Harvard Business School

9-501-061

January 9, 2001

Abgenix and the XenoMouse

Meet XenoMouse

"Meet XenoMouse™" headlined the piece from the Abgenix information kit. (See **Exhibit 1**.) If ever there was a mouse worth meeting, XenoMouse was probably it. While Lee Majors played bionic man, Steven Austin, in the popular *Six Million Dollar Man* television series in the 1970s, XenoMouse could well be termed the "Three Billion Dollar Mouse." XenoMouse lived at Abgenix in Fremont, California, just across the Dunbarton Bridge from Silicon Valley's famed Highway 101. While no product based on the genetically engineered XenoMouse had yet reached the market, he was the source of the company's near $3 billion market capitalization of March 31, 2000.

The product of a seven-year, $40 million research and development effort, XenoMouse was a unique strain of transgenic mice capable of producing antibodies potentially useful in the treatment of human disorders including cancer, transplant rejection, and inflammation. The idea of using mice to produce antibodies for treating human diseases dated back to the 1970s; but only recently had therapies based on this approach passed the rigorous safety and efficacy tests necessary for regulatory approval. Many industry observers were now predicting an "antibody wave" as genomics research identified thousands more possible disease targets for antibody therapy. And, the new generation of technologies for generating antibodies from mice, including XenoMouse, were capable of producing therapies which were believed to be more effective and well tolerated by humans. Major pharmaceutical and biotech companies had licensed access to XenoMouse.

In April 2000, R. Scott Greer, President and Chief Executive Officer of Abgenix, described the company as "well positioned to ride the antibody wave" due to a strong financial position from a recently completed series of private placements and follow-on public offerings of stock, raising over $600 million. (See **Exhibit 2** for a balance sheet as of March 31, 2000 and income statements for years 1998 and 1999.)

Abgenix generated revenues in two ways. First, it licensed XenoMouse technology to numerous corporate collaborators including leading pharmaceutical and biotechnology companies. (See **Exhibit 1** for list.) A collaborating company typically identified a specific disease target it was trying to "hit" with an antibody. Abgenix then sold exclusive access rights to using XenoMouse to develop antibodies for that specific target only. A collaborator paid an upfront fee, agreed to payments as the drug development program reached certain milestones, and a royalty on sales

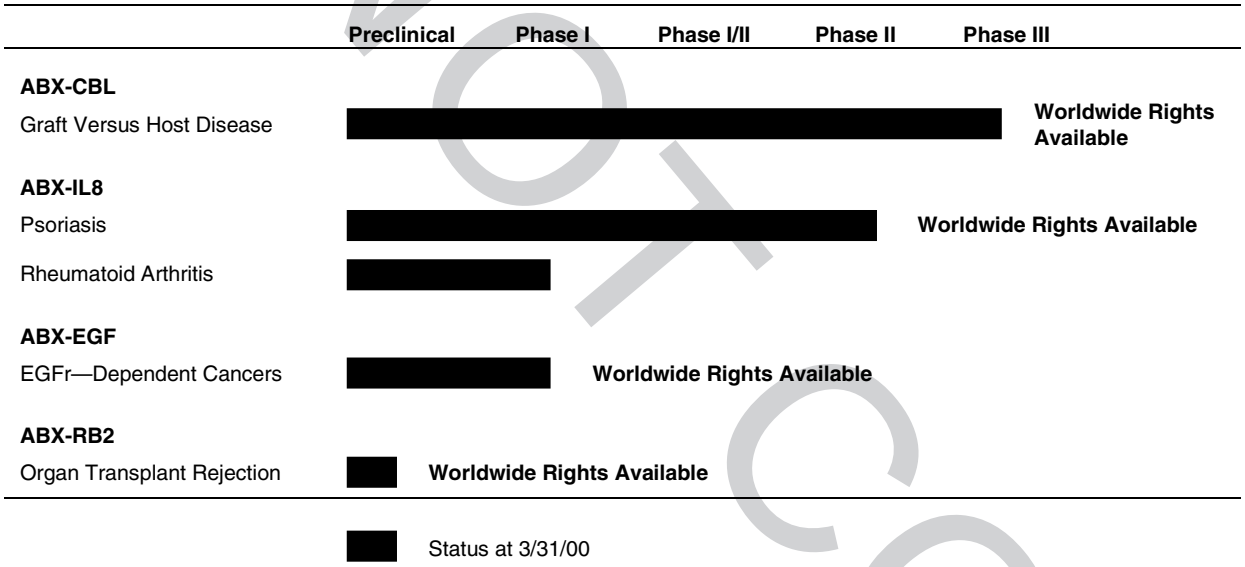
Professor Robert Dolan prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. Certain data have been disguised.

should the drug be commercialized. A typical arrangement had total fees before commercialization ranging from $7 to $10 million. Royalty rates ran from 4%-6%.

The Food and Drug Administration (FDA) prescribed and oversaw the drug testing and development process. Before testing in humans was permitted, "Preclinical Trials" had to show sufficient evidence of safety and desired biological activity to gain FDA approval of an "Investigational New Drug Application" (IND). Testing then proceeded through three phases with humans. Phase I focused on safety; Phase II on effectiveness against designated diseases and Phase III was large-scale testing with the doses to be prescribed when the product was sold commercially. Drug development was a risky business. The vast majority of drugs initially tested fail to gain FDA approval.

The second way Abgenix hoped to generate revenues was by pursuing the early stages of XenoMouse-based drug development, meeting with some success, and then selling off the rights to develop and market the drug. As shown in **Figure A**, Abgenix had four XenoMouse-generated drugs in various stages of the FDA process on March 31, 2000.

Figure A Development Programs (source: Company Records)



ABX-CBL was in Phase III clinicals and ABX-IL8, targeted at inflammatory disorders such as psoriasis and arthritis, was in initial human effectiveness studies. ABX-EGF, targeted at various cancers, had shown outstanding effectiveness in preclinical studies on mice and was in initial small-scale safety testing with humans. ABX-RB2, for organ transplant rejection, was not yet tested with humans. In each case, as the figure from an investor presentation shows, Abgenix described the program as "Worldwide Rights Available."

By selling the rights to a firm with a marketing capability in place, Abgenix avoided the many costs of bringing a drug to market—not the least of which was developing a field salesforce. Abgenix would participate in the upside potential by keeping with industry practice of structuring a deal involving its receiving royalty payments as a percentage of sales. While substantive discussions were in process with a number of firms on the developmental programs, no "sales" of programs had yet been made. The "sales cycle" for such a "product" was typically long as the buying company had to understand fully the test results so far and assess future prospects—all in an environment characterized by Ray Withy, Abgenix Chief Business Officer, as having "some element of unresolvable uncertainty." From its side, Abgenix had to scrutinize the "buyer" since the buyer's

degree of success would ultimately determine Abgenix's financial returns given the significance of the royalty rate on the sales piece of any deal.

Seventeen partners' programs moving ahead, many new technology licensing collaborations in the negotiation phase, and four promising proprietary development programs had made XenoMouse "The $3 Billion Mouse" in the eyes of the stock market. Greer faced key challenges: (i) pick the right partners for collaboration, (ii) continue to develop Abgenix skills and capabilities for the long term, and (iii) properly balance risk and potential reward in negotiated deals. This was made all the more challenging given the "unresolvable uncertainty" inherent in the biotechnology business—as both his knowledge of industry history and his Chief Business Officer often reminded him.

ABX-EGF Decisions

While two programs were further along in human testing, the ABX-EGF program targeting various cancers, was perhaps the biggest decision management faced in April 2000. In preclinical trials, ABX-EGF had eradicated pre-formed human cancer tumors injected into and growing in *all* test mice. As such, the "Worldwide Rights Available" designation on the program had attracted a number of potential partners willing to negotiate an upfront fee plus milestone payments triggered by events along the development path, followed by a percentage royalty on sales. In particular, Pharmacol, a large pharmaceutical company with whom Abgenix had no current relationship, seemed a good potential partner. It had the skills Abgenix deemed necessary for guiding the product through human trials, managing the regulatory process, and effectively bringing the product to market. It was also clear that Pharmacol understood the extraordinary opportunity and market potential for ABX-EGF if all worked out in the development process. Pharmacol's understanding of the potential upside meant that it would agree to a royalty rate which was "high" by industry standards.

Biopart, a biotechnology firm with a focus on oncology, was a different opportunity. In spirit, this would be a 50/50 partnership. Instead of handing-off to Biopart for a fee-plus-royalty, Abgenix and Biopart would run hand-in-hand sharing costs and profits incurred over time. Biopart was willing to make some payments initially to Abgenix in light of what it and XenoMouse would bring to the partnership.

Conceptually, a third option was to "go-it-alone," developing the in-house skill to carry the product through FDA approval and marketing. Greer, however, did not think this a viable proposition for Abgenix, especially in light of his statements to the investment community about not incurring these costs and thus becoming profitable quickly.

Greer would have to choose between doing a Pharmacol "hand-off" deal or Biopart "hand-in" deal now or he could simply wait a while. ABX-EGF had just recently even started Phase I trials, so it was early, by industry standards, to sell off the rights. Abgenix could continue on to Phase II and see how that went before making a deal.

Biotechnology Industry and Regulatory Process

The two leading biotechnology companies in 1999 were Genentech and Amgen. Biotechnology was distinguished from conventional pharmaceutical approaches by focus on producing therapeutics based on molecules present in the human body. In 1982, Genentech's work with a process known as "recombinant DNA technology" produced human insulin. It licensed the

marketing rights to Eli Lily. Three years later, Genentech became the first "FIBCO" (fully integrated biotechnology company) not only developing but also marketing and selling Protropin, a growth hormone for children. Amgen used recombinant DNA technology to develop two blockbuster drugs stimulating blood cell growth. Epogen and Neupogen generated $3 billion in sales for Amgen in 1999 and funded the year's $823 million R&D spending.

While both Genentech and Amgen were FIBCOs, capable of bringing their own products to market, each also had an extensive set of collaborations. Amgen described its model as "creation through collaboration" explaining: "From the beginning, corporate collaborations have been viewed as the path to accelerate transformation of Amgen into an independent commercial enterprise by accessing research and markets in areas where Amgen alone could not invest sufficient resources." (Amgen website: www.amgen.com) The collaborations were driven by the high cost and low likelihood of success for drug development programs. The "odds" were often described as follows: Of every 1,000 compounds tested in the lab, only one made it to human testing. Only 20% of those tested in humans received the FDA approval. Thus, it took 5,000 lab tested therapies to yield one marketed product.

The process was also very costly. When testing was complete, all the scientific data related to the drug including lab tests, animal testing, human testing, and manufacturing process specification were collected and filed in a "New Drug Application" to the FDA. These data were also pivotal in gaining international acceptance. A typical New Drug Application is a volume of over 1,000 pages.

Once a product has been approved and marketed, the company still files reports with the FDA documenting side-effect incidence. In several notable cases, the FDA forced withdrawal of a previously approved drug from the market.

Antibodies

Antibody production was the second major technology besides recombinant DNA in the biotechnology field. An antibody is a protein developed by the immune system. When a foreign substance (an "antigen") enters the body, the immune system produces an antibody to fight that antigen. The antibody binds to the antigen, neutralizing it and preventing it from reacting with normal cells. The antibody production capability of a human is limited however. First, even when "normal" it cannot generate antibodies to its own tissues which are multiplying out of control—as is the case with cancer. Second, an individual's immune system may become deficient.

In either case, an antibody produced in a different species, such as a mouse or monkey, could prove useful. The antibody was produced and administered to the human in need. To work effectively, the administered antibody needed:

1. "high specificity"—meaning it binds to only the one particular kind of antigen it is targeted against.

2. "high affinity"—it binds tightly so it can neutralize the antigen.

Antibodies generated in mice were found to have these two properties in many situations. Technology was developed to fuse together the antibody-producing cells of the mouse and an immortal myeloma cell which created a cell line capable of producing the same antibody indefinitely. In this way, the antibody-producing cells continued to secrete antibodies. These antibodies could then be gathered and administered to humans in therapeutic doses. Before development of XenoMouse, two problems plagued these efforts.

1. When the potentially therapeutic antibody was entered into the human body, the mouse protein in the antibody caused it to be recognized as foreign and the body immediately

began to try to reject it. Consequently, the antibody would have to be readministered frequently to have therapeutic effect.

2. With repeated dosing the body began to develop its own antibodies to the administered, hopefully therapeutic antibody. This was known as the Human Anti-Mouse Antibody or HAMA response. In many cases, the HAMA response prevented the mouse antibody from having the desired effect and induced allergic reactions.

The first, partial, solution to this was development of processes to treat antibodies to make them appear more "human-like." These approaches greatly reduced the mouse protein content, sometimes to as little as 5-10% of the antibody.

The 1980s had hailed antibodies as "magic bullets," in reference to their ability to find and bind only target antigens. Useful products however were slow to develop. It was not until November 1997 that Rituxan (from IDEC and Genentech) became the first antibody-based cancer treatment (non-Hodgkin's lymphoma) to receive FDA approval. By September, 1999 eight antibody products had reached the market including Genentech's Herceptin, a humanized antibody for metastatic breast cancer. For 1999, Genentech reported sales of $279 million for Rituxan and $188 million for Herceptin. Each antibody product on the market in early 2000 was "humanized," containing some mouse protein. The "humanization" of antibodies was both time consuming and expensive. This, plus the therapeutic limitations of humanized antibodies spurred development efforts in a second direction, i.e., the humanization of the source of the antibodies rather than after the fact partial humanization of the antibodies. Competing "humanized" mice were developed by Abgenix and GenPharm International (later acquired by Medarex): XenoMouse and "HuMAb-Mouse" respectively. To settle an intellectual property dispute, the two firms cross-licensed their technologies. In this way, each pursued its own method but without fear of a suit from the other. Abgenix believed it had a superior mouse as XenoMouse contained more human antibody genes than "HuMAb-Mouse." Medarex had 1999 revenues of $10 million and partnerships with noted firms such as Amgen, Bristol-Myers Squibb, Merck, and Novartis. Compared to conventional mouse approaches, both XenoMouse and HuMAb-Mouse promised:

1. longer lasting therapeutic effects as the body did not attempt to eliminate the drug

2. fewer unwanted side effects

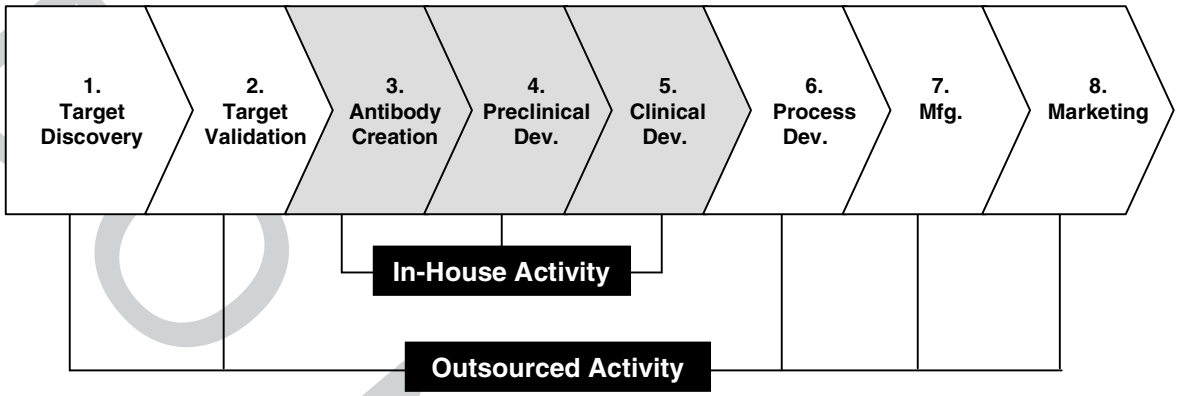
3. faster product development time as no time was needed to "humanize" the antibody produced.

Abgenix Business Model

Abgenix conceptualized the antibody product development value chain to have eight steps as shown in **Figure B**.

Steps 1 and 2: Target discovery and validation An antigen target is identified and its link to a disease verified. This was work many academic scientists carried out. Small biotechnology firms could also do this as the investment was not overwhelming. As an example, a number of published scientific papers identifying Epidermal Growth Factor (EGF) as a possible target. Research has shown that the EGF receptor was "overexpressed" on many kinds of cancer tumors. For example, over 80% of prostate cancers "overexpressed" the EGF receptor. Having too many EGF receptors on a cell meant the cell was overly sensitive to normal EGF's signaling to grow and perhaps divide.

Figure B Product Development Value Chain (source: Company Records)



Step 3: Antibody creation Having a verified target, the next step is to generate an antibody which can bind the target in a specific way, i.e., without bothering healthy cells. XenoMouse is one source of such antibodies.

Steps 4 and 5: Preclinical and clinical development This is carrying through the FDA prescribed process described above.

Step 6: Process development Design processes to manufacture quality-assured product in an economic fashion.

Steps 7 and 8: Manufacturing and marketing Make it and sell it.

In terms of this value chain model, Abgenix's two businesses could be described as:

1. Technology licensing of XenoMouse—do Step 3 only.

2. Proprietary product development programs—do Step 3, Step 4, and some but not all of Step 5.

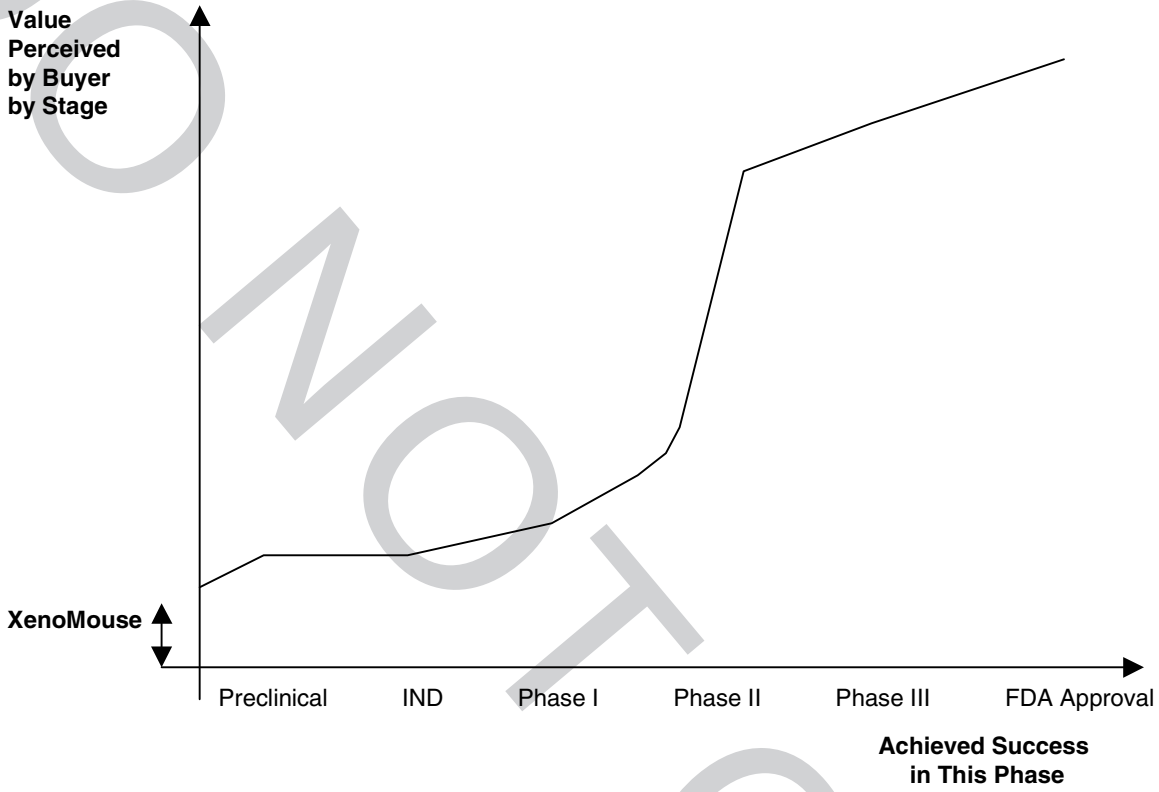
Ray Withy, Chief Business Officer, described the strategy as follows:

> Our source of comparative advantage has been XenoMouse. It's a product-generating platform. We started as an antibody-creating company—doing only Step 3. Collaborators brought us their targets and we generated an antibody for them or gave them XenoMouse and they could do it themselves. Then we went to a dual commercialization strategy, doing lots of signups to do Stage 3 for people, but we also saw there were some important validated targets in the literature. People were doing Steps 1 and 2 for us for free, so we took that and went ahead and did Step 3 for ourselves and then pushed forward into preclinicals of Step 4. How much of this we do and how far we take it is a critical decision for us. We need to not only generate some profits but also build our capabilities so we'll be a viable node in the network of biotechnology and pharmaceutical companies getting set up out there. How do we get the right connections in the network?

Abgenix's four development programs had proceeded to different stages although Abgenix had not yet even neared the point of filing a New Drug Application with the FDA for any of them. ABX-CBL had been tested in a Phase III study with 140 people but much more Phase III testing was needed. ABX-IL8 had just moved into a Phase II clinical trial for one indication last month; ABX-EGF

was in Phase I trial with 33 people and ABX-RB2 was still in the preclinical stage. Withy described the thinking on the criticality of Phase II success, being the first test of drug effectiveness with rigorous statistical analysis, in terms of the perceived value of a program rights by sketching out a value-by-stage diagram as follows.

Figure C



He noted:

> We start with what we get for XenoMouse over on the left—that's just access to the technology—with no risk or incremental spending on our part. Now, here's how it *typically* works—if there is such a thing as typical in this business. If we are doing development ourselves and have success in preclinicals, that bumps the value some over just access to the technology. INDs (Investigational New Drug applications filed with the FDA to get approval for human testing) and Phase I trials are not that big a deal for antibody therapies like ours because the theory so strongly indicates we won't have safety problems. The experiments, while necessary, and giving us dosing information, don't add a lot in terms of new information about likely eventual success. Phase II is the inflection point where you get the big bump in value. In Phase II, you have shown it effective to a statistically significant degree. Sure, there are things to still work out in Phase III and with the FDA. But that's been our thinking, if you can get it to Phase II, you can hand it off there and capture a lot of the value. Now, with EGF, maybe we have to think about this differently. Are the preclinical results so compelling that we have already created lots of perceived value? Or, on the other hand, is there so much potentially on the table that we should not be thinking about handing it off at all?

Geoff Davis, Chief Technical Officer, concurred:

> We have always had a strategy of being out by the end of Phase II. That's where the inflexion point on the value curve is. We don't even have anyone in the company who has been all the way through the end of a Phase III. We have to be sure we recognize our emotional attachment to EGF. We are pretty proud of the preclinical results—justifiably so—but we can't let our ego get in the way of figuring out where best to go from here.

EGF Market[1]

As described above, Epidermal Growth Factor and, in particular, the EGF receptor, had been identified as a target and verified to be associated with cancer. These results were well known throughout the industry and many firms were developing therapies with EGF as the disease target. An internal Abgenix report summarized the market potential for an EGF direct therapy as follows:

Market Potential

- Cancer is the second-leading cause of death in the United States.
- Over one million cases of cancer are diagnosed each year and half receive chemotherapy.
- The direct cost of cancer in the United States, including patient care, was estimated in 1990 to be $35 billion or 6% of the total cost of healthcare.

The U.S. Estimated New Cases (2000), Deaths and % Overexpression of EGF Receptor for Cancer

	Number of Cases	Number of Deaths	% Overexpressing EGF Receptor
Prostate	180,400	31,900	80-90%
Breast	184,200	41,200	20-30
Lung (NSCLC)	136,200	130,200	60-80
Colon and rectum	130,200	56,300	80-90
Urinary tract	86,700	24,600	50-70
Oral cavity and pharynx	30,200	7,800	50-90
Renal	31,200	11,900	70-90
Ovary	23,100	14,000	30-50

Source: American Cancer Society, "Cancer Statistics 2000," *Cancer Journal for Clinicians*, California, 2000.

Using the midpoint of the "% overexpressing EGF receptor" range given, the number of new cancer cases with overexpression of EGF in the United States in 2000 can be estimated to be 512,760. Herceptin, Genentech's antibody product for breast cancer, priced out at over $1,000 per week of therapy and an average therapy costs over $20,000.[2]

[1] Lehman Brothers report on "EGF Receptor Antagonists: An Important new Class of Anticancer Agents" by M. Wood, A.R. Leheny and B.M. Bizoza was helpful background information for this section.

[2] Ibid., pp. 10 and 19.

Two different approaches to EGF receptor therapies were undertaken in the industry. Small molecule drugs, capable of crossing the cell membrane, sought to block signaling of an activated EGF receptor. These drugs could be taken orally. Antibodies, which had to be administered intravenously, blocked the EGF receptor.

Small Molecule Competitors

The two leading players in small molecule drugs based on organic chemistry appeared to be AstraZeneca with IRESSA and OSI Pharmaceutical with OSI-774. Astra Zeneca was one of the five largest pharmaceutical companies in the world with health care sales over $15 billion. In 1999, it spent $280 million on the discovery and development of new treatments for cancer. It had four major cancer drugs on the market and over 300 sales representatives focusing on this market. In March 2000, it reported results of Phase I trials with 64 patients. IRESSA was "well tolerated . . and showed encouraging antitumor activity. . . ." It planned to be in Phase III clinicals for lung cancer treatment by the end of 2000.[3]

OSI was in Phase II clinicals. OSI described itself as "dedicated to being a leading pharmaceutical research and development organization." Also, "our business strategy and limited resources require us to enter into collaborative arrangement with various research partners." It had collaborations in place with Aventis, Novartis and Pfizer among others. It was conducting Phase II studies of OSI-774 both as a complement to chemotherapy and administered alone.[4] Small molecule drugs had shown some side effects: rash and gastrointestinal system upset.

Antibody Competitors

The major competitor producing an antibody therapy was ImClone with C225. It had begun human testing of the C225 antibody in 1994. C225 was a "humanized" antibody, not fully devoid of mouse protein. In one early test, it showed complete response when used in combination with radiation in 13 of 15 treated head and neck cancer patients. The other two patients had more than 50% tumor regression. It had two Phase III clinicals in place—one as a complement to chemotherapy and one as complement to radiation therapy. In late 1998, it granted exclusive C225 rights outside the United State to Merck KgaA of Darmstadt, Germany. In 1999, it spent $30 million on R&D and had revenues of $2.1 million. It was believed to be building an in-house salesforce and had stated in a company press release that its strategy was "to become a fully integrated biopharmaceutical company, taking its development programs from the research stage to the market."

Status of ABX-EGF

ABX-EGF performance in preclinical trials with animals was outstanding. Mice as the treatment subjects were injected with human epidermal cancer cells. No treatment was administered initially and the cancer tumors began to grow. After about two weeks, the test mice were injected with ABX-EGF twice a week for three weeks. Mice received no other cancer treatment, i.e., this was a test of ABX-EGF as a "monotherapy" rather than as a complement to chemotherapy or radiation. The result was that ABX-EGF completely cleared the preformed tumors in the mice. No relapse of the tumor was observed after discontinuation of the treatment.

[3] Source: Company website.

[4] Ibid.

In November 1999, Abgenix began Phase I trials. These trials involved escalating doses up to seven levels on 33 patients with five different cancer types. Testing to date had proceeded through the first several levels and no toxicity/safety problems had been noted.

Comparative tests vs. ImClone's antibody product, C225, in mice showed ABX-EGF to generate superior results. In addition, ABX-EGF would have the benefit of being a fully human antibody while C225 was one-third mouse and two-thirds human.

Moving Forward

Both Ray Withy, Chief Business Officer, and Geoff Davis, Chief Scientific Officer, had been "on the road" a great deal presenting the clinical data telling the ABX-EGF story to prospective partners. As Withy put it, "we targeted everyone who could be a player and went out to see them." Not unexpectedly, ABX-EGF generated lots of interest. Selling the ABX-EGF development program involved not only selling the program but the company as well; a potential buyer typically presented a complex decision-making unit to Abgenix with people from the scientific side to process the preclinical data, development and clinical people to assess where the program would go next and likely results, and manufacturing representation to assess how the product could be made in sufficient quantities and at what cost.

Abgenix had to develop its own sense of how good each collaborator would be because its financial return depended upon the collaborator's success in gaining FDA approval and marketing the drug. With this in mind, Pharmacol seemed the best option. Pharmacol was a pharmaceutical company with $12 billion in sales in 1999, drugs in many areas including cancer, and a salesforce which compared to AstraZeneca's in size and skills. Ray Withy commented: "With Pharmacol, we saw a potential sales revenue of $700 million per year when the market was fully developed in 10 years' time."

Through a long series of discussions, the likely structure of a deal with Pharmacol took shape. Pharmacol's payments to Abgenix before marketing of the drug would be:

Upon signing of deal:	$ 5 million
Beginning of Phase II trials:	$ 5 million
If/when Pharmacol Begins Phase III:	$ 8 million
If/when FDA Approval Received:	$10 million

Abgenix would receive a 10% royalty on sales in perpetuity. Since this was a "hand-off" to Pharmacol, Abgenix would incur no costs once the deal was signed. Withy anticipated that it would take five years to get ABX-EGF to market with Pharmacol even if things went according to plan. **Exhibit 3** shows the annual sales levels projected for the first 10 years after launch.

Biopart presented a different opportunity to Abgenix. Instead of a "hand-off," Abgenix would keep a "hand-in" a joint venture relationship. A biotechnology firm which had "gone public" in the first wave with Amgen and Genentech in the early 1980s, Biopart had focused on recombinant DNA technology. Its 1999 revenues were $510 million and had a good reputation for innovation and managing the regulatory process. The general parameters of a deal with Biopart would be:

1. Biopart would pay $5 million on signing of the deal and $5 million when Phase II clinicals began.

2. All costs and revenues would be shared equally by Biopart and Abgenix.

3. Abgenix and Biopart would jointly design and conduct Phase II tests. Biopart would take the lead on Phase III testing with some involvement from Abgenix.

4. Biopart would take the lead in marketing given its existing salesforce for cancer therapies. Abgenix could, if it wished, develop its own salesforce to work alongside Biopart reps. (Costs for this would be shared by the partnership per item #2).

As with the Pharmacol case, Withy estimated that it would take five years to get to market. He estimated product development costs over this period as follows:

	Total Development Cost for Abgenix/Biopart Partnership (in millions)
Year 1	$10
Year 2	20
Year 3	25
Year 4	35
Year 5	35

If the product were to be commercialized, an additional $15 million would be needed for premarketing launch activities in the launch year. Ongoing cost of goods sold would be approximately 10% of sales and S,G,&A would be 25% of sales.

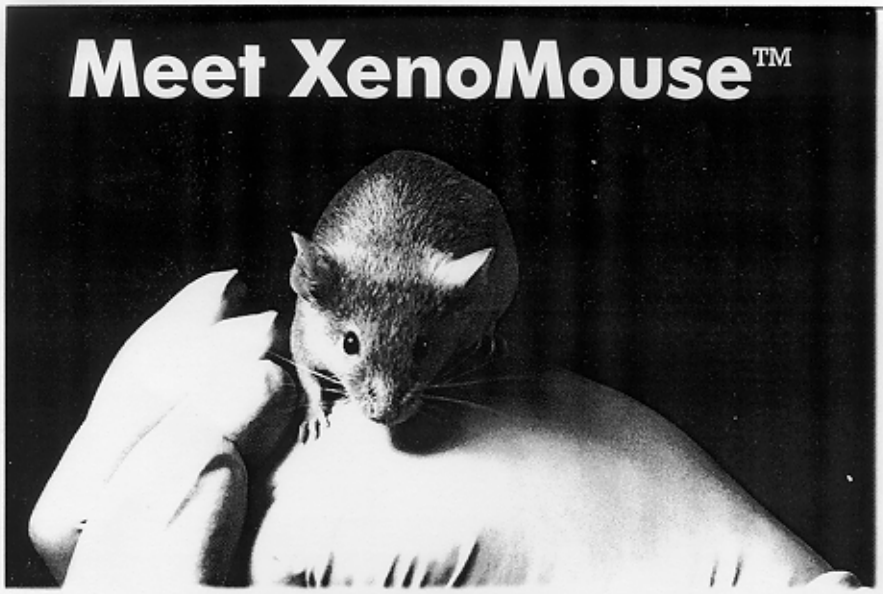
In assessing the relative merits of the Pharmacol and Biopart alternatives, one factor Abgenix management had to consider was the likelihood of attaining FDA approval and how much of the market would be tapped. The major difference between the Pharmacol approach and the Abgenix/Biopart partnership was the scale of the marketing effort Pharmacol could bring to bear. Thus, Abgenix projected that an Abgenix/Biopart partnership would generate 20% less sales than Pharmacol's estimates of **Exhibit 3**. However, given Biopart's clinical skills and the predominant role of the drug itself in testing, management thought the two routes represented the same time-to-market (five years) and a likelihood of ultimate FDA approval and market introduction (40%). Management felt it was highly likely that the development program would at least enter Phase III under either scenario. The $35 million in year 5 development costs for the Abgenix/Biopart partnership would be incurred only if FDA approval was achieved.

Abgenix Decisions

"Hand-Off," "Hand-In," or "Do Phase II's and Then Decide"—these were the three options Greer had to decide among. He would then have to support his chosen alternatives to his board of directors. Should he do a "hand-off" to Pharmacol—most likely what was expected by the board, the investment community and others given Abgenix's declared strategy? Or, was ABX-EGF special enough to warrant a "hands-in" joint venture agreement—which while not new to the industry, would be new to Abgenix? Or, should he wait to go to Phase II clinicals on a solo basis. This would mean the $28 million in year 1 and 2 development costs shown above would fall to Abgenix alone. Success at that stage though would greatly boost Abgenix's bargaining power for either a "hand-off" or "hands-in" negotiation. Greer felt sure he wanted a partner in this ABX-EGF effort at some point—but which type and when was a critical decision to make and manage. If he decided Pharmacol—what did he say to Biopart? If he decided Biopart—what did he say to Pharmacol? If he decided to do Phase II's himself, what did he say to each—you both stay here at the altar and I may show up to marry you in a couple of years? These were weighty decisions for the custodian of the "Three Billion Dollar Mouse."

Exhibit 1

Meet XenoMouse™



We have humanized a mouse so you don't have to humanize antibodies.

Corporate Collaborators

Biotech	Pharma
Amgen	Abbott
AVI BioPharma	BASF
Cell Genesys	Elan
Chiron	J&J/Centocor
Corixa	Pfizer
Genentech	Schering-Plough
Genzyme Transgenics	SmithKline Beecham
Gliatech	**Genomics**
Other	Curagen
RCT	HGS
US Army	Millennium

XenoMouse-Derived MAbs

- Fully human
- High affinity ($K_D = 10^{-9} – 10^{-11}$ M)
- Antigen-binding specificity
- Choice of IgG isotypes (IgG_1, IgG_2, IgG_4)

Technology Advantages

- ➡ Faster Product Development
- ➡ Lower Product Commercialization Costs

- One-step process to create MAbs
- Creates MAbs to human antigens and non-human antigens
- No need for molecular engineering
- MAbs can be produced in hybridoma cell lines
- MAbs can be produced in other cell lines utilizing proprietary technology

Abgenix

7601 Dumbarton Circle ■ Fremont, CA 94555
(510)608-6500 ■ Fax (510)608-6511
www.abgenix.com

Exhibit 2

Statement of Operations (in thousands except per share data)

	Year Ended December 31,	
	1999	**1998**
Revenue	$ 12,285	$ 3,842
Operating Expenses:		
General and administrative	5,164	3,405
Research and development	21,106	17,588
Equity in (income) losses in Xenotech joint venture		
Termination fee	8,667	--
Total operating expenses	$ 34,391	$ 21,100
Interest (income) expense, net	$ (2,067)	$ (431)
Foreign income tax	1,000	--
Net loss	$(20,499)	$(16,827)
Net loss per share	$ (1.41)	$ (3.00)
Shares used in computing net loss per share	14,537	5,603

Balance Sheet (in thousands)

	March 31, 2000 (unaudited)	**December 31, 1999**
Cash, cash equivalents and marketable securities	$568,003	$58,012
Property and equipment, net	5,253	5,300
Long-term investment	39,176	29,225
Intangible assets, net	45,814	46,591
Other assets	4,825	9,413
Total assets	663,071	148,541
Deferred revenue	13,367	3,767
Other current liabilities	6,286	7,143
Long-term debt and other	296	571
Stockholders' equity	643,122	137,060
Total liabilities and stockholders' equity	$663,071	$148,541

Exhibit 3 Projected Sales by Year by Pharmacol with Product Introduction in "Year 1" (for years 1 to 10)

Year	Dollar Sales (in millions)
1	$20
2	70
3	135
4	250
5	330
6	450
7	540
8	620
9	700
10	700