action was said to be easy it had to be learned. Physicians were somewhat reluctant to recommend a new device, taking a conservative wait-and-see attitude. The ALZA sales force might have been able to overcome these problems if there had not also been price resistance to the product. It was more expensive than competing IUDs and represented a much higher one-time outlay than the pill. To add to Progestasert's difficulties, there were indications that it did nothing to prevent ectopic pregnancies, those occurring outside the womb.

OCUSERT had to be inserted by the patients; since many of these were elderly and already very sensitive about their eyes, the product met with user resistance. This patient group was not only inherently conservative, but also very price sensitive, and OCUSERT was considerably more expensive per treatment day than eyedrops. The clear advantages of the product (once-a-week application and few side effects) were insufficient in themselves to sell it.

ALZA's Situation in 1977

The separate sales forces, unable to spread their costs across a range of products, became a serious drain on the company's stretched resources. Marketing expenditure for 1974–1977 exceeded $20 million and was running at an annual rate of $6.5 million.

Annual operating losses for 1975 to 1977 exceeded $15 million, and with sales in 1977 barely

EXHIBIT 12 Statement of Operations

	Years Ended June 30				
	1973	1974	1975	1976	1977
Net sales	$ —	$ —	$ —	$ 2,401,000	$ 6,102,000
Research revenue	—	—	250,000	399,000	1,108,000
Total revenue	—	—	250,000	2,800,000	7,210,000
Costs and expenses:					
Costs of products shipped	—	—	—	1,136,000	3,720,000
Start-up manufacturing costs	—	762,000	710,000	1,099,000	—
Research and product development expenses	6,073,000	6,751,000	7,515,000	8,434,000	8,087,000
General, administrative, and marketing expenses	1,470,000	2,937,000	6,125,000	7,223,000	9,077,000
Interest, net	(961,000)	(1,400,000)	(698,000)	462,000	1,296,000
Total costs and expenses	6,582,000	9,050,000	13,652,000	18,354,000	22,180,000
Loss before items below	(6,582,000)	(9,050,000)	(13,402,000)	(15,554,000)	(14,970,000)
Excess of sales value over cost of products previously shipped	—	—	—	420,000	—
Equity in net loss of Dynapol	(407,000)	(1,251,000)	(1,624,000)	(1,153,000)	(1,261,000)
Net loss	$(6,989,000)	$(10,301,000)	$(15,026,000)	$(16,287,000)	$(16,231,000)
Net loss per share	$(1.37)	$(1.83)	$(2.47)	$(2.30)	$(2.12)
Weighted average number of shares outstanding	$ 5,086,000	$ 5,642,000	$ 6,080,000	$ 7,086,000	$ 7,667,000

SOURCE: ALZA annual reports.

covering manufacturing costs, it was clear that the company's cash flow crisis was not a short-term phenomenon. ALZA's capital reserves had been exhausted. By June 1977, $14 million of a $20 million line of credit had already been taken up and the company was in default of loan conditions. The company's stock was selling at half of 1976 prices (Exhibits 12, 13, 14).

Faced with an increasingly precarious financial situation, Alex Zaffaroni devoted most of 1977 to the search for a long-term solution.

He approached almost all the major pharmaceutical and chemical companies with proposals for a comprehensive partnership which would secure the future of ALZA. In April 1977, Dr. Zaffaroni contacted a member of Ciba-Geigy's board of directors who introduced him to Dr. Gaudenz Staehelin, head of Ciba-Geigy's Pharma Division. Dr. Zaffaroni proposed that Ciba-Geigy take a major equity position in ALZA in return for licenses to existing and future technologies.

Ciba-Geigy AG

The Group

Formed by a merger between two major chemical companies in 1970, Ciba-Geigy AG was a diversified multinational with headquarters in Basle, Switzerland, subsidiaries in 60 countries, and sales representation in many more. 1976 group sales were 9.5 billion Swiss francs; 98 percent of end-product sales were made abroad but much of the manufacturing, particularly of active ingredients (AIs), was done in Switzerland. The group employed 75,000 people worldwide, of whom 21,000 were in Switzerland.

EXHIBIT 13 Balance Sheet June 30, 1976, and 1977

Assets

	1976	1977
Current assets:		
Cash	$ 1,129,000	$ 1,626,000
Certificates of deposit and bankers' acceptances	3,352,000	—
Receivables	722,000	1,544,000
Inventories, at cost	1,860,000	2,979,000
Prepaid expenses and other	544,000	756,000
Total current assets	7,607,000	6,905,000
Property, plant, and equipment:		
Prepaid land leases	1,062,000	1,062,000
Buildings	9,747,000	9,933,000
Equipment	5,198,000	6,253,000
Leasehold improvements	934,000	1,097,000
Construction in progress	507,000	597,000
	17,448,000	18,942,000
Less accumulated depreciation and amortization	(2,654,000)	(3,612,000)
Net property, plant, and equipment	14,794,000	15,330,000
Other, net	1,076,000	1,108,000
	$23,477,000	$23,343,000

Liabilities and Shareholders' Equity

Current liabilities:		
Accounts payable	$ 773,000	$ 357,000
Accrued liabilities	554,000	333,000
Bank loan	—	14,200,000
Current portion of long-term debt	17,000	19,000
Total current liabilities	1,344,000	14,909,000
Long-term debt, noncurrent portion	2,766,000	1,747,000
Commitments		
Shareholders' equity:		
Common stock, $1 par value: 10,000,000 shares authorized, 7,796,391 shares outstanding, 7,609,071 in 1976	7,609,000	7,796,000
Paid-in capital	71,786,000	73,911,000
ALZA's ownership interest in Dynapol, subject to restriction	(1,471,000)	(232,000)
Deficit	(58,557,000)	(74,788,000)
Total shareholders' equity	19,367,000	6,687,000
	$23,477,000	$23,343,000

SOURCE: ALZA financial statement.

Ciba-Geigy's facilities in and around Basle constituted practically a town by themselves, consisting of many office buildings, laboratories, and production plants, some of them dating from the 19th century. The company had its own social clubs, shops, and sporting facilities.

Company top management was largely drawn from a relatively small circle of old Basle families, and business and civic responsibilities were often intertwined. Many managers held high rank in the Swiss army. Most managers at Basle were Swiss and though the official language of Ciba-Geigy was English, many foreigners found that a mastery of Swiss German was essential to integration.

Basle was also the home of two other major chemical and pharmaceuticals companies, Hoffmann-La

EXHIBIT 14 Statement of Changes in Financial Position Five Years Ended June 30, 1977

	Year ended June 30				
	1973	1974	1975	1976	1977
Sources of working capital:					
Net proceeds from rights offering	$	$	$	$14,435,000	$
Exercise of stock options and warrants and issuance of stock under employee stock purchase plan	1,728,000	9,399,000	478,000	337,000	94,000
Sale of common stock		5,000,000	2,500,000	2,000,000	1,500,000
Issuance of common stock for patents and licenses	44,000		91,000	79,000	13,000
Warrants issued in connection with bank credit agreement				750,000	660,000
Bank loan under revolving credit agreement			4,000,000	1,000,000	13,200,000
Additions to long-term debt			1,800,000		
Exchange of common stock with Dynapol					23,000
	1,772,000	14,399,000	8,869,000	18,601,000	15,490,000
Applications of working capital:					
Net loss	6,989,000	10,301,000	15,026,000	16,287,000	16,231,000
Reduced by items not requiring working capital during the period:					
Depreciation and amortization	(385,000)	(538,000)	(685,000)	(915,000)	(1,000,000)
Sale of property, plant and equipment for note receivable	(597,000)				
Amortization of deferred interest				(333,000)	(447,000)
Write-off of advance royalties			(173,000)	(81,000)	
Write-off of advances to ALZA Mexicana, S.A.			(321,000)	(490,000)	(315,000)
Equity in net loss of subsidiaries	(406,000)	(1,350,000)	(1,695,000)	(1,153,000)	(1,261,000)
Total used in operations	5,601,000	8,413,000	12,152,000	13,315,000	13,208,000
Bank loan reclassified as current liability					14,200,000
Payment of bank loan				4,000,000	
Additions to property, plant, and equipment, net	1,291,000	3,738,000	5,331,000	1,857,000	1,494,000
Patents, patent applications, and licenses	44,000		87,000	127,000	27,000
Long-term note receivable	597,000			490,000	315,000
Advances to ALZA Mexicana, S.A.		305,000	253,000		
Deferred interest expense resulting from valuation of bank credit agreement warrants				417,000	462,000
Other, net	31,000	72,000	68,000	89,000	51,000
	7,564,000	12,528,000	17,891,000	20,295,000	29,757,000
Increase (decrease) in working capital	$(5,792,000)	$ 1,871,000	$(9,022,000)	$ (1,694,000)	$(14,267,000)

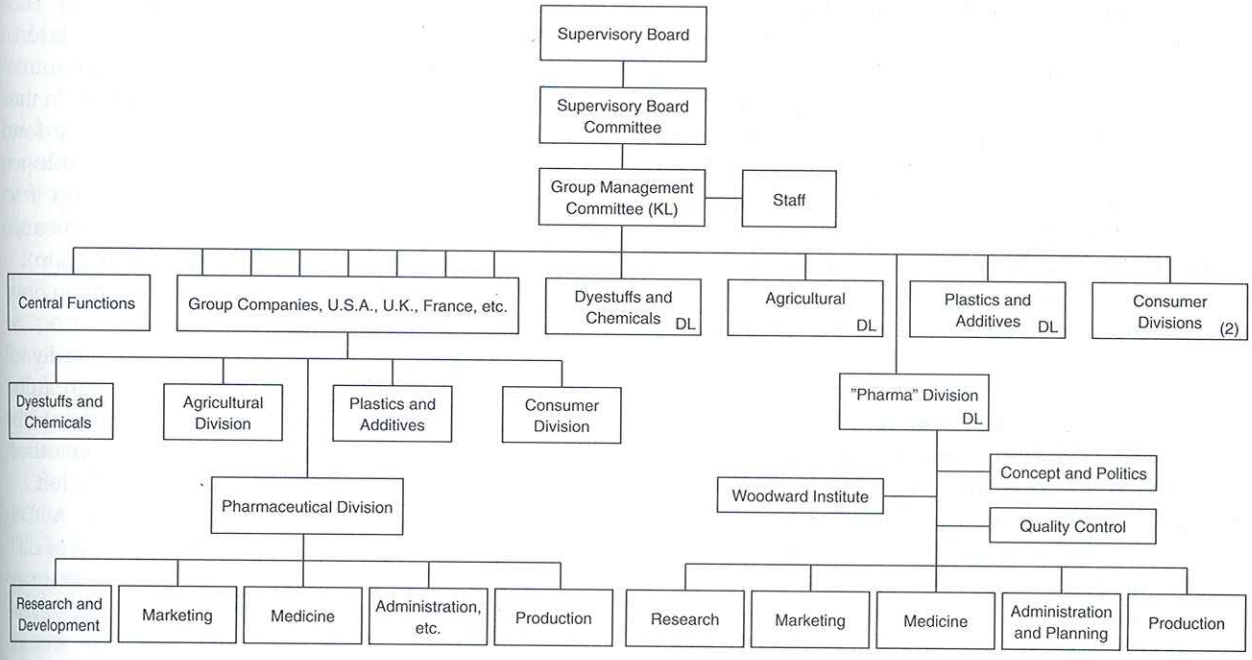
SOURCE: ALZA financial statement.

Roche and Sandoz. The two had one of the highest per capita incomes in the world (it was also a banking center), but the overall impressions given at all times, except Carnival, were of conservatism, sobriety, and order.

Ciba-Geigy's headquarters organization in Basle consisted of the Corporate Executive Committee (*Konzernleitung*, or KL), a number of corporate staff functions, and the divisional managements of four of the six Ciba-Geigy divisions: Pharmaceuticals, Agrochemicals, Dyestuffs and Chemicals, and Plastics and Additives. Divisional management for the Ilford Division was located in the United Kingdom, and Airwick was based in the United States and France.

Ciba-Geigy's operations in the countries were carried out by group companies which were also organized along divisional lines. While division managements at headquarters were responsible for worldwide strategies, direct authority over local divisional operations rested with group companies. The latter's plans were reviewed by regional corporate staff units.

EXHIBIT 15 **Ciba-Geigy A.C. 1977: Partial Organization Chart**



Integration of regional and divisional perspectives took place mainly in the KL. Each KL member was responsible for one or several divisions and regions (a partial organization chart can be found in Exhibit 15).

Ciba-Geigy Pharmaceuticals Division

The Pharmaceutical Division (usually referred to as Pharma) was the largest of Ciba-Geigy's divisions with 28 percent of group sales in 1976, and an even larger share of profits. Its 2.5 percent worldwide market share placed it among the leading companies in the industry. Although it was represented in more than 60 countries, its top four markets (United States, West Germany, Japan, and United Kingdom) accounted for about 42 percent of divisional sales.

The division concentrated almost exclusively on prescription drugs in five areas: cardiovascular preparations, antirheumatics and other anti-inflammatory preparations, psychotropic and neurotropic drugs, medicines for the treatment of various infectious diseases, and a more heterogeneous range of preparations including dermatologicals and drugs for coughs and colds.

Many of Ciba-Geigy's products in the first three areas were for long-term (chronic) treatment. These products had the advantage of yielding steady sales once a new patient was acquired but involved risks of unpredictable side-effects.

In the past, Ciba-Geigy had shown somewhat more concern for drug delivery forms than many of its competitors. It had launched a number of products of a nontraditional nature. Slow-K, a slow-release product introduced not long ago, had demonstrated both Ciba-Geigy know-how in this area and the commercial value of new delivery forms. There were also slow-release forms of injectable corticoids and Slow Trasicor.

Although the division had been regularly spending a high proportion (about 11 percent) of revenue on R&D, industry analysts rated its recent R&D productivity lower than that of other leading companies (Exhibit 4).

About two-thirds of the R&D effort was spent in Basle. Among the other three research centers, only the one in the United States (Summit) had all the functions necessary for complete product development. There was some funding of university projects,

and the company backed two semi-independent research institutes. Few of the important products had been obtained through licenses or joint research projects, and cooperation with other pharmaceutical companies had been both rare and, save one exception, unsuccessful.

Ciba-Geigy's R&D organization comprised many highly specialized experts. Most researchers in Basle were Swiss or German, and many of them had been with Ciba-Geigy for a number of years, whereas staff in the United States was mostly American and turnover was fairly high. Researchers and other staff were classified into a highly differentiated system of hierarchical ranks. The structure of the research department was both broad and deep. It was organized along functional lines, and there were four levels below the head of research.

The product development process was organized in such a way that a product passed sequentially through a number of different departments, first within R&D, then in Medicine, Technical Operations and, finally, Marketing.

Group companies had considerable freedom in developing their own strategies and programs, including the possibility to refuse introduction of products developed by Basle. Group company autonomy tended to increase in proportion to the importance of the subsidiary. In this regard, observers noted that some of Ciba-Geigy's most important products worldwide had not been introduced by its U.S. subsidiary.

Case III–4
ALZA Corporation (A)

Mark W. Cunningham, Reinhard Angelmar, and Yves Doz

The possibility of a partnership with or takeover by Ciba-Geigy was viewed with great concern by ALZA. For Alex Zaffaroni, as well as for almost all the scientists and managers on his team, the development of ADDS (advanced drug delivery systems) had become a life's dream; success would be the fulfillment of a vision. To abandon the crusade or reduce their commitment was out of the question. Yet recent results had been very disappointing. The first major products, OCUSERT and Progestasert, had been slow to develop and, when finally introduced, had not met with the expected success in the market. Further product introductions were a few years down the road. ALZA would not be able to hang on that long without outside help even if it shed its production and marketing operations and became a pure research organization once again.

Dr. Zaffaroni was desperate to maintain his research team intact for several reasons.

First, most ALZA employees trusted him blindly to find a solution to the financial crisis. They were fully aware of the gravity of the situation, but as the crisis deepened, very few of them started to explore other job opportunities and only a handful actually left.

Second, the effective development of ADDS demanded tight interaction between a variety of different technologies. Unless a viable research team in each technology could be maintained, ALZA's ability to conceive and develop new products would soon be jeopardized.

Third, he was ethically committed to maintaining a positive and creative climate in his company and could hardly imagine an ALZA run on a shoestring.

Dr. Zaffaroni's experience at Syntex had made him wary of large corporations and large-scale R&D efforts, though Syntex had been one of the most successful companies and he had been one of its leaders. Very few of the key staff of ALZA had large-company experience. They therefore viewed any link with a big organization with some degree of uneasiness and suspicion. Yet all were aware that this might be the only way to save ALZA.

This case provides additional information on ALZA's management organization and predicament in 1977, which will help the reader better understand its approach to a possible partnership with Ciba-Geigy.

ALZA's Strategy

While ALZA's devotion to its scientific mission—the development and commercialization of ADDS—remained constant throughout its history, the concept of how to achieve that mission evolved somewhat over time, at least partly under the pressure of events.

Alex Zaffaroni first envisaged a company that would evolve from R&D towards manufacturing and marketing as its products were developed and received FDA approval. OCUSERT and Progestasert had been seen as the first steps in ALZA's evolution into an integrated pharmaceutical company. Yet it was clear from the start that ALZA had neither the resources nor the competence to compete with major companies in the discovery and synthesis of new active ingredients and the manufacture of existing ones.

Research was therefore concentrated on the delivery systems and the screening of existing generic or proprietary active ingredients for suitability. Progestasert and OCUSERT both used drugs in the public domain, as would the first transdermal system (expected to use scopolamine against motion sickness).

Cooperation with outsiders was inevitable to a greater or lesser degree. From the very beginning, discussions with pharmaceutical companies centered on the licensing of active ingredients by ALZA, and/or of delivery systems by the partner. The first contact with Ciba-Geigy USA, which was of this kind, occurred in 1971, but produced no concrete results.

Dr. Zaffaroni was concerned to avoid excessive contact with the majors. There was, at first, no question of undertaking contract research; ALZA had as much money as it needed and wished to avoid the transfer of its technology to potential competitors. However, in 1976 long-term research agreements were signed with Merck (cardiovascular and anti-inflammatory applications of OROS) and Boehringer Ingelheim of West Germany (antihypertensives in transdermal systems). Both agreements were for contract research giving ALZA clear objectives and budgets. Intercompany project teams were not set up, and the emphasis was on the provision of a service rather than collaboration. Neither project had progressed very far by 1977, though they yielded revenues of $1.7 million in that year.

This change in policy partly reflected ALZA's need for new sources of revenue, but also the feeling that it was now strong enough to stand the contact with outside cultures. It was also felt that the launch by leading pharmaceutical companies of major products based on ALZA's systems would enhance ALZA's credibility and bring in royalties. There were no exclusivity provisions that would prevent ALZA from using what they learned in these projects for other products.

Overseas marketing agreements were sought for the ALZA products because a dedicated international sales force would be impossibly expensive. However, they were deliberately restricted to small, geographically limited concerns. Marketing in the United States was kept in-house to retain control and added value. The United States was the largest market for ALZA's products and thought likely to be the most receptive to new and better methods of treatment.

Manufacturing was retained at Palo Alto because it was central to the strategy of integration and because ALZA did not feel that anyone else had the necessary skills to handle it.

Dr. Zaffaroni was concerned that ALZA should not be allowed to grow too large for its entrepreneurial spirit and that its concern for the individual be maintained. Growth would therefore be achieved not through internal diversification but through the formation of spin-off companies exploiting research groups' expertise in new areas. These would operate independently and would be funded at least partly by outside capital. They would provide new opportunities for scientists and managers from the mother company. The first of these affiliates, Dynapol, was formed in 1972 to exploit ALZA expertise in polymer and other technologies in the nutritional field.

ALZA Organization

Authority in ALZA stemmed from Dr. Zaffaroni, the founder, chairman of the board, and president. Though the board of directors included the vice presidents in charge of medical affairs and ALZA Pharmaceuticals (the commercial and production organization), and the part-time company secretary, the remaining members were essentially outside advisors. Several had investments in ALZA and all were now close friends of Dr. Zaffaroni.

The Board of Advisors consisted of 10 very distinguished scientific academics who served to keep ALZA in touch with the latest developments in their fields and exercised their influence on its behalf. They also added to its prestige and credibility. They played no active role in the running of the company.

Reporting to Dr. Zaffaroni were the heads of finance, pharmaceuticals, research, medical affairs, control, technical development, and administration. The first four formed the management committee with Dr. Zaffaroni.

Finance Division. Mr. Martin Gerstel, head of the Finance Division, had joined the company direct from the Stanford MBA program in which he had distinguished himself. He had previously been a financial analyst at Cummins following a BS in industrial engineering.

Pharmaceuticals Division. The Pharmaceuticals Division had been formed in 1973 to handle the production and marketing of the company's systems. It provided the infrastructure and services of an integrated pharmaceutical company, which had not until then been required. It was set up as a separate unit operating from dedicated facilities on a 10-acre site not far from the main ALZA buildings. The original production facilities had become the pilot plant. A factory intended to manufacture Progestasert on a large scale had just been completed in Mexico and was owned only 49 percent by ALZA for legal reasons.

The Pharmaceuticals Division was headed by Dr. Carroll Walter, formerly VP of Syntex Laboratories, who was supported by sales, marketing, and production executives recruited mainly from the pharmaceutical industry. Nearly half of ALZA's employees (250) were still in pharmaceuticals, but the division's rapid buildup of staff in 1975–76 had been followed by dismissals in both production and sales departments in the financial crisis of 1977.

Research Division. Dr. Urquhart, the head of research, had been a professor of physiology at Pittsburg University and of biomedical engineering at USC before joining ALZA in 1969. Until 1975 the division had devoted itself exclusively to ALZA's internal projects, but in 1976 contracts for long-term joint-development projects had been signed with Merck (OROS) and Boehringer Ingelheim (Transderm). Dr. Urquhart was supported by directors for Pharmaceutical R&D; Physical Biological, Materials and Engineering Science Administration; Engineering; and Analytical Methods.

Though it was possible to be involved exclusively in basic research in a narrow field, most of the members of these departments worked on multidisciplinary project teams. Thus, a polymer chemist might report for most day-to-day purposes to a project leader who was a biologist or engineer. The division still employed 220 people in mid-1977, having undergone very little pruning. It was acknowledged to be the company's essential core.

Dr. Felix Theeuwes (OROS), a Belgian chemist with an academic background, and Dr. Janet Shaw (OCUSERT), a British physiologist and biologist who joined from Institutional Research, were typical of ALZA's project leaders. Most had distinguished backgrounds in research and had either invented the systems they were developing or had been associated with them from the start. Mr. Peter Carpenter, a Chicago MBA with a chemistry degree and considerable consulting experience, had been hired as a project leader in 1977 but rapidly took over responsibility for planning.

Medical Affairs. Dr. Virgil Place, head of the Medical Affairs Division, had been director of clinical pharmacology at Syntex. The department was responsible for literature research and library services, data processing, and regulatory affairs. The department also set up the clinical research required for the registration of new products and for the marketing information package. Pharmaceutical companies generally consider the latter role crucial to the successful launch of any new product, particularly if it uses unfamiliar concepts. The Clinical Research Department had to cover such diverse fields as opthalmology, gynecology, and cardiology with a very limited staff (seven nurses, two trials managers and two research assistants).

A series of highly detailed organization charts had been drawn up in 1974, but their release had never been authorized by Dr. Zaffaroni; he felt that the company's interests were best served by playing down the formal structure. His objective was to keep relationships within the company as fluid as possible since he believed that flexibility and multichannel communications were essential to the maintenance of the entrepreneurial spirit of ALZA. This was considered particularly important in the R&D and medical areas.

Consequently, though their immediate responsibilities and reporting lines were clear to ALZA employees, they had little sense of the company's overall structure. Individuals were given the titles traditional in the industry (principal, senior, and junior scientist) but the exact status of each individual was not clear in all situations; a senior scientist in charge of a project might even have a vice president reporting to him or her if the latter had special skills essential to the project.

The lack of role definition could cause problems. A high proportion of scientists joining ALZA left again very rapidly because they found it hard to fit in. They were given few clear orders and were expected to propose their own work program or

sign on for those of others. The organization demanded and received a very high degree of commitment from its members. Very few left after the first few months, and all seemed not only prepared but also happy to work long hours.

In some senses the atmosphere was similar to that in university research departments with their emphasis on creativity and the free flow of ideas. This was not surprising since most employees came from that background. It was a challenging environment but also, for those who were fully committed, a very supportive one. People believed that what they were doing was not only worthwhile but also unique. They were an elite band.

There was no restriction on contacts between departments and Dr. Zaffaroni and his vice presidents were well known to all the research staff. Intellectual standards were said to be extremely high; most lab technicians/assistants had graduate degrees and were genuine actors in the research process rather than order-followers. However, it was clear to all concerned that "when the chips are down, there's one person to say this is the way we'll do things": that person was Dr. Zaffaroni.

The Role of Dr. Zaffaroni

Dr. Zaffaroni had very strong personal beliefs which were central to the way ALZA had been set up and continued to be run. He believed that one of a company's or chief executive's main tasks was to enhance the job satisfaction and promote the personal growth of his employees. He provided the appropriate framework in the form of an attractive, almost luxurious working environment, and tried to ensure that his researchers were not disturbed by administrative or budgetary controls.

He promoted the intellectual content of work, the scientifically elegant solution to a problem, and though he was aware that this might lead to operational inefficiencies, he felt that this attitude was the only one possible in a high-technology research-dependent organization. Employees were encouraged to take an interest in areas in which they had neither experience nor qualifications, and several scientists ended up in marketing or general management.

Dr. Zaffaroni believed in recruiting the best available brains and was prepared to go to great lengths to get the people he wanted. ALZA bought Virgil Place's consulting company, and set up a shell company for Alan Michaels, the first head of research and an expert in core membrane technology, which was eventually bought out on advantageous terms. Dr. Higuchi, the originator of much of the ADDS theory, wanted to continue to teach in Kansas, so an institute was set up around him, which was later sold to Merck when he wanted to move on.

Alex Zaffaroni believed that one major objective of the company must be to foster the personal growth of its employees. To this end, the organization must be adapted to the individual rather than the other way around. One way of encouraging personal and organizational growth was to allow research groups or individuals to form spin-off companies that would exploit ALZA technologies in new fields. The first of these was Dynapol, set up to work in nutrition.

Perhaps the most important element of Dr. Zaffaroni's leadership was his ability to inspire those around him with his own enthusiasm and sense of mission. It was a major factor in the very low turnover of scientists which was maintained even when the going got tough. He was respected for his past scientific achievements, for his obvious concern for his colleagues, and for his refusal to compromise quality for commercial convenience. He was somebody of whom his employees and colleagues could be proud.

Dr. Zaffaroni's ability to attract and retain the faith of investors was also of a high order; though the first $2 million came from his own pocket, by 1976 he had raised more than $70 million from private placements and public issues. A great deal of this money came from friends and acquaintances both within and outside the industry. The list of highly distinguished scientific advisors and consultants also helped maintain the confidence of investors. The technique was later adopted by the biotechnology start-ups of the late 1970s.

The Financial Crisis

Since the start of operations in 1968, ALZA had accumulated a deficit of around $75 million. Cumulative operating revenues (at various points investment income and interest were sizable) had reached $10 million by mid 1977. Annual operating losses had jumped from $9 million to $13.5 million in 1975 with the buildup of overheads, and had been running at around $15 million for the last two years. (A statement of operations for 1973–1977 can be found in Exhibit 12 of Case III–3.)

Exhibit 13 of Case III–3) the company's liquid- very largely inventory lion, while current liabili- on because the bank loan had as ALZA failed to meet working worth conditions. The banks were er for repayment or for proof of a new funds which would guarantee survival. had agreed not to force ALZA into liquidation long as negotiations with a real chance of succeeding were in progress with potential partners.

ALZA calculated that the company's cash shortfall over the next five years would be somewhere between $30 million and $50 million, depending on the speed with which successful new products could be brought to the market and on the readiness of the banks to extend payment terms.

The Search for Partners

The search for financing occupied Martin Gerstel and Dr. Zaffaroni to the exclusion of almost all other activities from late 1976 onwards. The company's Scientific Advisors and non-executive board members were also mobilized.

It was clear from early 1976 that some additional financing would probably be necessary, but the real extent of this only became clear with the early sales figures for Progestasert. The company's financial position (see above) and operational difficulties led its investment bankers to advise that a public issue of stock would not be taken up by the market. Private placements would yield little or nothing for the same reasons. ALZA was already in default of the terms of its bank loans by 1977 and had no surplus from which to pay interest charges. There was therefore no possibility of further bank financing.

Since ALZA could not raise money in expectation of pure financial return, it was obliged to look for a partner interested in its research expertise, existing technology, or both. In the first half of 1976 ALZA had signed agreements with Merck and Co., one of the biggest U.S. pharmaceutical companies, and with Boehringer Sohn, Ingleheim am Rhein from West Germany.

Merck had agreed to finance a three-to-five-year joint-development program for cardiovascular and anti-inflammatory systems using the OROS technology. It also bought $3.5 million of ALZA stock at over $20 a share with an option for $1.5 million more. Boehringer Ingleheim had signed up for a long-term joint development of transdermal systems but bought no equity.

There was no immediate prospect of an increase in the financial commitment of either of these companies, and it was now clear that similar agreements with other companies would be insufficient to save ALZA. At least half of any research payment represented real costs to ALZA, so the contribution to overheads and loan repayments would always be fairly small.

Approaches made to almost all the remaining major pharmaceutical companies failed to produce a positive response. Dr. Zaffaroni also approached a large number of companies in the chemical and petrochemical industries, though he felt that purchase by a company outside pharmaceuticals was not in ALZA's best interests. Arco expressed interest, but in detailed discussions had failed to come up with a real offer.

ALZA and Ciba-Geigy

The first contact with Ciba-Geigy USA in 1971 had not led to any further discussions, though it had revealed that company's interest in this area. Dr. Zaffaroni met the Ciba-Geigy main board (KL) member responsible for their Pharma Division at a scientific conference in March 1977 and suggested cooperation. He was put in touch with the head of Pharma Division, Dr. Staehelin, and flew to Basle to meet him in April. The meeting was very successful on a personal level and it was followed in May by a Ciba-Geigy visit to Palo Alto.

The Ciba-Geigy team consisted of the Swiss heads of research (Dr. Heusler) and production (Dr. Goetz) and the head of Pharma US (Mr. Mackinnon). They were not authorized to negotiate in any way, but looked at the ALZA operation and took a great deal of financial and technical data away with them. Nothing of importance was heard from them for some time despite the obvious need for a quick decision, but in late July Dr. Zaffaroni heard that Ciba-Geigy was ready to discuss the terms of a possible collaboration or purchase.

He did not know what these terms might be. Possibilities ranged from outright purchase of all shares and integration into Ciba-Geigy to a large-scale research contract with little or no infusion of capital. As far as Ciba-Geigy knew, negotiations with another potential buyer, possibly Arco, were still in progress.

ALZA Assessment of Ciba-Geigy

Ciba-Geigy's financial soundness and commercial power were not in doubt, and it could afford to offer ALZA generous financial terms. It seemed likely that organizationally ALZA would be associated with the U.S. subsidiary, though the bulk of research was done in Basle.

Ciba-Geigy had one major sustained-released preparation on the market (Slow-K, which used a wax-matrix system) and a number of slow-release variants of major products. It seemed to have a fair amount of pharmacokinetic and systems development experience. The system which seemed to interest them the most was OROS.

The Swiss company produced a wide range of patented and generic compounds, many of which might be suitable for inclusion in ALZA systems. It also had considerable marketing and distribution strength worldwide. There was a visioncare section and though research in endocrinology was being carried out, Ciba-Geigy had only little presence in contraception.

Dr. Zaffaroni's impression was that Dr. Staehelin would wish to preserve ALZA's unique character, but he had no clear indication of the thinking of the Research Department and American subsidiary. Professor Woodward, an ALZA scientific advisor and CIBA-Geigy main board member, was very much in favor of linking the two companies.

Objectives of ALZA and Ciba-Geigy

ALZA's negotiating strategy would depend on the relative importance of different objectives, some of them perhaps conflicting, and upon its perception of the objectives of Ciba-Geigy.

The primary objective of ALZA was survival. The banks were ready to foreclose on their loans and effectively bankrupt the company. This would not necessarily mean the end of ALZA because a restructuring might be possible, but it would undergo a radical change. It might, for example, become a research and development laboratory relinquishing the ambition to become an integrated concern and living off research contracts and royalties.

However, Dr. Zaffaroni wished to see his company changed as little as possible. He wanted to preserve its unique character: the excellent working conditions, the freewheeling creativity, the employees' sense of commitment. Therefore, the second main objective was to retain ALZA's autonomy, or at least a degree of freedom of action; Ciba-Geigy might be prepared to save ALZA but only under terms which would be less acceptable than a restructuring—integration as an in-house research unit of Ciba-Geigy, for example.

Dr. Zaffaroni believed that if the company could hang on for another three to five years, the next generation of ADDS, principally OROS and transdermal systems, would make it financially viable. They had applications for a much wider range of treatments than the first generation. He therefore wanted to keep ALZA's options for the future as open as possible.

A third objective was to retain as much as possible of the technology already developed under ALZA's control, and to maintain a real interest in future developments. The granting of exclusive rights to all or part of the technology would jeopardize ALZA's long-term development.

The position of Ciba-Geigy with regard to these issues was by no means clear. ALZA could be regarded primarily as an almost risk-free investment if majority control was obtained because of the tax advantages available. ALZA had several years of losses and R&D and capital depreciation that could be written off against the profits of Ciba-Geigy's American subsidiary.

A deal could be seen as a means of getting Ciba-Geigy up to speed in a promising new area through technology transfer, or as a quick way of getting new or revitalized products onto the market. However, the interests and positions of Basle and Summit management within Ciba-Geigy might not necessarily be identical.

Case III–5
Ciba-Geigy Limited: Pharmaceutical Division (A)

Mark W. Cunningham, Reinhard Angelmar, and Yves Doz

When Dr. Gaudenz Staehelin was appointed chairman of the Pharma Divisional Committee (*Division*

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sleitung, or DL) in 1975, he as the first nonscientist to hold this position. A lawyer by training, the soft-spoken, 39-year old scion of an old Basle family had entered the company in 1964. Before his nomination to Pharma, Dr. Staehelin had worked in the company's corporate legal department. He had been deeply involved in the complex legal and organizational aspects of the 1970 merger between Ciba and Geigy.

The appointment of a nonscientist as DL chairman was interpreted by Pharma staff as a signal of possible change in the division's way of operating. The division's evolution since the 1970 merger provided further grounds for this expectation: internal estimates suggested that the division had dropped from second to fourth place in world pharmaceutical sales since 1970; moreover, there were few promising new compounds in the pipeline. At the same time, the total group was becoming more dependent on the Pharma Division for growth and profits, as the industrial divisions (dyestuffs and chemicals and plastics and additives), the traditional backbone of the company, were being hit by the recession.

One of Dr. Staehelin's first moves was to develop an explicit statement of the division's mission, objectives, and strategies in the form of a divisional *Leitbild* (charter). It stated the intention

> to maintain and improve . . . our leading position in the health care industry . . . We intend to concentrate on the pharmaceutical business . . . [but] to extend the scope of our activities and to develop from a Pharmaceutical Division to a Health Care Division.

The growth and profitability targets set by the Leitbild were significantly above the industry average.

Organization Structure

Ciba-Geigy's worldwide Pharma Division comprised the divisional management in Basle, with the staff functional units directly subordinated to the divisional management (research, medical, technical operations, marketing, administration, and planning), and the Pharma divisions of group companies (Exhibit 1).

Divisional Management

The chairman of the division was chiefly responsible for worldwide strategies and their implementation through local divisions, for the management of the worldwide functional groups in Basle and, in regard to the R&D process, for decisions concerning the research program, the inclusion of new preparations (including licensed products) in the development process, their inclusion in the product line, and product withdrawal.

Dr. Staehelin was highly sensitive to Ciba-Geigy's tradition of decision making by consensus. This meant that major decisions were in fact taken by the divisional management committee which, in addition to the chairman, included the heads of the functions (see Exhibit 2). The arrival of Dr. Staehelin in the Pharma Division had coincided with or preceded other changes in DL and other key positions:

- Dr. Karl Heusler, 54 years old, was appointed head of Pharma research in 1974. Dr. Heusler, a chemist, had entered Ciba in 1951. After a distinguished scientific career in the area of stereoid synthesis, Dr. Heusler had successively occupied the positions of head of the Woodward Research Institute, head of chemistry with Ciba and, after the merger, head of chemistry of Ciba-Geigy.
- While Prof. Oberholzer remained in place as head of the Medicine Division, immediately below him Dr. P. Loustalot (54 years old and with 25 years' service in Ciba-Geigy) had recently taken over the responsibility for all Phase 3 and 4 clinical trials.
- Dr. Götz, 41 years old, had moved from pharmacy research to production and had taken over the production function in 1975 after many years spent abroad establishing new units.
- Mr. Orsinger, 48 years old, and in marketing since he returned to headquarters in 1967, had taken over the function in 1975.

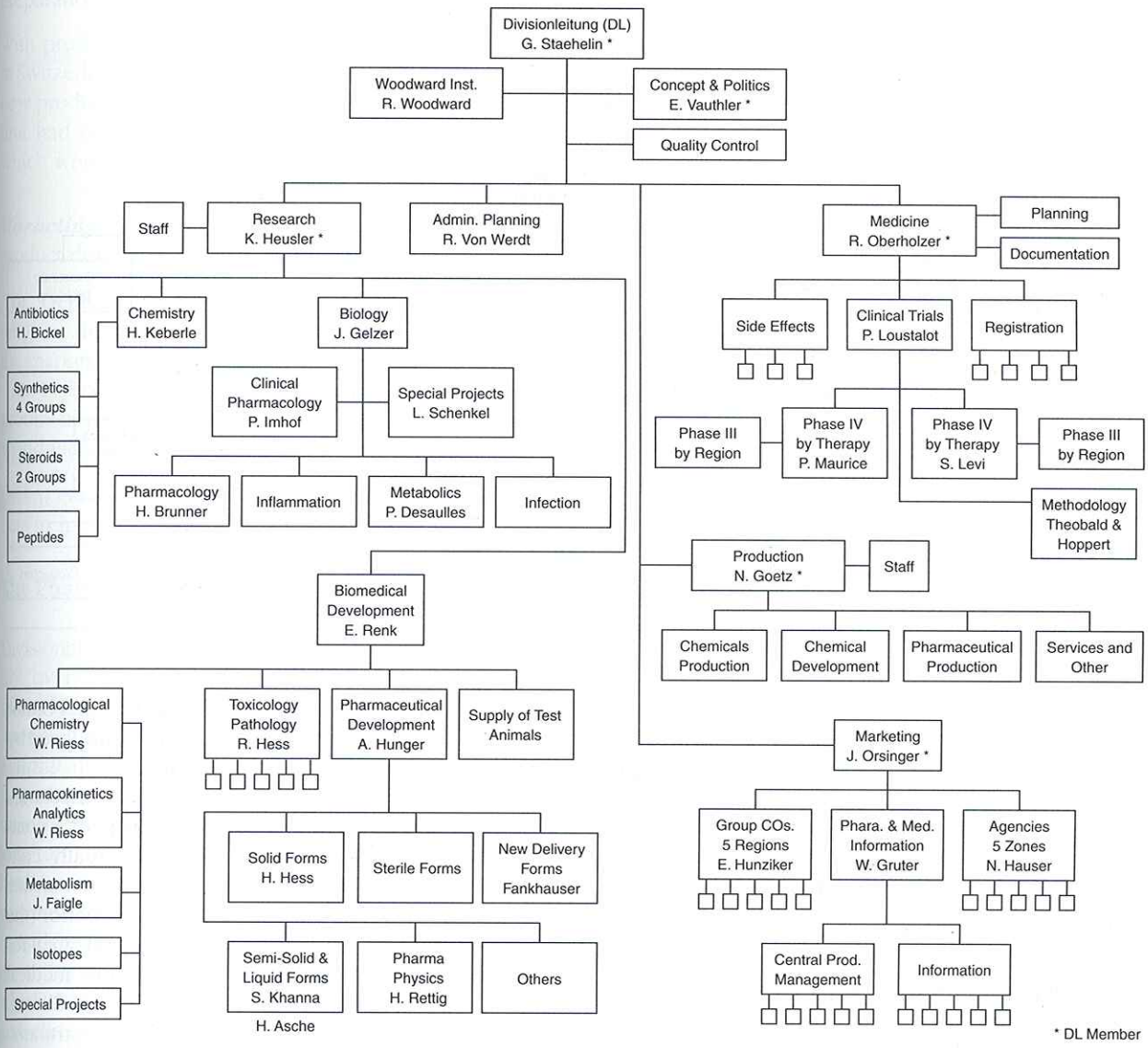
The Worldwide Functional Groups in Basle

Research Basle. Research Basle had the following four missions:

1. Provide new candidate-compounds and preparations for development.
2. Contribute to the development of selected compounds by performing human/clinical pharmacology (Phase I) studies.
3. Provide scientific support to Pharma divisions in group companies (e.g., for marketed products).
4. Provide evaluation and expert opinion on third-party products.

Basle research accounted for about two-thirds of the division's annual research effort. All of Ciba-Geigy's

EXHIBIT 1 Ciba Geigy Pharma Division, 1978



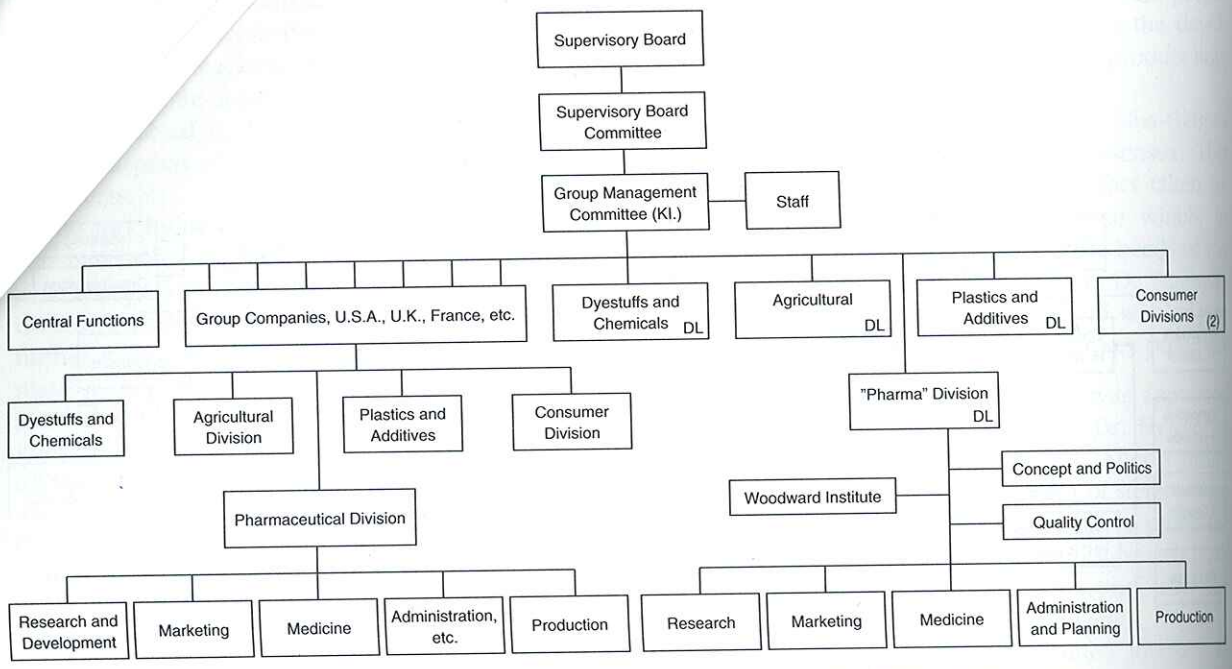
internally developed products had their origin in Basle.

Except for India, which had a research unit specializing in tropical diseases, only the U.S. division had a research unit capable of drug discovery and preclinical development. Its size was about one-third that of the Basle unit.

Basle research had no direct authority over research carried out in group companies. Divisional management, which in principle had the power to coordinate worldwide research, had not taken an active role in research strategy formulation. In particular, there was no clear policy concerning the assignment of specific research programs to research units. This had led to some duplication of effort and communication and cooperation problems, especially between Basle and the United States.

The U.S. division felt that its size, the highly competitive nature of the U.S. market, and the scientific resources available in the United States all argued for a greatly expanded role for the U.S. research

.G. 1977



unit. Basle managers typically responded that U.S. research was too narrowly focused on the U.S. market, and that this parochial orientation was inappropriate for a worldwide operating company.

Medical Department. Its major missions in regard to new product development were:

1. Plan, initiate, and oversee the conduct of clinical studies at headquarters and by medical departments of group companies (Phases II, III and IV).
2. Design and develop new methodology for clinical research.
3. Ensure the coordination of the clinical activities of group company Pharma divisions worldwide.
4. Ensure timely registration and revalidation of products with appropriate authorities worldwide.

Only about 20 percent of the division's total medical expenditures were spent by the Basle Medical Department. This reflected the fact that the bulk of the clinical studies were performed outside Switzerland and paid for by group companies.

Like the Research Department, the Medical Department in Basle had no direct authority over the medical departments of group companies (MEGROCs). Group companies were free to decide whether or not to conduct clinical trials on a compound proposed by Basle, and with what priority and speed.

Typically, there were many intermediaries between the physician in Basle in charge of a compound and the clinical investigators actually conducting clinical trials in the countries. Persons involved in Basle were: the immediate superior (the *Bereichsleiter* in charge of the indication area for which the compound was targeted), the medical coordinator for the region, the head of Clinical Research, and the head of the Medical Department. The main intermediaries in each country were: the head of the Medical Department and the physician responsible for the indication area. The difficulties of managing international clinical trials created personnel problems for the Basle medical departments: recruitment of highly qualified specialists was difficult and physician turnover was high.

Technical Operations. The major contributions of this unit during the new product development process were:

1. The production of sufficient amounts of active ingredient to enable preclinical and clinical testing

2. The development of delivery (dosage) forms.
3. The scaling-up of production processes in preparation for market introduction.

With production of active substances concentrated in Switzerland, most of the technical development of new products was carried out in Basle. Only the U.S. unit had complete technical development facilities which were managed independently of Basle.

Marketing. Marketing's role in regard to new product development was as follows:

1. Define and help build the division's product range . . . in such a way that it meets the needs of the market and is consistent with divisional goals.
2. Elaborate marketing strategies for products or groups of products to ensure best possible local and worldwide market penetration and profitability.

Group companies were free to decide which products to introduce and with what strategy.

The Pharma Divisions of Group Companies

Divisional management at Basle had no direct control over the actions of local divisions, though it often had considerable influence. Financial and operational targets were set by the KL (*Konzernleitung*) after discussions with the DL. Contributions to parent company expenses and profits were the main target variables. The annual budget and the long-term plans for the divisions were agreed to between the countries and Basle, and performance was then monitored by the latter. Group companies considered generally that their primary task was to meet the stated objectives and that the means by which they did so were their affair. This attitude was actively encouraged by Dr. Staehelin, who felt that country organizations were in the best position to judge their own market and should be free to act as "independent, entrepreneurial units."

In regard to new products, this meant that countries made their own evaluations of the probability of the commercial success of a compound under development in Basle and, on this basis, decided whether to conduct clinical trials or introduce the product. In fact, Basle frequently had to sell its potential products to the countries. Countries could also license in products in order to round out their product range.

The U.S. group company, in particular, has a reputation for going its own way, in Pharma as well as in the other divisions. It had not launched VOLTAREN, an antirheumatic product which by 1976 had become the company's second most important seller, or TRASICOR, a cardiovascular product (number 4 in 1977). Both of these products were developed internally and both were rejected by the United States. On the other hand, several products had been licensed from the outside to fill gaps in the range.

R&D in the Ciba-Geigy Pharma Division

R&D in the Pharma division, Basle, mainly comprised the following activities:

- Drug discovery (chemistry, biology-nonclinical development, toxicology, pharmacokinetics, pharmaceutical development, analytics, chemical development, biotechnological development).
- Medicine (human pharmacology/clinical pharmacology, clinical research, drug monitoring).
- Licensing in and out of products.
- R&D activities of affiliated firms and institutions.
- Various R&D management and support functions (e.g., patents and documentation).

Exhibit 3 shows the main R&D functions, their relationship over time, and the departments responsible for each.

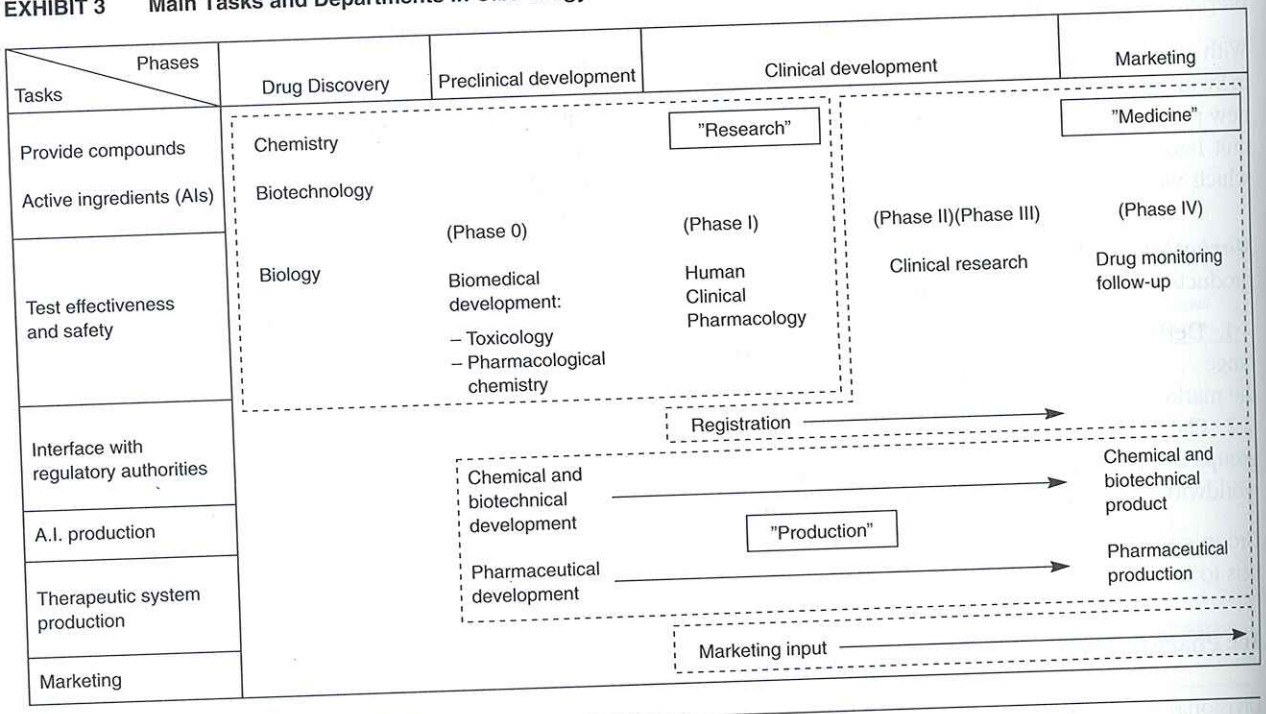
Financial Resources for R&D

The overall level of R&D effort amounted to about 11 percent of sales. Because of the increasingly stringent regulatory requirements, the amount of resources devoted to developmental activities had been increasing. At present, drug discovery absorbed about 27 percent, nonclinical development 24 percent, and medical activities 27 percent of the total R&D budget.

One of the motives for the 1970 merger had been to benefit from economies of scale in R&D. Consequently, division management had attempted to contain the rise of R&D costs after the merger. The ambitious profitability targets set by the 1976 *Leitbild* and the recent economic recession had led to a virtual freeze on R&D expenditures.

Shifting of resources between research projects and programs was difficult. The major reasons for this were: the fragmentation of the R&D activities across many different departments, the lack of an organizational process for setting clear and opera-

EXHIBIT 3 Main Tasks and Departments in Ciba-Geigy R&D Process



tional R&D priorities, the absence of objective data that could justify the shift vis-à-vis the staff concerned, an R&D culture that discouraged competition for resources, and a tradition of letting researchers work on their own projects (officially up to 30 percent of their time).

Human R&D Resources

One consequence of the containment and the recent freeze of R&D expenditures was a virtual ban on outside hiring except at the most junior levels. This meant that a department that wished to change its know-how basis could do so only by attracting staff with the requisite know-how from central R&D or by retraining its staff. Yet most Ciba-Geigy scientists were very reluctant to change discipline, or even project, and only with difficulty could they be reassigned against their will. Since the company had a tradition of long-term employment, they could hardly be dismissed either. Every department contained some scientists, often senior and highly paid, who were not optimally productive.

Ciba-Geigy AG had three official hierarchies existing side by side; two of them indicated the level of managerial or scientific responsibility, and the third the legal status of the individual. Prestige was generally measured by position in the legal hierarchy, which had six levels. No criteria for promotion were made explicit, though length of service requirements generally had to be met; each promotion was proposed by section heads, cleared by division heads, checked by personnel and finally authorized by the KL. There were strict quotas on the numbers of managers at each grade.

The management grades were fairly straightforward and linked to the size of importance of responsibilities. Scientists were assessed on knowledge, creativity, communication, initiative, and contribution (the first two having the heaviest weighting) and promoted after well-established intervals. Those wishing to remain pure researchers could acquire special status, but those wishing to enter research administration had to switch to the business hierarchy after a certain point. Remuneration was tightly linked to grade, and there were very few incentives directly linked to performance in the short term.

In-House versus Contract Research

Almost all research work was done in-house. Though there were well-established links with professors and

researchers at many universities, and some funding was made available to them, their work was usually of little immediate relevance to current Ciba-Geigy projects. Such relationships were intended mainly to keep the company up-to-date with the latest theoretical work. The Friedrich Miescher Institute at Basle, funded largely by Ciba-Geigy, did basic research work. True coordination with programs within the company was not attempted. The institute was perhaps valued most as a recruiting ground. The relationship with the Woodward Institute in the U.S. was somewhat closer, however.

Joint research projects had been undertaken with several large companies. Though there had been several successes, many had broken down because of divergent objectives. There was generally a feeling in research circles that Ciba-Geigy research was second to none and that the money was better kept in the family.

The New Product Development Process

Individual compounds moved from the chemistry lab to the marketplace by the successive efforts of individuals in the research and medical departments. Within research, primary responsibility rested with the *Sachbearbeiter* (in chemistry) and the project leader (in biology). Upon completion of Phase I preclinical development, the compound was turned over to the clinical trial sponsor in the medical department. The marketing aspects were handled by the product management group with responsibility for the product's indication area.

The decision on whether to promote a compound to the next phase of development had important financial consequences and therefore was made at higher levels of management, including the DL during the later phases. The decision-making bodies, typically, comprised representatives of the various functions involved in the development process. In general, no decisions would be made unless a consensus among the different parties existed.

There was a general feeling that the development process was too slow. A variety of reasons were given. Some managers felt that the *Sachbearbeiters* and project leaders, who generally were work-bench scientists, lacked a sense of urgency and tended to prolong work on a compound out of a sense of scientific curiosity. The researchers complained that management took too long for deciding which compounds to promote to the next phase. They also perceived the physicians in the medical department as having a negative attitude toward "their" compounds, tending to reject or repeat studies done in human pharmacology (Phase I) and generally searching for data that would justify killing the compound. They also felt that there was a strong resistance to products that went outside Ciba-Geigy's traditional areas of expertise.

The fractionation of the technical development activities was also cited as an obstacle to speedy development:

- Toxicology and pharmacological chemistry reported to the head of biomedical development, one of three areas in the research department.
- Pharmaceutical development (this involved delivery forms) reported to the head of technical operations (production).
- Chemical and biotechnical development reported to the head of technical operations.

The ADDS Task Force

Dr. Staehelin's objective was to achieve above-average growth in pharmaceuticals and at least to regain the Number 2 position worldwide. Because of the decline in new chemical entities, this would require more effective exploitation of the existing product range and of the products already under development.

When Dr. Abt, head of the market research unit in the marketing department, suggested early in 1977 that ADDS might be a vehicle for superior growth, Dr. Staehelin responded by setting up a task force with the brief to investigate the attractiveness and practical feasibility of ADDS for the Pharma Division.

Task Force Composition and Views

Dr. Abt chaired the task force. Pharmaceutical development was represented by two members, notably Dr. Hunger, the head of the group. Basle research was represented by Dr. Riess, the head of pharmacological chemistry, and Dr. Fuchs from human pharmacology. Dr. Doebel was Summit's delegate to the task force, and two more members with different backgrounds rounded out the group. The heterogeneous nature of the group guaranteed that different perspectives on ADDS were aired.

Marketing saw some possibilities for enhancing the existing product line via ADDS and insisted on

the importance of having oral one-a-day formulations for new products whenever possible. It saw also a few possibilities for using ADDS to turn generics into commercially viable products.

The majority of those working in pharmaceutical development felt that there was nothing particularly new or startling in the ADDS concept; they had been working on new delivery forms for many years.

Research suggested that it would be nice to do some basic research on "experimental pharmaceutical development" with substances requiring special delivery forms (e.g., immunostimulators, peptides).

Speaking for the U.S. group, Dr. Doebel emphasized its commitment to ADDS via the HEMAC project, a polymer-based oral slow-release system, on which 12 persons were working (mostly in U.S. central research). He argued that HEMAC should be adopted throughout the division, and that future ADDS research should build on U.S. experience.

The group also attempted to assess Pharma's total existing resources in the area of delivery systems:

- Of a total staff of 247 devoted to pharmaceutical development (110 in Basle, 62 in the United States), about 28 were involved in developing slow-release formulations, and only 14 (including the 12-person HEMAC group) were carrying out exploratory research on new delivery systems. The bulk of the staff was totally absorbed by normal product development tasks and had no free capacity to work on special projects.
- Pharmacological chemistry contributed to delivery systems research mainly through pharmacokinetics (the study of how drugs are distributed in the body) and drug metabolism (the study of how the body breaks down the drugs). Existing capacities were barely sufficient to handle ongoing projects.
- Capacities in biology and medicine (clinical research) were insufficient for systematic testing of delivery systems

Recommendations of the ADDS Task Force

The general conclusion of the task force was that delivery systems would become increasingly important in the future. It made four specific recommendations:

1. Additional capacity for basic ADDS research should be created within the division. The mission of the new unit should be to cooperate during preclinical development with biology to develop new delivery systems for specific, interesting substances. The unit could be created in Basle by adding one or two researchers to the three already working on such problems (one in central research and two in pharmaceutical development).
2. Whenever possible, oral once-a-day formulations should be available for all new product introductions. The consequent change in the division's development policies would require about 20 additional persons, mostly in pharmaceutical development.
3. In cases where specific needed technologies were not available in-house, outside development contracts should be pursued. ALZA was cited as one among several possible sources. The task force pointed out that third-party contracts would not solve the present development capacity constraint, as any new system would require extensive in-house testing. Outside contracting would also involve additional coordination costs.
4. HEMAC should be adopted outside the United States in those situations where its superiority to other systems could be shown.

Ciba-Geigy Views on ALZA: Early 1977

ALZA was one of the companies the task force members had in mind for carrying out ADDS contract research. Various individuals at Ciba-Geigy had had personal contacts with Dr. Zaffaroni over the years; others had formed their opinions through reading articles by him and his associates.

People in pharmaceutical development in Basle were generally skeptical regarding the ALZA systems, which they saw as being either unfeasible or mere gimmicks. Incompatibilities of personal styles had turned some U.S. research managers strongly against Dr. Zaffaroni. Marketing interpreted the lack of success of Progestasert and OCUSERT partly as a demonstration of strong market resistance to ALZA's unconventional delivery systems.

Others, particularly researchers not specialized in delivery systems, tended to have more positive attitudes. For example, Dr. Heusler, who was familiar with Dr. Zaffaroni's work on steroid synthesis, considered him to be a first-rate scientist. Dr. Schenkel, who headed the endocrinology lab in the biology group, had come away from a recent presentation by Dr. Zaffaroni convinced that some of his systems provided a solution to problems that had escaped solution until then.

In 1971, a high-level U.S. research manager had visited ALZA and explored possibilities for cooperation. He was told that as a matter of principle ALZA was not interested in cooperating with large pharmaceutical companies, except as a potential source of compounds for ALZA systems. Since then, no official contact between ALZA and Ciba-Geigy had taken place.

Ciba-Geigy Assesses the ALZA Opportunity

In April 1977, Dr. Vischer, member of the KL and former chairman of the Pharma division, informed Dr. Staehelin that he had been contacted by Dr. Zaffaroni, who wanted to find a buyer for ALZA, which was in financial difficulties. According to Dr. Vischer, Dr. Zaffaroni was very pressed by time and needed a really fast decision.

Dr. Staehelin, who had just learned about the recommendations of the ADDS Task Force, decided immediately to send a party consisting of Dr. Götz, Dr. Heusler, and Mr. MacKinnon, head of the U.S. Pharma Division, to ALZA in order to make a first assessment of the situation. On the basis of their report, he invited Dr. Zaffaroni to Basle. During their first meeting, he and Dr. Zaffaroni immediately established a strong personal rapport and decided to start negotiations between the two companies.

In May, the DL set up a project team with the task of studying in depth the possibility of gaining access to ALZA's technology. The project group in turn appointed three subgroups to carry out a thorough investigation of the scientific/technical, financial, and marketing aspects. All groups potentially involved in a collaboration were represented.

Assessment of ALZA's Technology

The full range of ALZA technologies is included in Exhibit 10 of Case III–3. The intrauterine and ocular devices and the osmotic minipump were already on sale and seemed to work well.

The transdermal delivery system (TTS) was available in prototype and thought to be two to four years from launch with scopolamine. The TTS-system would deliver regular quantities of a drug for periods from one day to one week. Boehringer-Ingelheim had a non-exclusive license for one of their substances.

The OROS system (oral sustained release) seemed to be technically very advanced and only waiting for test programs with suitable ingredients. Merck was already testing this product which was the one of most immediate interest to Ciba-Geigy.

ALZA was thought to possess advanced polymer technology and to be highly innovative but somewhat weak in development and production. It was estimated that without outside help, it would take Ciba-Geigy several years and considerable additional resources to acquire a similar level of expertise. Patent coverage of ALZA's inventions was extremely tight.

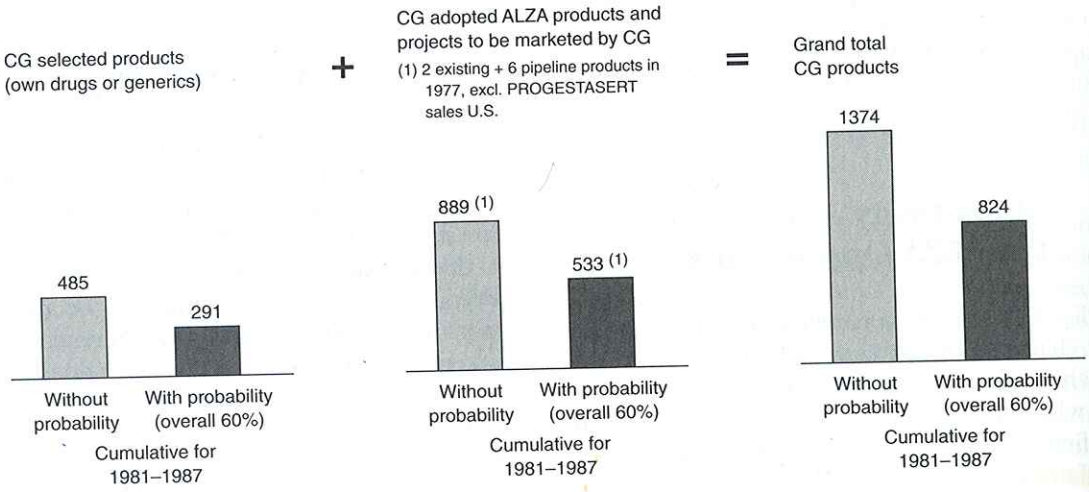
Exhibit 4 indicates potential Ciba-Geigy–ALZA projects, by indication area and by type of ALZA system to be used.

EXHIBIT 4 New Drug Delivery Systems (Potential ALZA Projects)

System \ Indication	Cardio-vascular, Diuresis	Anti-inflammation	CNS	Others	Total
OROS	12	2	2	4	20
Transdermal	3	—	1	3	7
CHRONOMER (Inject./Implant.)	—	—	—	5	5
OCUSERT	—	1	—	2	3
New systems	1	—	—	4	5
	16	3	3	18	40

SOURCE: Ciba-Geigy internal report.

EXHIBIT 5 Ciba-Geigy Estimate of 1981–1987 Sales of ALZA-Related Products



SOURCE: Ciba-Geigy report.

Marketing Assessment

Neither of the two major products, Progestasert and OCUSERT, had performed up to expectations in the marketplace. The former was affected by general doubts about IUDs after the Dalcon Shield scare, was expensive, and demanded new application techniques. OCUSERT was also much more expensive than the eye-drop alternative for glaucoma and demanded application skill of a largely elderly customer group.

Sales of these products had been expected to put ALZA into profit by 1977–78 but with sales of $2.8 million in 1976, and indications of less than twice that in 1977, they were hardly meeting direct costs, let alone contributing to marketing expenses. No other major product was within three years of introduction.

The project team estimated cumulative 1981–1987 sales of Ciba-Geigy–ALZA products at $824 million (Exhibit 5).

Financial Assessment

Sizeable manufacturing and marketing organizations had been built up by ALZA for the new products, and general, administrative, and marketing expenses had risen from $1.3 million (22 percent of costs) in 1974 to $8.1 million (46 percent) in 1976.

By the middle of 1977, the company had an accumulated deficit of $69 million and an annual operating loss of $15 million. Bank debt stood at $14 million and a $20 million line of credit arranged with a number of banks in 1973 was expected to be exhausted by the end of the year.

Merck had invested $3.5 million since 1975 as part of its research agreement and was under no obligation to increase its holding. Share prices, which had stood at a high of $36 in January 1970, had been dropping steadily since January 1976, and in June 1977 stood at $7.50. There were 7.8 million shares outstanding, of which 13 percent were held by Dr. Zaffaroni. There were no other major shareholders. ALZA's financial position is summarized in Exhibit 6.

Ciba-Geigy's financial experts ruled out acquisition of 100 percent of ALZA's stock because its price, calculated at present stock values, would have amounted to about $70 million. In addition, an after-tax cash infusion of $20 million to $25 million would still have been necessary.

Other arrangements considered were:

1. A license agreement covering ALZA's patents and know-how.
2. R&D contracts for specific projects.
3. A loan which would entitle Ciba-Geigy to the rights under 1 above.
4. Acquisition of 80 percent of ALZA's stock, which would cost about $35 million. This would give

EXHIBIT 6 Ciba-Geigy Summary of ALZA Financial Position, 1977

Balance Sheet (in millions)

	June 30, 1977	June 30, 1976
Current assets	$ 6.9	$ 7.6
Fixed assets	16.4	15.9
Total assets	23.3	23.5
Bank debt	14.2	1.0
Total liabilities	16.6	4.1
Common stock	7.8	7.6
Paid-in capital	68.0	65.9
Deficit	(69.1)	(54.1)
Stockholders' equity	6.7	19.4

ALZA management has estimated that their bank debt will be $20 million by the end of 1977; stockholders' equity will be approximately zero.

Operating Statement (in millions)

	1977	1976	1975	1974	1973
Income	$ 7.2	$ 2.8			
Total cost and expenses	22.2	18.4	15.9	11.0	7.2
R&D cost and expenses	8.1	8.4	9.0	8.1	6.9
Operating loss	(15.0)	(15.6)	(15.9)	(11.0)	(7.2)

SOURCE: Ciba-Geigy internal report.

Ciba-Geigy control of ALZA and allow it to consolidate ALZA with the U.S. group company and lead to tax savings estimated at $27 million.

Ciba-Geigy's Options

The opportunity to collaborate with ALZA had to be compared with other ways of building up ADDS expertise.

One alternative consisted in collaborating with other firms on specific ADDS projects. Other small firms with specialized ADDS expertise existed, but none seemed to offer the same breadth and quality of ADDS expertise as ALZA.

A second alternative consisted in building up ADDS expertise in-house. This alternative, which fit with the division's traditional behavior, was favored by the pharmaceutical development group. Although their tests showed that the ALZA systems seemed to work, they remained skeptical. Their most favorable comment was, "It's an interesting idea." They were convinced that they could do whatever was necessary by themselves if given the appropriate resources.

Support for collaboration with ALZA was based on a variety of reasons. Mr. MacKinnon and other managers of the U.S. division felt that ALZA provided a unique opportunity for increasing Summit's role as an R&D center and could yield real benefits to the division. Internal build-up of ADDS capacity would most likely benefit Basle research. But it would be difficult for Basle to ignore Summit when collaborating with another U.S. company. The fact that the U.S. unit had been involved since the first approach to ALZA was in itself already highly significant. The few Summit researchers who felt that ALZA was based more on superb salesmanship than on valid scientific concepts were clearly a minority.

Most researchers in Basle outside the pharmaceutical development group thought that ALZA's systems were sound. Dr. Keberle, head of chemistry, who had started work on pharmacokinetics and metabolism at Ciba in the 1960s, was confident that the systems would work. Researchers in biology (e.g., Dr. Schenkel) thought that the ALZA systems would allow the rapid development of interesting compounds with a short half-life, for which no satisfactory delivery systems existed yet.

Dr. Heusler, as head of research, saw speed as the major advantage of a collaboration with ALZA. Building up internal resources comparable in competence to ALZA, in his estimate, would take at least five to eight years, provided the necessary qualified personnel could be attracted to Basle. This would be too late to fill the gap he foresaw on the basis of the products presently in the R&D pipeline. From the point of view of technical operations, Dr. Götz saw the potential for a broadening of Basle's expertise with polymer-treatment and laser-drilling (for the OROS system).

In thinking about the various arguments concerning the collaboration with ALZA, Dr. Staehelin felt strongly that ALZA could give more to Ciba-Geigy than just its technology. His own company was well-organized but somewhat rigid. ALZA seemed to be run on a completely different basis. A collaboration with ALZA would expose his organization to valuable new forms of thinking and acting. But how should the relationship be structured in order to get the full benefit of ALZA's scientific and organizational know-how?

In mid-July 1977, time was running out for ALZA. Dr. Zaffaroni made it very clear to Dr. Staehelin that ALZA would go under unless a potential partner came up with a firm proposal within the next few weeks.

About Our Research

We spent more than five years studying the internal workings of 15 strategic alliances around the world. We sought answers to a series of interrelated questions. What role have strategic alliances and outsourcing agreements played in the global success of Japanese and Korean companies? How do alliances change the competitive balance between partners? Does winning at collaboration mean different things to different companies? What factors determine who gains most from collaboration?

To understand who won and who lost and why, we observed the interactions of the partners first-hand and at multiple levels in each organization. Our sample included four European-U.S. alliances, two intra-European alliances, two European-Japanese alliances, and seven U.S.-Japanese alliances. We gained access to both sides of the partnerships in about half the cases and studied each alliance for an average of three years.

Confidentiality was a paramount concern. Where we did have access to both sides, we often wound up knowing more about who was doing what to whom than either of the partners. To preserve confidentiality, our article disguises many of the alliances that were part of the study.

Reading III–5
Collaborate with Your Competitors—and Win

Gary Hamel, Yves L. Doz, and C. K. Prahalad

Collaboration between competitors is in fashion. General Motors and Toyota assemble automobiles, Siemens and Philips develop semiconductors, Canon supplies photocopiers to Kodak, France's Thomson and Japan's JVC manufacture videocassette recorders. But the spread of what we call *competitive collaboration*—joint ventures, outsourcing agreements, product licensings, cooperative research—has triggered unease about the long-term consequences. A strategic alliance can strengthen both companies against outsiders even as it weakens one partner vis-à-vis the other. In particular, alliances between Asian companies and Western rivals seem to work against the Western partner. Cooperation becomes a low-cost route for new competitors to gain technology and market access.[1]

Yet the case for collaboration is stronger than ever. It takes so much money to develop new products and to penetrate new markets that few companies can go it alone in every situation. ICL, the British computer company, could not have developed its current generation of mainframes without Fujitsu. Motorola needs Toshiba's distribution capacity to break into the Japanese semiconductor market. Time is another critical factor. Alliances can provide short-

[1]For a vigorous warning about the perils of collaboration, see R. B. Reich and E. D. Mankin, "Joint Ventures with Japan Give Away Our Future," *Harvard Business Review*, March–April 1986, p. 78.