Incyte Pharmaceuticals
Product Development Strategy for Limited Genomic Database Products

Final Project Report
EESOR 483 - Strategy and Planning Models
Spring 1997

June 6, 1997

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June 6, 1997

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Acknowledgments

Special thanks to the following persons, without whose contributions this project would not have been possible. We appreciate your assistance and sincerely hope that our efforts will help Incyte Pharmaceuticals to be successful in the future.

Tod Klingler

Richard Goold

Roy Whitfield

Randy Scott

Kent Davidson

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Executive Summary

Incyte Pharmaceuticals is the leading supplier of gene sequence and expression database products to large pharmaceutical firms worldwide. Incyte's products provide researchers with access, on a non-exclusive basis, to sequence and expression data that are not available publicly, along with the software tools to store and analyze these data.

As competitors grow and the public domain of informational resources expands, Incyte will need to develop new markets and new customers in order to maintain its competitive advantage.

Team RHOF has analyzed the viability of moving into one such new market - *the market for gene sequence and expression database products for small pharmaceutical and biotech firms*. Incyte's current product line **prices out** all but the top 50 pharmaceuticals, and in its current form is most attractive to the top 25 pharmaceuticals. However, by designing a more low-end "limited genomic database" product tailored to the needs of smaller pharmas and biotechs[1], Incyte may be able to tap this new market at low cost, diversify its customer base, and better position itself to remain the leader in its industry.

Our analysis is centered around the following problem statement:

> *Given the trends and competitive forces in the marketplace, along with Incyte's ongoing strategic initiatives, should Incyte develop a "limited genomic database product" for the small pharma and biotech markets? If so, how should Incyte design this product and when should it be introduced to the marketplace?*

[1] Pharmas" or pharmaceutical companies are those firms that are involved in the development of drugs, usually in conjunction with a significant research effort. Biotechs are those that are involved primarily in research with little or no drug development or manufacturing.

Using the results of interviews with key Incyte staff, customer surveys, and a variety of analytical tools, we have developed a recommendation for Incyte, namely to move ahead immediately with the development of a product which allows customers to select a custom subset of the LifeSeq® database which is tailored to their specific research needs. We have also developed a pricing strategy for this product.

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1. Overview

1.1 Background: Incyte Pharmaceuticals

Incyte Pharmaceuticals is a leading company in the rapidly evolving industry of genomic information-based products and services. Currently, Incyte's main product line is a suite of high-end gene sequence and expression[1] databases that facilitate pharmaceutical research by providing information that is not publicly available, along with an easy-to-use interface and software tools to analyze the information. Incyte is also the first biotech company to re-sell non-exclusive information rights to pharmaceutical companies, allowing it to sell subscriptions to its database products to multiple customers.

Incyte's major product is the human gene sequence and expression database (LifeSeq®). In addition to this product, Incyte markets sequence and expression databases for rodents (and other model organisms), microbial organisms, and other species, as well as several related products. See Appendix A for selections from Incyte's corporate brochure describing the company overall, and the LifeSeq® product in particular.

Incyte's LifeSeq® database contains partial sequences and sampled expression levels for nearly three times as many genes as are currently known in the public domain. This exclusive information, combined with the software to extract, organize, and analyze the data, makes Incyte's products unique in the marketplace. No serious competitive products to Incyte's database tools currently exist.

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[1] Gene sequences are simply the string of nucleotides (A,C,G, or T) that comprises all or part of a gene on a DNA molecule. Genes vary in length from a few hundred nucleotides to several thousand nucleotides. Incyte's human gene database contains short "snapshots" of sequences (about 200-300 nucleotides in length) for observed genes in human tissue. Understanding the sequence of a gene is the first step to understand its functionality - and understanding a gene's functionality is the key to developing drugs to influence its effects. Gene expression data provides another key to understanding a gene's functionality. A gene is "expressed" when it is used in a cell. Expression data provides an index of which cells a gene is observed in, as well as how frequently the gene sequence was observed. Researchers can use expression data to hypothesize possible uses for genes.

Incyte realizes that it must commit to an ongoing strategy of change and development to be a preferred supplier of genomic data and analysis tools to pharmaceutical researchers. Since major paradigm shifts in the biotechnology industry are expected to occur, it is part of the company's policy to develop business plans that go beyond the five year point, looking ahead to changes for the future. Since Incyte cannot sustain its current competitive advantage if the company does not plan for the future, it is important that Incyte develop business strategies that will both capitalize on current resources and develop new sources of competitive advantage.

Incyte's current advantage is built around a strategy that is unique in the pharmaceutical and bioinformatics industry. CEO Roy Whitfield describes the strategy: "Information is non-exclusive. Everybody wants it and other people can generate it. So the route to competitive advantage is not patents, it's market share." Though other companies, like Human Genome Sciences Inc. (HGS) of Rockville, MD, are engaged in the business of providing DNA sequence data to pharmaceutical firms, their strategy is to sign exclusive agreements with a few large pharmaceutical companies and hope for big royalty payoffs later. Incyte's success is not based on such a gamble on patents or future markets. Rather, its current strategy is to penetrate a large portion of the "big pharma" market , consisting of about 50 of the world's largest pharmaceuticals, and increase its revenues per customer.

From its strategy of providing non-exclusive data and information services to a large share of the market, Incyte has built four major sources of competitive advantage:

Information: Incyte has a significant lead in collecting information regarding human genetic sequences compared to any potential competitors. Pharmaceutical companies place a high value on this advanced information.

Customer Relations: Incyte has a synergistic relationship with its current client base which includes 15 of the largest pharmaceutical companies. These companies offer feedback on the products and can communicate their needs and demands with Incyte.

Resource Capital: Incyte has a foundation of resources including software development, scientific expertise and human capital that is superbly adapted to meeting some of these growing demands. This includes a unique combination of bioinformatics and software development expertise. These resources can be transferred to a number of projects in the biotech information industry.

Market Share: Incyte currently services a significant share of the potential market for sequence and expression database products among large pharmaceuticals. This, along with the brand-name recognition that it brings about, comprises a significant source of competitive advantage for Incyte.

1.2 Organization of This Report

Our report is organized into two main sections:

First, the *Evaluation of Strategic Context* section characterizes the important market and competitive forces that will come into play over the next 3-5 years. This section explains these trends and their impact on demand for EST[2]-based limited genomics data products, along with considerations related to how Incyte's current marketing initiatives, especially in the area of genomics software, may also affect the subset product.

Second, the *Development of Product Strategy* section analyzes a set of product alternatives against several criteria related to their viability in the marketplace, and lays out recommendations for how to time the product introduction.

The foundation of our analysis is based on three key components, as shown in figure 1.

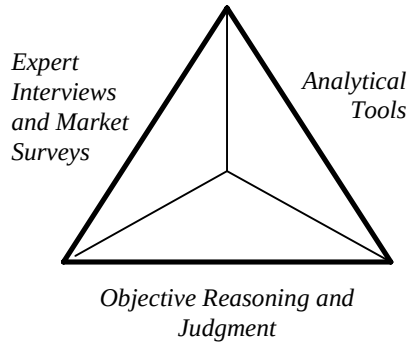

Figure 1: Foundations for Team RHOF Analysis

In the *Evaluation of Strategic Context* section, we use Porter analysis, scenario analysis and an analysis of market trends based on expert interviews to motivate the development of the subset product. Additionally, we analyze the software market potential using an options approach to further support this decision.

In the *Development of Product Strategy* section, we develop several product alternatives, based on an assessment of product design ideas from interviews performed at Incyte, and make recommendations on which product alternative will be most valuable to Incyte, and when Incyte should introduce that product. We incorporate customer survey information along with feedback from key Incyte staff to develop a quantitative "rating" of each alternative against several criteria. We use a decision analysis approach to develop a financial evaluation of the product design decision under key uncertainties. We then use a deterministic multiattribute decision framework to develop a composite evaluation that incorporates non-

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2 EST: Expressed Sequence Tag. The product under consideration is a subset of the LifeSeq™ database, which is a collection of EST sequence and expression data. As the technologies change and public information grows, demand for EST-based data will fall off in favor of sequence and expression data from other technologies.

financial as well as financial factors. We consider the real option value of a delayed product introduction.

In both sections, our use of objective reasoning and judgment played a key role in making sense of our results. Only by carefully analyzing the problems at hand were we able to see which models were appropriate. Due to the unique nature of Incyte's business, our analysis relied heavily on information from within Incyte rather than drawing erroneous parallels to related markets.

2. Evaluation of Strategic Context

Incyte's decision to offer limited data products to the marketplace must be made in the context of relevant market factors, competitor positions, and Incyte's overall strategic plan. This section explores the "strategic context" related to the introduction of limited data products, and its impact on the decision-making process.

2.1 Market Trends

Incyte's decision to offer limited data products to the marketplace must be made in light of expected future trends in the marketplace. Through our interviews, we have developed projections of future demand in several key markets (see figure 2).

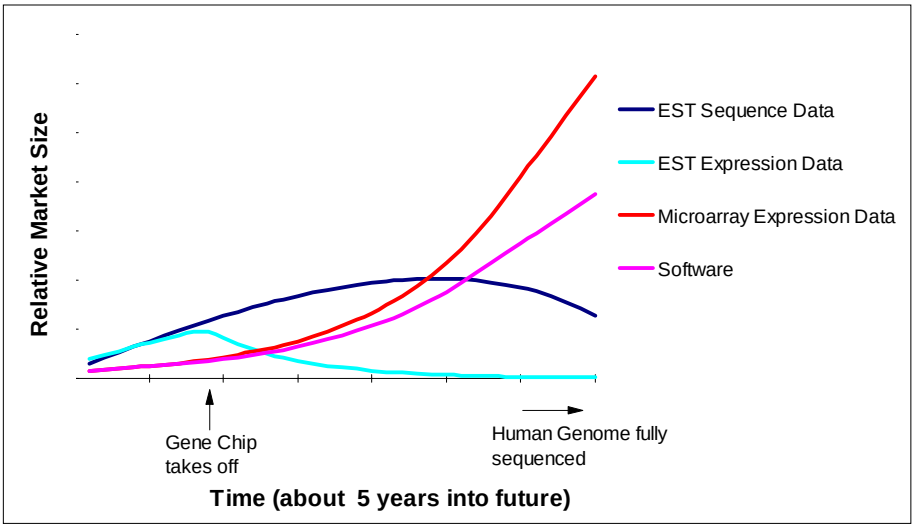

Figure 2: Projected Demand in Genomics Markets, 1997-2002

LifeSeq® is an EST sequence and expression along with the software to organize and analyze these data. Clearly the demand for LifeSeq® (and therefore for any subset or limited access version of LifeSeq®) is limited to a time window of approximately a 3 years as new technological advances will devalue EST-based sequence and expression data. This indicates that Incyte will need to consider the decision to develop a LifeSeq® based limited genomic database product in light of this decreasing demand and also in light of the fact that they will need to be moving into the software and microarray data markets over the next few years[3].

Given the two factors discussed above, Incyte will wish to develop a product which becomes profitable in a short time period and also which complements a software or microarray product offering well. Figure 3 depicts three time snapshots of the pharma and biotech markets for genomics products. At any point in time, different segments of the market have different needs, and the general trend is that the earliest adopters of a given product or technology tend to be larger (higher ranking) firms than future adopters. This pattern indicates that there is a great potential for customer "buy-up" from one product to a newer product as a firm's needs mature. For a customer who can currently afford a "software only"

product for analyzing public genomic data, a logical next step may not be to purchase the full LifeSeq® database, but rather to buy-up to an intermediate product that costs less yet still adds value. The limited genomic data product provides this intermediate product solution.

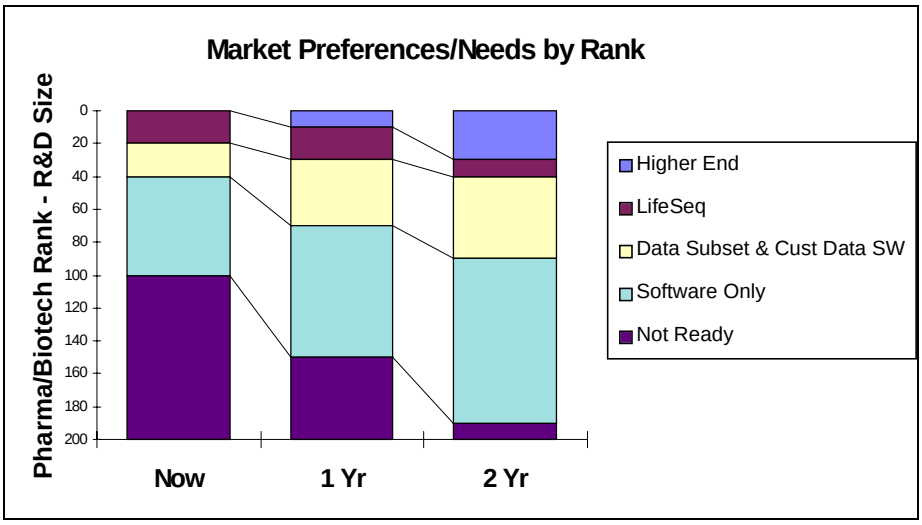

Figure 3: Pharma/Biotech Projected Market Profiles, 1997-1999

More importantly, by reaching the second tier of pharma and biotech customers with these data products, Incyte improves its name recognition and establishes customer relations in lower market segments which will allow for greater penetration in future software and microarray data markets.

Together, these trends help to motivate the introduction of a limited data product, and also set the stage for further assessment of what type of product to offer.

2.2 Internal Strategic Planning: Current Initiatives

Incyte, of course, is fully aware of the market trends and uncertainties discussed above. There are two major initiatives underway to strategically position Incyte for the changing genomics industry. These current initiatives must be considered when evaluating the potential of a limited data product.

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[3] The software and microarray data markets are discussed further in the following section.

2.2.1 The “Software Only” Market

One of Incyte’s advantages has always been its unique resource of combined expertise in both software and bioinformatics. However, they have traditionally been focused on products that combine software tools with access to proprietary data. Realizing the high growth trends in the “software only” market and the next tier of customers ready for such a product, Incyte has begun to offer software products without proprietary data. The “software only” offering thus far (currently under development) consists of “low-end” and “high-end” products, spanning the range of new customer needs and willingness to pay. The “low-end” product consists of the same basic core analysis tools that LifeSeq® customers get, without any Incyte proprietary data. This product offering would include an integrated, updated database subscription containing only public domain data; this would sell for less than $100,000. The “high-end” product would sell for $500,000 to $1M, including more advanced analysis and database tools, as well as an extensive suite of software tools designed to allow customers to install their own genomic data into the database. Limited data products could compliment these software products and strengthen this push into future markets with smaller pharmas and biotechs.

Since a recent decision by Incyte to pursue the “high-end” software market is so essential to our strategic context, we decided to confirm the value of the decision to enter this market now. Using a financial options framework considering the price volatility of the software over the next five years, we found that, indeed, Incyte should exercise this option now. See Appendix B for details regarding the options analysis.

2.2.2 DNA Microarray Technology

The other major new initiative at Incyte concerns another high growth market, microarray expression data. This is the same expression data that is currently included in LifeSeq®, but a new technology known as the DNA microarray technology (“Gene Chips”) will radically alter the way the data is

generated.[4] The dramatic acceleration in production of expression data will make obsolete the value of the expression data in the LifeSeq® product. Though the LifeSeq® product will be of diminished value, Incyte hopes to create a new core of business by providing new data generation and analysis services based on using the gene chip. Though it is unclear who among the half-dozen gene chip start-ups will become the next Intel (if there will be one at all), Incyte has recently teamed up with Affymetrix, Inc., the leader thus far in developing gene chips. Incyte could profit greatly from these changes, but we treat this initiative as beyond the scope of our project. It is relevant, though, because the value of expression data in the limited data products is rapidly diminishing. Furthermore, as with software, limited data products could help pave the way for opening up new pharma markets that may be extremely lucrative in the future.

2.3 Competitive Dynamics

Incyte's source of competitive advantage was outlined in the "Background" section, and included primarily their superior information and their unique combination of resources. Incyte's competitive position can be summarized by two key threats: the threat of substitution in their current data market, and the threat of competition (new entrants) in their two major emerging markets (software and microarray expression data). The situation is depicted graphically in Figure 4.

[4] Gene chips, fabricated with the same technology as microcomputer chips, are crammed with grids of "molecular tweezers" built to grip DNA. Though still in the testing stages, they can analyze thousands of genes at once, telling researchers which genes are expressed in the tissue they are studying. The rate of growth of the gene chip is projected to parallel the rate of growth of the computer chip. For more information, see "Gene Chip Breakthrough" by David Stipp, in the March 31, 1997 issue of *Fortune* (Appendix C of this report).

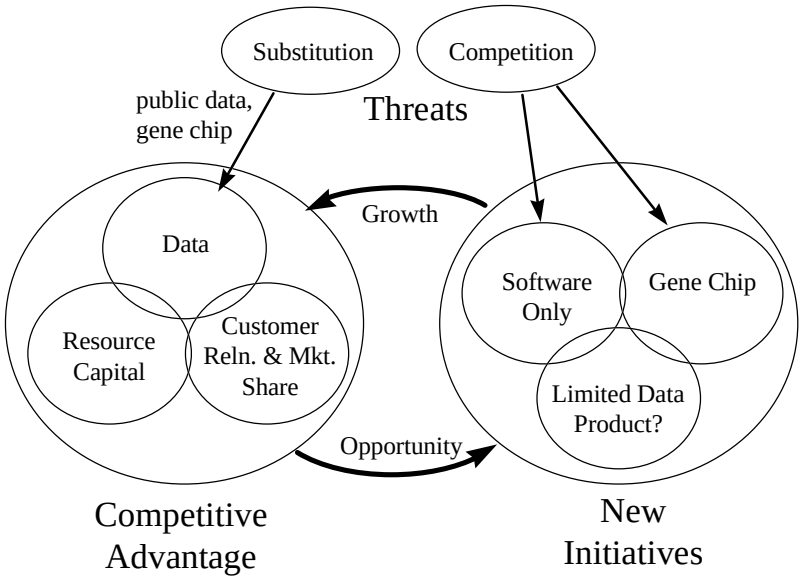


Figure 4: Incyte competitive dynamics

2.3.1 Current Market

Incyte has recently enjoyed a tremendous competitive advantage: its huge lead in valuable genomic data, in which no one could reasonably be expected to catch them. However, as previously mentioned, the value of the expression portion of the data will rapidly diminish as gene chip technologies proliferate within the next two years. Also, the Human Genome Project (HGP), providing human DNA sequence data to the public, will near completion in the next five years. As it does so, researchers will be increasingly satisfied and occupied with publicly available data, and less motivated to pay for Incyte proprietary data. Incyte's DNA sequence data will still be of some value, though, as it offers non-human sequence data and comparative genomics data that is not part of the HGP.

2.3.2 Future Market

The microarray (gene chip) industry is just emerging, and there are a number of players already. The potential competition in the software industry is even greater, as there would be low barriers to entry into the genomics market for software companies. Incyte will no longer be able to rely on its lead in data to attract customers. Rather, Incyte will need to differentiate its products based on superior quality and

special features. They have the perfect background and resource base to enter both markets, but they must do so soon. Limited data products can help establish relations with the new generation of customers early on, boosting their chances of getting these customers for the high growth markets. Furthermore, the limited data is a natural compliment to the software. The limited data product could be viewed as a "plug-in" to the software. The additional plug-in feature would be another aspect differentiating Incyte's software product from others, and the base of software users could help stimulate demand for the limited data product.

It is worth emphasizing the importance of entering these new markets early to stake out loyal customers before competitors do. This is especially true for software, where switching costs may be high once a company has started using someone else's software. *A vital role of the limited data product, then, is to provide as much support for these major new market initiatives as possible. The limited data product may be a low cost introduction to Incyte for future customers. But whatever limited data product Incyte decides to offer, it is crucial that it be aimed at filling the needs of new customers, forming trusting, long-lasting relationships with them in the process.* To offer a limited data product that earned short-term profits but estranged the next tier of customers would be very undesirable, given the huge growth projections in the new markets of which this next tier is a part..

2.4 Scenario Analysis

To identify consistent patterns and the range of possible futures, we constructed a few scenarios for how the future market could turn out. These scenarios are each described in Appendix D. Considering possible developments in new technology and possible competitive structures for the software industry, we noticed some trends. First, it is unclear how much advantage Incyte will have based on the data side of its business, including the new gene chip initiatives. The prospects are good, but nonetheless they are uncertain. Second, regardless of which scenario develops, software will be a large market in which

Incyte can be a key player. This emphasizes the importance of getting into the software market early, for which purpose the limited data product may help.

3. Development of Product Strategy

Team RHOF has attempted to address the questions of how Incyte should design a limited genomic data product and if and when they should introduce the product. Using internal interviews and market surveys, we assessed the value of several product alternatives against numerous attributes. Using a multiattribute decision framework to tie together both quantitative and qualitative measures, and an options analysis, we developed recommendations regarding which product to introduce, and when to introduce it.

3.1 Product Alternatives

The product alternatives which we considered in our analysis are described below. This list of alternatives was developed entirely from suggestions made from Incyte staff.

3.1.1 Subset Product Alternatives

Disease (Research)/Tissue Subset Product: This product offering would include approximately 5-10 predefined subsets of LifeSeq®, with each subset containing libraries related to a specific tissue or disease. Each subset would be priced according to its size, with an average subset size of approximately 1/20 that of LifeSeq® being sold on a subscription basis at approximately 1/10 the price. The subsets would be updated monthly with relevant libraries. Examples of subsets under this product paradigm include a cancer subset, a cardiovascular subset, or a diabetes subset.

Functional Area (Class) Subset Product*:* This product offering would include approximately 10-20 predefined subsets of LifeSeq®, with each subset containing sequence homologs to genes in a specific functional area. Each subset would be priced according to its size, with an expected average subset size of 1/40 that of LifeSeq®, at 1/20 the price. The subsets would be updated monthly with relevant sequences. Examples of subsets under

this product paradigm include a cytokine subset, a growth factor subset, or a signal peptide subset.

Custom Subset Product*:* The custom product offering would not be based on predefined subsets of LifeSeq®; rather, under this paradigm, customers would specify the collection of sequences or "libraries" that would best suit their research needs. Pricing would be based on a per sequence or per library basis. Updating would be available, priced either on a per sequence / per library basis or by an up front fee.

3.1.2 Restricted Access Product Alternatives

Frozen Version of LifeSeq®: This product offering would be a one-time purchase of a snapshot of the full LifeSeq® database, without updates. This would give the customer the benefit of access to the entire database (for extensive search results); however, the customer would not have the advantage of using the latest data. The frozen version would either be based on the latest version of LifeSeq® or could alternatively be based on the LifeSeq® release from six months prior to the purchase date. Either version would be priced high enough to make the regular LifeSeq® contract seem attractive.

Service Based Billing: Under this paradigm, customers would not obtain an installed database or direct access to LifeSeq®. Rather, a customer would pay on a per query and/or per hit basis. Under this product offering, the customer pays for the identified targets before he sees them.

3.2 Product Attributes

The product attributes against which each of the alternatives was judged are detailed below. These attributes represent important quantitative and qualitative factors used to assess the viability of the product alternatives.

Target Market: The collection of pharmaceutical and biotech firms whose needs are best met by this product offering.

Estimated Buyers: The expected number of potential customers who would purchase this product.

Development Costs: The estimated cost to develop this product offering.

Product Life: The expected time period during which reasonable sales of the product occur.

Cannibalization: The extent to which demand for Incyte's other products is reduced by the new product offering (that is, rather than buying LifeSeq®, a customer would buy a subset product instead). We considered cannibalization in terms of loss of renewals of current customers, loss of potential new customers, and damage to current customer relations.

Buy-up to LifeSeq®: The degree to which this product complements and encourages buy-up into the LifeSeq® product.

Market Synergy with High and Low End Software: The degree to which this product complements and supports new software product lines ("LifeLess" and "Novartis-type software"). Does the product encourage buy-up from or cross-purchasing to the software products?

Expansiveness (Opening New Markets): The extent to which the product's target market segment positions Incyte in a new market that can provide for long-term growth.

Encourages Industry Pressure: The extent to which one customer's purchase of this product will encourage other customers in the same segment to purchase the product as a defensive maneuver. An example of this effect at work in the genomics market is included in Appendix J.

Responsiveness to Demand: The extent to which the product meets the needs of the potential customer base.

Effect on Current Partner Relations: The extent to which Incyte's relations with current customers are damaged or sensitized through the introduction of the limited data product.

3.3 Product Evaluation

To compare the desirability of each of the product alternatives, we scored each of them against the product attributes. The scores were based on interviews with Incyte staff and results from the market survey. A summary of these input data can be found in the table in Appendix F, and details of the market survey can be found in Appendix E. Using the attributes that contribute directly to short-term profit, we applied decision analysis to come up with an assessment of expected short-term profit. To incorporate the remaining attributes, which were more qualitative measures, we used a multiattribute approach to

develop a composite "score" for each alternative. The scores were based on the expected short-term profit values from the decision analysis combined with the qualitative evaluations.

3.3.1 Decision Analysis

We used a decision analysis approach to evaluate the financial aspects of these limited data products, and fed these results into the multiattribute assessment as a single "Short-term Profitability" attribute. The scores for this attribute were assessed strictly according to the numerical results of the decision analysis. The decision analysis model, illustrated in figure 5, was structured as follows:

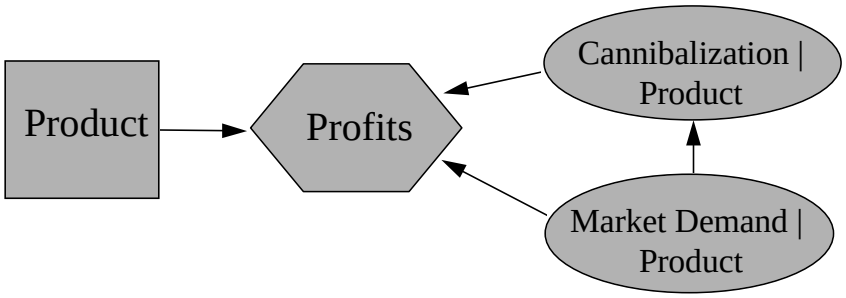


Figure 5: Decision Diagram

Decision: *Product Alternative* - The product alternative to be launched by Incyte.

Value Measure: *Profits* - Short-term (3 year) profits.

Uncertainties: *Market Demand* - The quantities demanded over the next three years given each product alternative. Probabilities were assessed for high, medium, and low demand markets by key marketing figures at Incyte.

Cannibalization - The degree to which introduction of a given product alternative will eat away at demand for other Incyte products, specifically LifeSeq®. Probabilities were assessed for cannibalization in all markets.

Uncertainty ranges for other inputs, such as prices, costs and proportion of new customers that "buy-up", are considered to have less impact on the value and were therefore held as fixed. The average price of LifeSeq® was estimated to be $4M per year. Summaries of all the input data used and details of the analysis can be found in Appendix G.

Figure 6a reveals that the highest NPV expected profits were for the disease/tissue based product, $18M, and the custom product, $17.7M over the next three years. The other products were not too much lower. The frozen product yielded the lowest expected profit. Figure 6b shows a breakdown of the short-term profit factors into the major components of direct profits, cannibalization effects, and buy-up effects. It is interesting to note that the DA results are quite different when cannibalization and "buy-up" are not included.

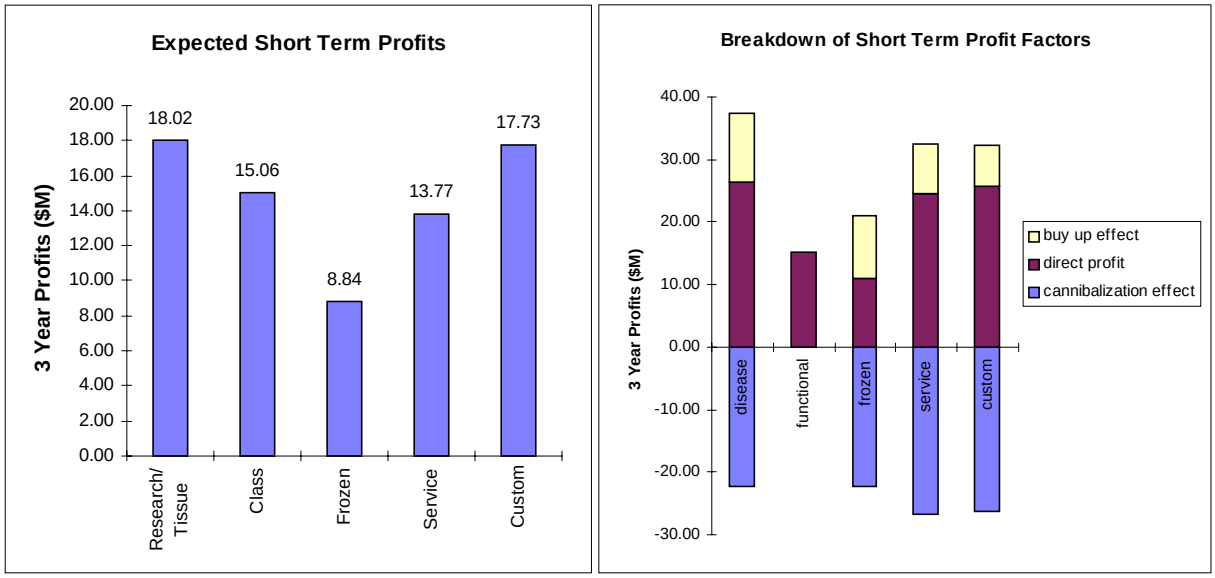


Figure 6a&b: Expected short-term profit valuations from decision analysis

3.3.2 Multiattribute Approach

The results from the DA are instructive but are only a *part* of the big picture. The other factors were qualitative attributes which we add into the analysis in this section.

We scored each of the remaining qualitative attributes based on the interview results. These attributes were defined by concerns of the Incyte experts. Since each of the attributes is important to Incyte, a product that scores well on many of the attributes would be very desirable. Scores were between 1 and

10, 10 being the best. We combined the qualitative scores with a normalized "short-term profit" score, also scaled from 1 to 10[5]. The plot of the scores in figure 7 shows that the custom and the disease/tissue based products generally scored better than the other products on most of the attributes.

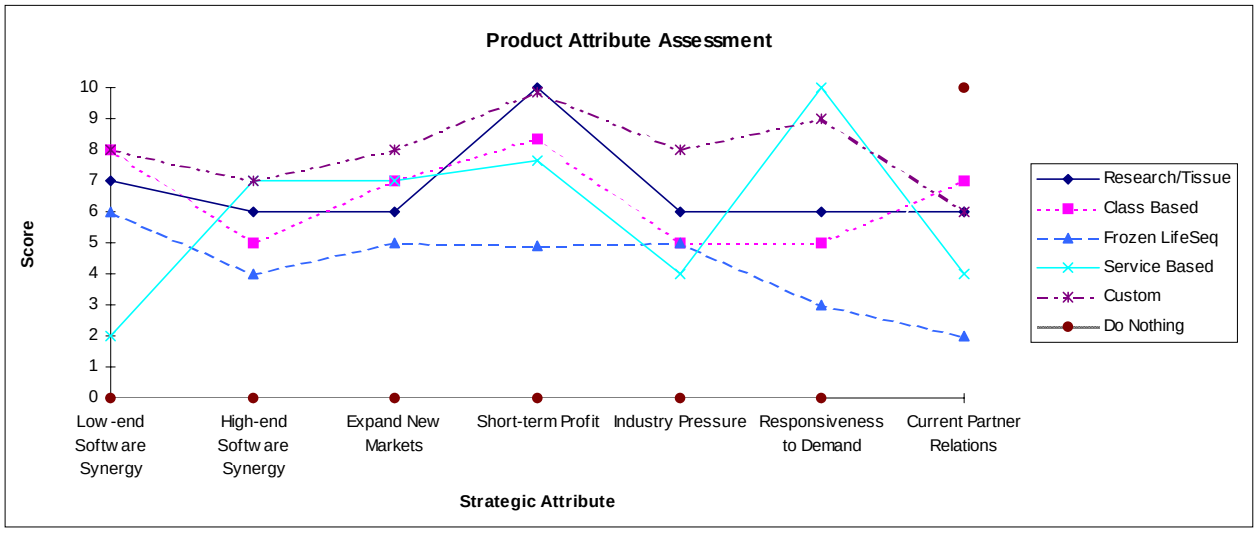


Figure 7: Product Attribute Assessment

While all of the product attributes are important, individual decision makers are likely to value them differently. We facilitate these individual preferences with a flexible, multiattribute decision making spreadsheet tool in which the user weights each product attribute according to how much he values them. A composite score is evaluated for each product by taking the weighted average of the scores for each attribute. Composite scores of the products can then be compared across different sets of weights. These comparisons will prove instructive in looking at sensitivities of the recommended decision to different sets of concerns. The results from two sample sets of weights are illustrated in Appendix H.

[5] The scores for each attribute could have been translated into dollars instead of a 1-10 scale. However, for the same reasons that we did not quantify them in the DA (namely that a quantitative dollar value that attempts to incorporate all the attributes would may be misleading), we did not translate the scores into dollars.

3.4 Analysis of Option to Wait

We analyzed their decision from both a real decision options and a financial options point of view. Both analyses showed that Incyte should introduce the product now while re-evaluating its position every six months. Please refer to Appendix I for details.

4. Conclusions

4.1 Current Recommendations

Our analysis recommends the development of custom database product arrangements to meet the needs of smaller pharmaceutical and biotech firms implemented as soon as possible. We believe the custom product and resulting new customers would strengthen Incyte's strategic position as it pursues the growing software and data markets. Consistent with this approach are the following conclusions/observations.

- This decision is NOT based only on short-term profit considerations. We value the product alternatives along several attributes.
- The custom product offers excellent synergies with other Incyte products. Its addition to the product line allows Incyte to offer a more flexible solution to the customers' needs.
- By developing custom subsets, Incyte minimizes the risk to its reputation associated with a failed "standard" product offering.
- The market segment most interested in limited data content is new to Incyte—primarily, the second tier pharmas and biotechs—are an important future growth market for Incyte. Incyte will learn a lot a from this product offering about these customers and their needs.
- The custom product allows more flexibility for future product options. The custom product can easily be extended into a more standard product, based on customer feedback and demand.

4.2 Plans and Recommendations for Future Work

Chris Fry and Thomas Olavson will continue to work with Incyte's marketing department during the summer of 1997 to assist in further exploring these and other strategic issues. There are several potential projects which may be pursued.

Refinements to current analysis: Our analysis is preliminary at best in that it was necessary for us to quantify many intangible factors. Clearly, these factors are uncertain as are their interrelationships. Our multiattribute decision-making framework addressed the interrelationships among these factors in a simplified manner. If it is deemed valuable, we could refine some of the key uncertainties and inputs to the decision through further interviews and customer surveys. Additionally, we could refine the decision analysis to incorporate all of the intangible factors.

Analysis of limited genomic data products for PathoSeq®: The analysis we have performed for the LifeSeq® database could be repeated for Incyte's PathoSeq® product. This product contains sequence and expression data for pathogenic bacterial organisms, the research of which is very valuable in pharmaceutical research. Possible subsets of this product's data content include selling the genomes of individual organisms on a price per organism basis.

Detailed market assessment of second tier pharmas and biotechs: Incyte offers a wide product line which continues to grow as new technologies are introduced and consumer demands change. As was demonstrated in the *Strategic Context* section, it is important for Incyte to move into the second tier pharma and biotech markets, beyond the largest pharmaceutical research houses. One important area of future work which we may pursue is to develop a detailed characterization of these second tier markets, through combining customer surveys and interviews with data analysis methods.

4.3 Lessons Learned

Our participation in this project taught us (or reiterated to us) several valuable lessons that we will carry away as we move into future research and professional careers. We found this experience to be very valuable in that it put the tools that we learned in the classroom into context through real application. We took away 4 main lessons from the experience:

1. **Strong feedback loop with client is vital:** One of the most important lessons we learned was the value of client communication on a project such as this. It is very easy for a group of students working on a company project to limit their exposure to key client staff in the interest of time. Unfortunately, real world problems are generally not well-defined, and a major portion of the effort is involved in seeking out and speaking to the

correct people to truly understand the problem at hand. Our team went down several "wrong paths", where we drew conclusions based on a limited picture of the client's true issues. Since we had the active participation of several client staff in this project, we were able to identify incorrect assumptions and (drastically) restructured our approach on several occasions. Although this was a frustrating experience, we recognize now that the true value of our report and recommendations came from the close communication loop which we maintained.

2. **Quantitative tools are not the most important:** We used several quantitative models to support our analysis. However, a big lesson to us was that these models do indeed play only a supporting role in our analysis. Incyte is a unique company in a unique competitive position which does not follow a "typical textbook example". We saw the greatest value coming from our strategic context analysis and our multiattribute assessment of Incyte's product alternatives, both of which were fairly non-quantitative approaches.

3. **Framing is key:** We spent a considerable amount of time early on in our project assessing what issue or issues to research for Incyte. We are grateful for having carefully analyzed the problem situation early in our project, so that we were able to end up with a problem that was both interesting and important to Incyte.

4. **Maintain objectivity and flexibility:** Our experience with Incyte was that each person we interviewed possessed a different viewpoint or opinion on which product would work or which markets are in Incyte's future. We realized how important it was to keep an open mind and separate opinion from fact in this process. One great benefit to Incyte will simply be to see all of their opinions laid down in one place.

Appendices

Appendix A: Selections from Incyte Pharmaceuticals Product Brochure

Not included in Incyte release.

Appendix B: Software Financial Strategy

The options framework is a good tool to assess whether Incyte should enter the software industry now. This financial analysis rests on several assumptions. First, the decision to enter or exit the software industry can be made at any period in the lattice. Thus, if the profit from software falls below the costs of maintaining the product, Incyte will opt not to produce software that period. The second assumption is that we may use risk neutral valuation to evaluate the cash flow streams at time (t+1) when at time (t).

Variable List

S(0)	Initial Price of Software	$500,000
sigma	Volatility of software price	.48
T	Time in software cycle	5 years
Δt	Turnover period	.5 years
r	risk free rate specified by company	.12

Method

From these variables, we many deduce the parameters for the options lattice[1].

u	Upward price motion	=	e^(sigma*Δt^.5)	1.4
d	Downward price motion	=	e^(-sigma*Δt^.5)	.712
R	Risk free rate	=	1 + r	1.12
q	Risk neutral probability =		R - d/ u - d	.589

[1] We assume that the prices follow a lognormal distribution, allowing us to use geometric brownian motion in the lattice. This is based on a historical study of Incyte's stock which does show a lognormal distribution.

Next, we deduced several tables of information regarding the growth trend of the software market for Incyte. Over the 5 year software cycle, demand appears to be greatest at the beginning. As the technology saturates the market, there is decelerated growth. At period 0, we start with an initial demand for 4 software packages. In period .5, we multiply that constant by 3. We repeat this for each period. Below is the table describing market growth.

Period (t)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Market Growth	1	3	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.5

Figure 1: Product Demand Multiplier

We also saw that costs starting at period 0 are $325, 000. These costs will change as the demand for the product grows. Thus, we can construct a cost table per period using the above table of market growth. Costs are a direct reflection of the number of software units demanded. Below is the table describing costs.

Period (t)	0.00	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
Costs	325.00	1092.00	1223.04	1301.31	1311.73	1248.76	1118.89	939.87	736.86	536.43	300.40

Figure 2: Costs of Software (in $1000s)

Next, we construct the lattice of potential revenues for a software package. We do this by using the u and d. At each node, price can either move up by factor u or down by factor d.

In addition, the revenue is derived using the market growth factor specified in the table. We start at node 0 with the fact that software costs $500 K and there are 4 packages sold. Then, the successive nodes take price and the growth of the original demand into account.

	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
0	2000.00	8424.72	11829.33	15779.32	19940.46	23798.99	26733.32	28152.61	27670.76	25254.50	17730.19
0.5		4273.14	6000.00	8003.49	10114.08	12071.18	13559.51	14279.39	14034.99	12809.44	8993.00
1			3043.28	4059.48	5130.00	6122.67	6877.57	7242.71	7118.74	6497.12	4561.37
1.5				2059.02	2602.01	3105.50	3488.40	3673.60	3610.73	3295.43	2313.59
2					1319.77	1575.15	1769.36	1863.30	1831.41	1671.49	1173.49
2.5						798.94	897.45	945.09	928.92	847.80	595.21
3							455.20	479.36	471.16	430.02	301.90
3.5								243.14	238.98	218.11	153.13
4									121.21	110.63	77.67
4.5										56.11	39.39
5											19.98

Figure 3: Lattice of Revenues (in $1000s)

Next we construct the net profit lattice. This is done by subtracting the appropriate cost at each year. It is important to note that cost is independent of price and dependent only on demand.

	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
0	1675.00	7332.72	10606.29	14478.00	18628.73	22550.22	25614.43	27212.74	26933.90	24718.07	17429.78
0.5		3181.14	4776.96	6702.17	8802.35	10822.41	12440.62	13339.52	13298.14	12273.00	8692.59
1			1820.24	2758.17	3818.27	4873.91	5758.68	6302.84	6381.89	5960.69	4260.97
1.5				757.71	1290.28	1856.74	2369.51	2733.73	2873.87	2759.00	2013.19
2					8.05	326.39	650.47	923.43	1094.55	1135.06	873.08
2.5						-449.82	-221.44	5.22	192.06	311.37	294.81
3							-663.69	-460.50	-265.70	-106.41	1.50
3.5								-696.73	-497.88	-318.32	-147.28
4									-615.64	-425.80	-222.73
4.5										-480.32	-261.01
5											-280.42

Figure 4: Latice of Profit (in $1000s)

The goal of this exercise is to show Incyte that entering the software industry now, opposed to later is optimal. Thus, we roll back the lattice performing the following operation to place a value in the node.

Value (t) = MAX [Profit (t),

(1/R)*(Profit up (t+1)*q + Profit down (t+1)*(1-q))]

This evaluates whether the value of entering the software industry at time t is more profitable at time t+1. The lattice of these results is below.

	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
0	5025.00	7332.72	10606.29	14478.00	18628.73	22550.22	25614.43	27212.74	26933.90	24718.07	0.00
0.5		3181.14	4776.96	6702.17	8802.35	10822.41	12440.62	13339.52	13298.14	12273.00	0.00
1			1820.24	2758.17	3818.27	4873.91	5758.68	6302.84	6381.89	5960.69	0.00
1.5				757.71	1290.28	1856.74	2369.51	2733.73	2873.87	2759.00	0.00
2					164.18	341.61	650.47	923.43	1094.55	1135.06	0.00
2.5						-42.51	-1.88	69.41	192.06	311.37	0.00
3							-113.24	-104.76	-86.35	-53.21	0.00
3.5								-158.51	-161.81	-159.16	0.00
4									-200.08	-212.90	0.00
4.5										-240.16	0.00
5											0.00

Figure 5: Option Lattice (in $1000s)

Results

From the above lattice, we want to show that entering the software industry now as opposed to later is optimal. Thus, we have a summary lattice that displays

1 if Incyte should exercise the option to enter the industry

0 if Incyte should not exercise the option to enter the industry

The summary lattice shows that Incyte should perhaps not have entered the industry at period 0 which is now. But, it shows that Incyte should act within the next 6 months to enter the industry. In addition, unless profit becomes negative, Incyte should remain in the software industry until the end of the software cycle. Please note that the “0” at the end of the software cycle at period 5 is automatic as the option to enter or exit has expired.

	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
0	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
0.5		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
1			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
1.5				1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
2					0.00	0.00	1.00	1.00	1.00	1.00	0.00
2.5						0.00	0.00	0.00	1.00	1.00	0.00
3							0.00	0.00	0.00	0.00	0.00
3.5								0.00	0.00	0.00	0.00
4									0.00	0.00	0.00
4.5										0.00	0.00
5											0.00

Figure 6: Result Lattice

Appendix C: "Gene Chip Breakthrough" Article

Stipp, David, "Gene Chip Breakthrough", *Fortune*, March 31, 1997.

Appendix D: Market Scenarios

We considered three key areas of uncertainty in constructing scenarios:

- *Gene Chip.* Who will have strategic control over it, if anyone? Will the gene chip manufacturers have dominant control, much like Intel has control over the microchip? In that case data service providers like Incyte would be at the mercy of manufacturers and have less advantage, just as PC manufacturers are at the mercy of Intel. Alternatively, if the gene chip is relatively easy to manufacture, and the types of data to look for and how to analyze the data are the key value-added areas, Incyte's services could be quite valuable. Also uncertain is the amount of advantage that comes to Incyte from its partnership with Affymetrix, a gene chip manufacturer.
- *Other Data Threats*. Besides the gene chip, there are other uncertain threats to Incyte's data advantage. First, unexpected new DNA sequencing technologies could lower barriers to entry for competition, reducing Incyte's data lead and speeding up the substitutability threat of public data for Incyte data. Second, as more data is available both publicly and privately, companies may be more tempted to do their own sequencing, or form partnerships to do so.
- *Software Industry Structure*: How much product differentiation will there be in the software industry? How much room will there be for competitors? Will software become a low profit commodity, as many players are forced to compete on low cost?

<u>Scenario 1: High Growth</u>

In the high growth scenario, there is high demand for both Incyte's software and data products. Incyte capitalizes on the gene chip technology, and its DNA sequencing business still prospers from demand for non-human and comparative sequencing. Its strength in data services feeds into its software products, which are highly differentiated and of superior quality compared to others. With the combination of software and data services, Incyte is a high growth company, providing "complete product solutions" to a wide range of pharmas and biotechs.

Scenario 2: Software is King

In this scenario, the data component of Incyte's business is of marginal value, as they are hit hard by substitution threats. There is so much data available in the public and through the gene chip, that few companies are willing to pay Incyte for more data. Competitors are able to capitalize on the gene chip equally well, and it does not provide a competitive advantage to anyone in particular. However, the genomics research community as a whole grows incredibly fast, inspired in large part by the gene chip revolution. Companies are in high demand for complex, sophisticated software to make sense of the sea of new data. Not just any software company can meet this demand. Incyte is well equipped to meet this demand, and by pursuing opportunities early, they can be a key player in the high profit-margin software market.

Scenario 3: Low Growth

Similar to scenario 2, developments in technology and the gene chip make Incyte's data of far less relative value to customers. Again as in scenario 2, the use of software and data-mining tools grows rapidly. However, the software industry is driven by a large number of low cost producers. Incyte initially prospers in selling software, but competitors easily copy their software and tools and subsequently cut into their advantage. The end result is a large genomics software industry, but with many players viciously competing for a small profit. Incyte has trouble being a growth company in this environment, and it is tempted to alter its course.

Appendix E: Market Survey Results

This appendix has a compiled list of the survey results assessing demand for limited genomic database products. The information is organized in the following manner:

1. Company Name
2. Company Research and Development Budget
3. Price Willing to Pay for Limited LifeSeq Product
4. Company Interests

In the survey, we asked questions about the company's research interests. We found a fairly consistent trend in the 18 companies surveyed that they were willing to pay about 2% of their R&D budget. In this section, we list the major research areas to show whether the company showed an interest in the area.

1 = Company Interest

0 = No Interest

The identified research areas of interest were:

(1) Tissue (product organized around a particular tissue type)

(2) Research (product organized around a particular disease)

(3) AIDS

(4) Cancer

(5) Cardiovascular

(6) Respiratory

(7) Immune

Market Survey Results (cont'd)

	1	2	3	4	5	6
Company Name	BTG	Nippon	Biochem	Celltech	Bio-Gen corp	MedImmune
R&D ($M)	20	50	5	26	10.9	27
Price willing ($M)	0.4	1	0.1	0.51	0.22	0.55
Interests						
Tissue	1	1	1	0	1	1
Research	1	1	0	0	0	0
AIDS	0	0	0	0	0	0
Cancer	1	0	1	1	1	1
Cardiovascular	1	1	1	0	1	1
Respiratory	1	1	0	0	1	1
Immune Interest	0	1	1	1	0	0

	7	8	9	10	11	12
Company Name	Douglas	BIOGEN	Prodesfarma	Warner Lamb	Recherche	ASTA
R&D ($M)	10	90	10	501	295	73.6
Price willing ($M)	0.185	1.8	0.2	10	5.8	1.3
Interests						
Tissue	0	1	1	1	1	1
Research	1	1	1	1	1	1
AIDS	1	0	1	1	1	0
Cancer	1	1	1	1	1	1
Cardiovascular	0	1	1	1	1	1
Respiratory	0	1	1	1	1	1
Immune Interest	1	1	1	1	1	1

	13	14	15	16	17	18
Company Name	IVAX	Medeva	Genzyme	Scotia	Hybridon	Baxter
R&D ($M)	60	14.85	68.8	24	39	345
Price willing ($M)	1.7	0.29	1.38	0.25	1	0.5
Interests						
Tissue	1	0	1	1	1	0
Research	1	1	1	1	0	1
AIDS	0	0	0	0	0	1
Cancer	1	1	1	1	1	1
Cardiovascular	1	0	0	1	1	0
Respiratory	0	0	0	0	1	0
Immune Interest	1	1	0	0	0	0

Appendix F: Product Attribute Assessment from Incyte Interviews

		Disease/Tissue-Based	Functional Area	Frozen	Service-Based	Custom ($x/library)
	Overall Benefits	Useful for pharmas focused on 1 disease or research area	Meets needs of research-focused biotechs	No cost way to get lower end market; Potential Buy Up	Small mkt can use w/ no investment; also entice large	Tailored to individual needs - serves all markets
	General Concerns	Genechips will provide better substitute in 2 years	HGP will kill market in 3-5 yrs	Needs to be high-priced to avoid cannibalization	How to price to avoid cannibalization	Service costs; complexity
Quantifiable Factors (Incorporated into short term profit evaluation...)	**Target Market (companies ranked by R&D spending)**	25 +	50 +	25 - 75	25 +	25 +
	Estimated Buyers - 3 Yr Planning Horizon	10 pharmas, 10-20 biotechs	50	10 - 20	30 - 50	40 - 60
	Development Costs	$4.65M	$4.2M	$0.9M	$6.54M	$1.65M
	Target Price	$1M @ 1/10 data content	$250K for 1/40 data content	$1 -3 M	$10 K per search + $100 K per hit	$30-35K per library; 15-20 libraries per customer
	Product Life	2 yrs	3+	3+	3+	3+
	Cannibalization: Loss of Current Customers	1 - 2 customers	No	No	1 - 2 customers	1 - 2 customers
	Cannibalization: Current Partner Relations	Not Much	Least: smaller class-based package is less of a threat to large pharma LifeSeq users	Likely: close substitute to LifeSeq product offered at lower cost	Some	Not Much
	Cannibalization: New Customers	2 - 9 (30% of LifeSeq market)	No	2 - 9	4-10	4-10
	Buy Up to LifeSeq	Very Good: As they realize the importance of full database.	Poor: The small biotech market can't afford to buy up.	Fair: this is a close substitute, so buy-up is not as tempting	Fair: If company uses dB a lot and realizes that economical to purchase whole thing.	Good: like research based, but they are a little happier with custom, so less likely to buy up
→	**Short-Term Profits (2-3 yr)**	Very Good: $18.0M	Very Good: $15.1M	Fair: $8.8M	Good: $13.8M	Very Good: $17.7M
Non-Quantifiable Factors (Used w/ short term profit in multiattribute product assessment...)	**Low End Software Synergy**	Good: nice plug in to low end software	Excellent: nice, inexpensive plug-in to low end software	Fair: more expensive plug-in to low end software	Poor: The service based dB is not a software product.	Good: nice plug in to low end software
	High End Software Synergy	Good: high end customers have needs to add to their own and public data, esp. as organized by research, as large pharmas are	Good: high end customers have needs to add to their own and public data	Fair: high end software customers have their own data; unlikely to buy whole data set	Very Good: high end customers have own data, likely to want to supplement with specific Incyte data	Very Good: high end customers have own data, likely to want to supplement with specific Incyte data
	Opening New Markets	Good: Smaller companies can afford portion of dB.	Very Good: Small biotechs (large market) can afford class based products.	Fair: Captures market "on the fence"; not really a new market, just apprehensive customers.	Very Good: Any size company can access the dB to try it out.	Very Good: Smaller companies can get what want for less.
	Industry Pressure (Keeping Up With the Joneses)	Good: Bigger companies see that smaller companies have info relevant to research; but know that incomplete dB is less valuable	Good: Bigger companies see that smaller companies have info relevant to research; but know that incomplete dB is less valuable	Fair: Frozen LifeSeq is geared toward medium sized companies, not small ones that might pose threat to them.	Poor: Big companies realize that service is expensive and incomplete.	Excellent: Bigger companies see that smaller, specialized companies have exactly what need.
	Responsiveness to Demand	Very Good: Pharmas that can't afford LifeSeq still want access to dB and this is a solution.	Very Good: Biotechs that can't afford LifeSeq still want access to dB and this is a solution.	Poor: Not a lot of demand for this. Trying to force demand since it's a cheaper product	Perfect: Customers want access to the entire dB without paying so much up front.	Excellent: Giving customers exactly what they want makes them happy.

Assumptions:

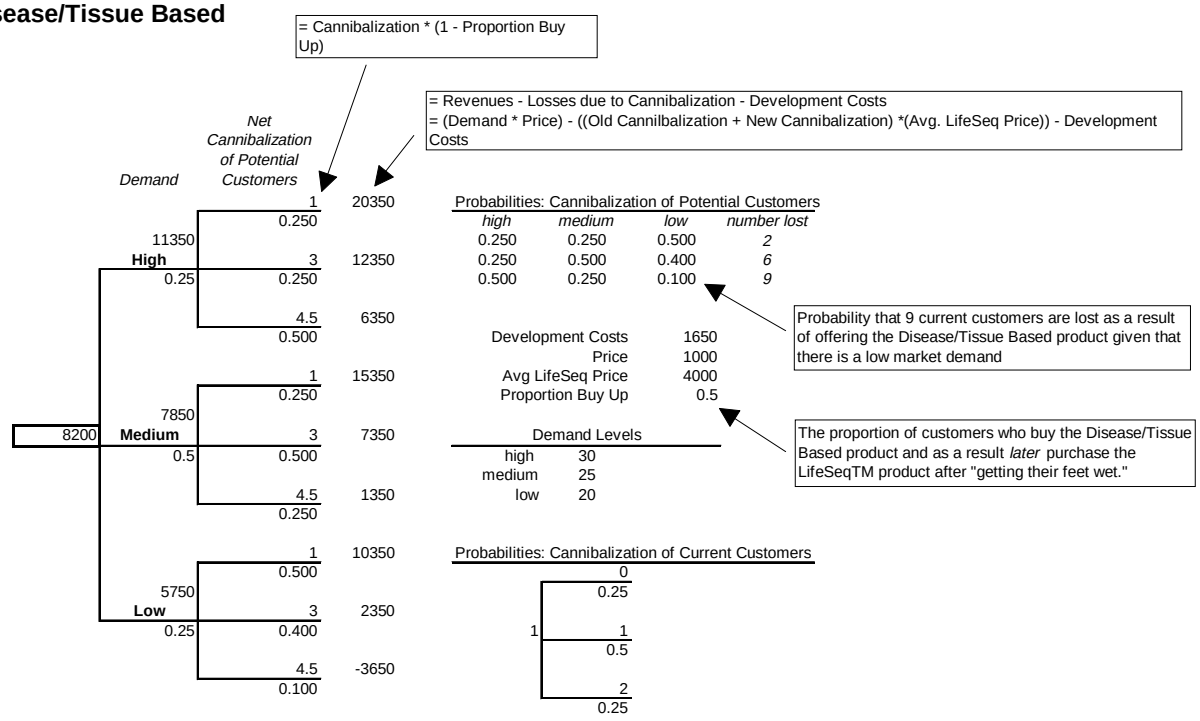
There is a maximum of 35 potential LifeSeq partners.
A 3 yr planning horizon on costs, demand and pricing.
Pharmas are #1-50; Biotechs are #50+
The average number of libraries that a partner would want in a custom dB is 15-20.
The service-based product is priced high enough to avoid cannibalization.
-We estimate this to be roughly _____ but there is a *high* level of uncertainty here.
The target prices are relatively certain; this is not a major uncertainty. Uncertainties are cannibalization and demand.
Product Life information from market trends extracted from Incyte experts.

Appendix G: Certain Equivalent Calculations Used In Decision Analysis

Model Details

Expected revenues were calculated by market demand times price for each branch of the decision tree. Prices were set as specified in the product alternative descriptions. The product alternatives that are offered as subscription services (Disease/Tissue[2], Functional, Custom) were assumed to be three year subscriptions and revenue streams were discounted by 12% per year. Growth in demand each year was assumed to be linear. Cannibalization effects, the number of customers lost times the average price of LifeSeq™, were all assumed to occur in the first year and were subtracted from the expected total revenues. Development costs were estimated as totals over the three year time horizon and were subtracted from total revenues over the three year period. A sample decision tree and example analysis is below.

Disease/Tissue Based



[2] The Disease/Tissue Based product has an estimated product life of two years, so the NPV of profit was calculated over this two year time frame rather than the three year horizon as the other subscription products were.

Data Summary

The following tables summarize the input data for the calculation of the certain equivalent of each of the product alternatives.

Disease/Tissue Based

Probabilities: Cannibalization of New Customers

high	medium	low	
0.250	0.250	0.500	2
0.250	0.500	0.400	6
0.500	0.250	0.100	9

Growth Rate	1.12
Development Costs	1650
Price	1000
Avg LifeSeq Price	4000
Proportion Buy Up	0.5

Demand Levels

high	10.00	20.00	30.00
medium	8.33	16.67	25.00
low	6.67	13.33	20.00

Probabilities: Cannibalization of Old Customers

	0	0.25
1	1	0.5
	2	0.25

Class Based

Probabilities: Cannibalization of New Customers

high	medium	low	
0.990	0.990	0.990	0
0.005	0.005	0.005	2
0.005	0.005	0.005	4

Growth Rate	1.12
Development Costs	4200
Price	250
Avg LifeSeq Cost	4000
Proportion Buy Up	0.1

Demand Levels

high	16.67	33.33	50
medium	15.00	30.00	45
low	13.33	26.67	40

Probabilities: Cannibalization of Old Customers

	0	0.99
0.015	1	0.005
	2	0.005

Custom

Probabilities: Cannibalization of New Customers

high	medium	low		
0.250	0.250	0.300	4	
0.250	0.500	0.600	6	
0.500	0.250	0.100	10	

Growth Rate	1.12
Development Costs	1650
Price	600
Avg LifeSeq Cost	4000
Proportion Buy Up	0.25

Demand Levels

				(base)
high	10.00	20.00	30.00	60
medium	8.33	16.67	25.00	50
low	6.67	13.33	20.00	40

Probabilities: Cannibalization of Old Customers

	0	0.25
1	1	0.5
	2	0.25

Service Based

Probabilities: Cannibalization of New Customers

high	medium	low	
0.250	0.250	0.300	4
0.250	0.500	0.500	6
0.500	0.250	0.200	10

Development Costs	3543
Price	1000
Avg LifeSeq Cost	4000
Proportion Buy Up	0.3

Demand Levels

high	50
medium	40
low	30

Probabilities: Cannibalization of Old Customers

	0	0.25
1	1	0.5
	2	0.25

Frozen

Probabilities: Cannibalization of New Customers

high	medium	low	
0.250	0.250	0.500	2
0.250	0.500	0.400	6
0.500	0.250	0.100	9

Development Costs	900
Price	1800
Avg LifeSeq Cost	4000
Proportion Buy Up	0.45

Demand Levels

high	20
medium	15
low	10

Probabilities: Cannibalization of Old Customers

	0	0.25
1.25	1	0.5
	3	0.25

Costs

The following cost data was used in the decision analysis.

Summary

Alternative	Cost
Software	$ 2,250,000.00
Research	$ 1,650,000.00
Class	$ 1,200,000.00
Frozen	$ 900,000.00
Service	$ 6,450,000.00
Custom	$ 1,650,000.00

These costs are the PV (carried through with the WACC for the increasing salaries and costs of capital) for 3 years. They are fairly certain and based on the statistics given by Scott Clarke and the annual report.

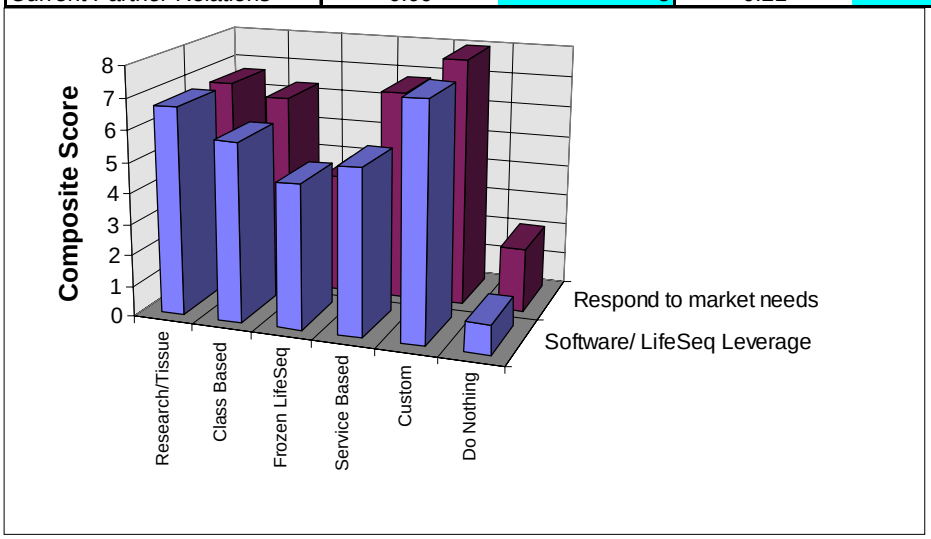
ALTERNATIVE	REQUIRED COSTS		NPV COSTS 3 YRS
Software	$ 325,000.00	6 months	**PV costs**
	$ 750,000.00	year	**$2,250,000.00**
Research based	Per year		Cost per year
	$ 200,000.00	computer equipement	$ 550,000.00
	$ 150,000.00	account mgr	
	$100,000	slack cash	**PV costs**
	$ 100,000.00	project mgr	**$ 1,650,000.00**
	$ 550,000.00	total costs	
Class Based	Per Year		Cost per year
	$ 200,000.00	computer equipment	$ 400,000.00
	$ 150,000.00	account mgr	
	$ 50,000.00	half time project mgr	**PV costs**
	$ 400,000.00	total costs	**$ 1,200,000.00**
Frozen	Per Year		Cost per year
	$ 200,000.00	computer equipement	$ 300,000.00
	$ 100,000.00	account mgr	
	$ 300,000.00	total costs	**PV costs**
			$ 900,000.00
Service based	Per Year		Cost per year
	$ 200,000.00	computer equipment	$ 2,150,000.00
	$ 200,000.00	2 account manager	
	$ 600,000.00	4 project managers	**PV costs**
	$ 250,000.00	customer service	**$ 6,450,000.00**
	$ 100,000.00	slack cash	
	$ 500,000.00	customer relations/mktg	
	$ 300,000.00	addt'l equip costs	
	$ 2,150,000.00	total costs	
Custom	Per Year		Cost per year
	$ 200,000.00	computer equipment	$ 550,000.00
	$ 100,000.00	project manager	
	$ 200,000.00	customer service	**PV costs**
	$ 50,000.00	slack cash	**$ 1,650,000.00**
	$ 550,000.00	total costs	

Service based incurrs highest cost due to high customer relations factor.

Appendix H: Sample Multiattribute Decision Evaluations and Sensitivity Analysis

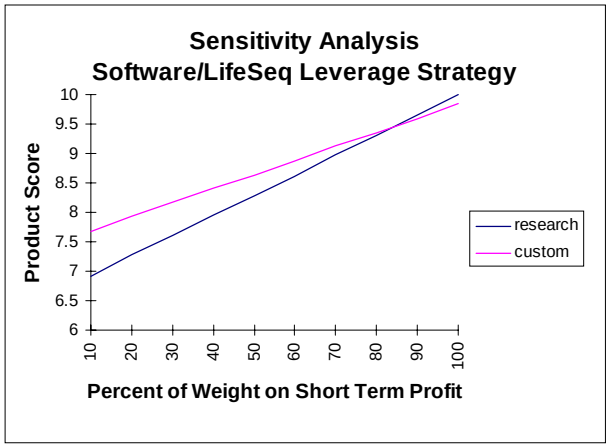
The weightings assigned to the various attributes help determine the "composite score" for each product. In this appendix, we show the product "composite scores" for two different attribute weightings. The relative weightings are shown below. The resulting composite scores for each product are shown in the graph. Note that even though the relative weights are very different in the two weighting schemes, the custom and disease products still have the highest "composite scores." This suggests that the recommendation to go ahead with the custom product is quite robust.

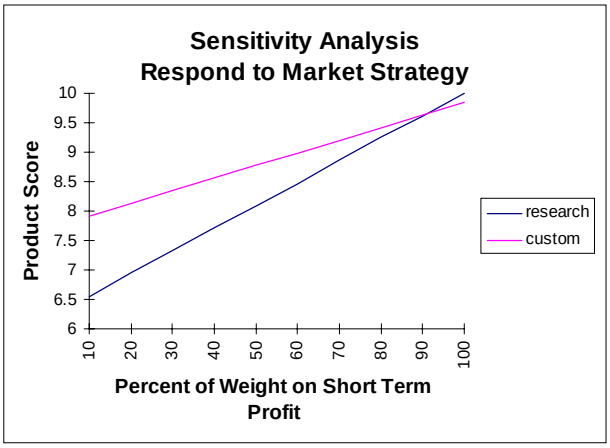
			ANALYSIS MATRIX	
Strategy Name	Software/ LifeSeq Leverage		Respond to market needs	
	Normalized Weights	Raw Weights	Normalized Weights	Raw Weights
Attributes				
LifeSeq Enticement	0.19	10	0.05	2
Low-end Software Synergy	0.19	10	0.05	2
High-end Software Synergy	0.19	10	0.05	2
Expand New Markets	0.13	7	0.21	8
Short-term Profit	0.04	2	0.13	5
Industry Pressure	0.13	7	0.05	2
Responsiveness to Demand	0.04	2	0.26	10
Current Partner Relations	0.09	5	0.21	8



Sensitivity Analysis

To further explore the robustness of these results, we asked ourselves how much the weightings would have to change before the product decision changed. The research (disease/tissue) product is rated higher than the custom product only with regard to the "short-term profit" attribute. So how much would the short-term profit need to be valued to choose the research-based product? The graphs below show that, with the two weighting schemes considered above, the decision would have to be based almost exclusively on short-term profit (weight > 85%) to change the decision.


Sensitivity Analysis
Software/LifeSeq Leverage Strategy
Product Score
10
9.5
9
8.5
8
7.5
7
6.5
6
10
20
30
40
50
60
70
80
90
100
Percent of Weight on Short Term Profit
research
custom


Sensitivity Analysis
Respond to Market Strategy
Product Score
10
9.5
9
8.5
8
7.5
7
6.5
6
10
20
30
40
50
60
70
80
90
100
Percent of Weight on Short Term Profit
research
custom

Appendix I: Limited Database Product Financial Strategy

It has been determined by the pervious strategic analysis that producing a custom LifeSeq product be a positive contribution to Incyte's competitive position. Optimal timing of the introduction of this product is crucial to this strategy. The main concern of Incyte is that this limited product will deter profit from its major LifeSeq product.

To quantify this concern, we performed an options analysis which examined whether it would be optimal for Incyte to exercise the option to enter the limited product into the market at each point in the three year product cycle. We would then compare the profit made at each point to the potential loss of profit from cannibalization. The juxtapositioning of profit data and cannibalization losses regarding the custom product would then allow Incyte to see whether the concern was real enough as to delay introduction with the uncertainty of the price of the new product.

Variable List

S(0)	Initial Price of custom product (estimated)	$500,000
sigma	Volatility of custom product	.2
T	Time in product cycle	3 years
Δt	Turnover period	.5 years
r	risk free rate specified by company	.12

Method

From these variables, we many deduce the parameters for the options lattice[3].

u	Upward price motion	=	e^(sigma* Δt ^.5)	1.15
d	Downward price motion	=	e^(-sigma* Δt ^.5)	.868
R	Risk free rate	=	1 + r	1.12
q	Risk neutral probability	=	R - d/ u - d	.888

Next, we must assess how many custom products will be sold in each period. We assume that if between 50 and 60 are sold that the penetration rate will be exponential. Thus, more products towards the end of the cycle will be sold than towards the beginning of the cycle. A graph depicting the number of the custom products sold at each point in the three year cycle is below.

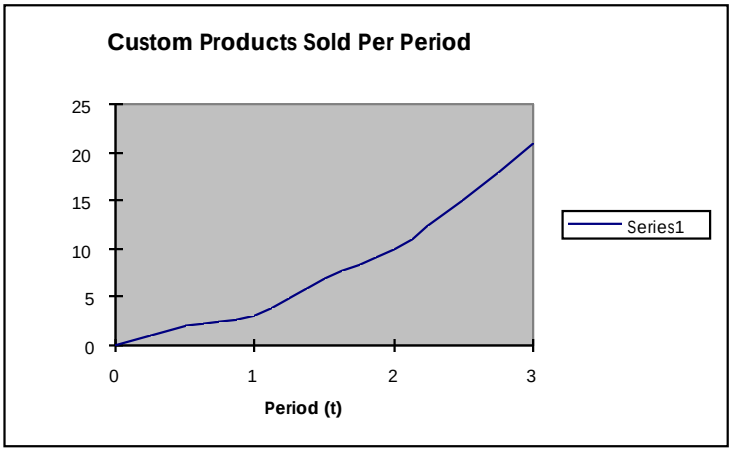


Figure 1: Custom Products Sold Per Period

Next, we must assess the costs of development per period. This is done by multiplying the estimated cost per product by the number of products sold per period. A table of this data is below.

Period	0	0.5	1	1.5	2	2.5	3
Cost	0	258	387	903	1290	1935	2709

[3] We assume that the prices follow a lognormal distribution, allowing us to use geometric brownian motion in the lattice. This is based on a historical study of Incyte's stock which does show a lognormal distribution.

Figure 2: Cost Per Period ($1000s)

After assessing the information regarding the custom product, we must assess the information regarding the cannibalization costs. We assumed in the decision analysis that a total of 15 (both new and existing) customers of limited LifeSeq would be detracted by this new product. We assumed that the percentage of this 15 that would be detracted would follow the same pattern exhibited in the penetration of the product. As time goes by and the product becomes more popular, more customers will be cannibalized away from the large LifeSeq product.

A table of the data for cannibalization exists below. For each period, we assess the number of cannibalized customers following the pattern exhibited in the custom products sold per period. Then, we multiply this number by $4 million, the cost of the LifeSeq product. Finally, we assume that there is a 50% chance of this profit loss. The expected loss due to cannibalization at each period is then .5*Total Cannibalization Value (t).

Period	0	0.5	1	1.5	2	2.5	3
Total Number Cannibilized	0	0.5172414	0.77586207	1.810344828	2.586207	3.87931034	5.431034483
Total Cannibilization Value	0.00	2068.97	3103.45	7241.38	10344.83	15517.24	21724.14
Expected Value Cannibilization	**0.00**	**1034.48**	**1551.72**	**3620.69**	**5172.41**	**7758.62**	**10862.07**

Figure 3: Cannibalization Loss Per Period ($1000s)

The lattices regarding price and profit may now be formed to evaluate the option. First, we use the u and d to examine how the price of the custom product may change from period to period.

Price							
	0	0.5	1	1.5	2	2.5	3
0	500	575.95496	663.448221	764.2325802	880.3271	1014.05749	1168.102873
0.5		434.06172	500	575.9549551	663.4482	764.23258	880.3270828
1			376.819158	434.0617227	500	575.954955	663.4482206
1.5				327.1255459	376.8192	434.061723	500
2					283.9854	327.125546	376.8191582
2.5						246.534346	283.985356
3							214.0222456

Figure 4: Prices Lattice for Custom Product ($1000)

Using the information regarding the number of products sold from figure 1 and the cost per period from figure 2, we may construct the net profit lattice.

Net Profit							
	0	0.5	1	1.5	2	2.5	3
0	0	893.90991	1603.34466	4446.628061	7513.271	13275.8624	21821.16034
0.5		610.12345	1113	3128.684686	5344.482	9528.4887	15777.86874
1			743.457475	2135.432059	3710	6704.32433	11223.41263
1.5				1386.878821	2478.192	4575.92584	7791
2					1549.854	2971.88319	5204.202323
2.5						1763.01519	3254.692476
3							1785.467157

Figure 5: Lattice of Net Profit ($1000)

Results

Finally, we examine whether Incyte should exercise the option to enter the industry at each time period. For each node, we placed

1 if Incyte should exercise the option to enter at period (t)

Profit of Product (t+1) > Expected Cannibalization (t)

0 if Incyte should not exercise the option to enter at period (t)

Cannibalization (t) > Profit of Product (t+1)

We would evaluate the profit of the product using the option pricing technique, taking the risk neutral probabilities of profit from the up and down states in the lattice[4]. The table of results are shown below. Please note that the 0 values in period 3 reflect the fact that Incyte cannot exercise the option at the end of the product cycle.

Option							
	0	0.5	1	1.5	2	2.5	3
0	1	1	1	1	1	1	0
0.5		0	1	1	1	1	0
1			1	0	1	1	0
1.5				0	0	0	0
2					0	0	0
2.5						0	0
3							0

Figure 5: Results Lattice

The lattice shows that it is a financially sound idea to introduce the customs product at this time. Incyte should, however, reevaluate this idea at each point in the cycle based on the movement of price.

[4] The formula at each node for future profit is (1/R)* [q*Profit up (t+1) + (1-q)*Profit down (t+1)]

Appendix J: *Genomics Review* Article

This article provides an excellent example of the "Encourages Industry Pressure" attribute described in the *Product Attributes* section.

Silverman, E., *March Genomics Digest*, April 4, 1997