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# *Financing the Development of Biobased Products*

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It is indeed a privilege to be invited back to an organization of which I was proud to be a part when I was in academic administration. Now that I have been out of academia in the private sector for a few years, I believe I can offer you a slightly different perspective on the agricultural biotechnology industry — a perspective that may help you attract new sources of financing. My presentation will play off some of the earlier talks, in the context of how we turn great science into great business. My major theme is that we must position this initiative to be a successful business, for it to be considered a success. As a context for my presentation, I will discuss some of the restructuring that has occurred in the traditional agricultural research and development complex, and some new funding paradigms that have developed to support new industry. I will also emphasize the importance of partnerships and alliances as technology moves from universities through these new paradigms to be commercialized by the larger companies. This perspective, I believe, is germane not only to developing a biobased industry, but also to how our academic institutions commercialize technology.

## IT'S ALL IN THE TIMING

As Ralph Nader said, we have been here before. Indeed, we have been here many times before and, in most cases, colossal failures resulted. Renewed interest in biobased materials has resulted from recent high prices of crude oil. Oil at \$30 a barrel, rather than \$10 to \$15 a barrel, is a major economic factor.

Timing is everything in business, and the time seems to be right for the transition to more biobased products. During the past year, President Clinton issued an Executive Order and we have seen increased funding from the United States Department of Agriculture (USDA) and the US Department of Energy

(DOE) for research in bioproducts and biomass. In addition, the National Research Council of the National Academy of Sciences issued a comprehensive report laying out scientific opportunities that underpin the development of this industry. The importance of the NABC 2000 *Vision Statement* should not be overlooked, because it lays out a vision that has stimulated debate. However, I believe among the most important developments over the past year were the actions of some of the large chemical companies. For example, DuPont's CEO Chad Holiday stated, "By 2010, 25 percent of DuPont's revenues will come from the biomaterials bioprocessing sector." This declaration was followed by a major new biobased initiative in the development of precursors for a new line of polymers. Likewise, Cargill-Dow created a joint venture, also to develop biobased precursors for the polymer industry. These were seminal events because, if the biobased industry is to be successful, it will require major initiatives by the large chemical companies to develop markets for the new materials. A biobased initiative cannot be driven only by universities or public policy.

It is essential to understand also that environmental issues and public concern over them are important, but not sufficient to drive this development. We can talk about protecting the environment, but unless it helps corporations improve their bottom line, the economic incentive to improve protection of the environment will be absent. The Kyoto Agreement may be the first step in putting an economic incentive in place for protecting the environment. For example, in Canada, they are considering rebuilding an industry that will foster compliance with the Kyoto Agreement. Such agreements are powerful economic incentives.

I do not think we can over-emphasize the importance of market development when timing a new initiative. For example, there is always pressure for lower cost, and faster, better and cheaper ways to develop products; but unless there is a confluence of forces — public policy, economic incentives, and customer demand — new technologies will languish and new companies will fail. Some of the most important initiatives over the past year were the movement of the major chemical companies into this space, and international trade agreements.

## SHIFTING PARADIGMS AND THE TECHNOLOGICAL OPPORTUNITY

The development of biobased materials will require a number of new and enabling technologies, some of them coming out of the biotech industry. Fortunately, many of these new technologies have been paid for by the pharmaceutical industry, were tested and tried in agricultural biotechnology, and are now at a point where we can begin to efficiently use them in a new biobased industrial chemicals arena. But, biotechnology is only one aspect. Future success will require the integration of programs across the physical and biological sciences, and the development of effective technology-transfer out of our universities into innovative start-up companies.

To demonstrate the importance of early-stage technology transfer and the formation of new companies, it is important to understand the paradigm shift that has occurred in agricultural research and development over the past five years. This paradigm has been adopted from the pharmaceutical industry, which went through that change some ten to fifteen years ago.

The paradigm shift is exemplified by the emergence of life sciences companies, built on the premise that core genomics technologies will be used to develop new products in both the pharmaceutical and agricultural industries. The adoption of this strategy has driven some \$18 billion worth of mergers and acquisitions in agriculture over the past four years. Companies like DuPont and Monsanto “partnered-in” the technologies that they needed, and then began to partner up and down the value chain to not only integrate new technology and build value in the product, but also to position themselves to capture some of the value created. These companies (which were largely chemical) recognized that if they were to move in this arena they did not have the internal skill-set to do it in the traditional manner, but saw they could — in a cost-effective way — partner it in with small, innovative companies.

That is exactly what the pharmaceutical industry has done in the past. Companies like Merck now access over 60 percent of the products in their pipeline through alliances and partnering activities.

And just when we were beginning to see agricultural research and development pursue that same model, the life sciences model was called into question. During 1999, several large pharmaceutical companies, which had previously supported the life science strategy, began to re-evaluate their commitment. While technology synergies occurred early as the new products began to move through the development and marketing pipelines, the differences between agriculture and pharmaceuticals became significant. In late 1999 and continuing through 2000, we saw some life sciences companies disaggregate into pure-play agricultural units. Despite this disaggregation, the paradigm shift remained intact: large corporations will increasingly depend on small companies as a source of new products and enabling technologies. Strategic alliances are a critical part of the new paradigm, and those alliances must include relationships to access technology, to source and market new products and, in the future, will include farmers, producers, technology suppliers, and companies that can carry the new products to the consumer.

As we re-think agricultural research and development, or research and development in support of a biobased industry, it is important to understand the new structure, under which we will rely on small companies that are spinoffs of university research to take the technology, move it through proof-of-concept, and begin to put it into practice. These innovative start-up companies will go through a series of transitions to optimize their positions for initial public offerings (IPOs) or to be acquired by a large multinational corporation. But, in all cases, developing partnerships both among themselves, and with the multinationals, is critical to their success.

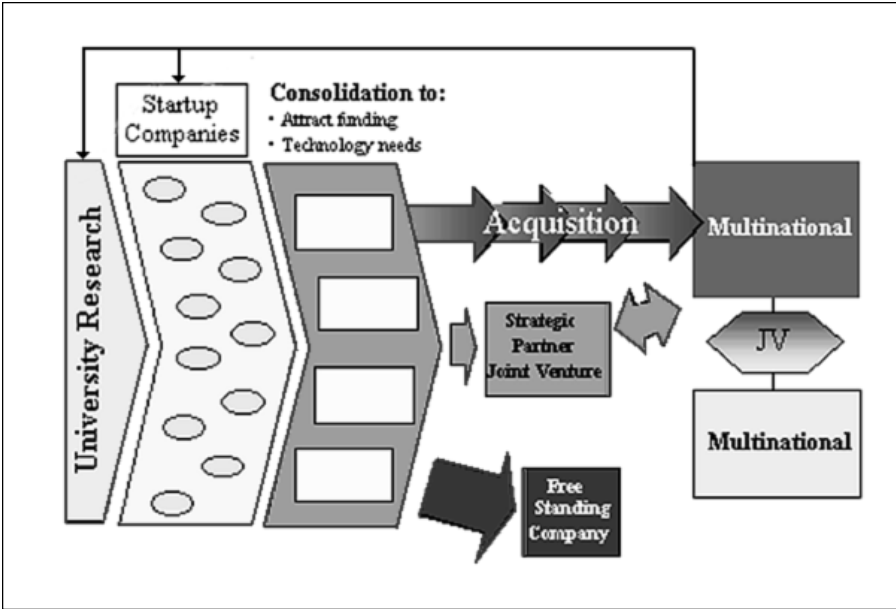


Figure 1. Evolving Biobased Industrial R&D

**FINANCING: THE FUEL OF CHANGE**

Also of vital importance is the ability of these start-ups to attract private equity financing, and there lies one of the important attributes of the new paradigm: accessing a new source of capital to fund agricultural research and development — the private equity market.

To give you a sense of the size and availability of this new money, over \$11 billion of private equity was raised during the first quarter of 2000. Obviously, this was driven by a very positive capital market and interest in biotech companies positioned within the life sciences. Only in the last few years has agriculture begun to take advantage of this financial opportunity, and if the new biobased research effort is to be successful, it also must attract this new source of financing, and thus an important part of that strategy must be the formation of new companies.

Although we exist in a new paradigm, some things remain the same. The foundation of any successful activity is a need for robust fundamental research programs. The industry cannot move forward unless we have major public funding at our universities and federal laboratories for the development of new knowledge and enabling technologies. The new challenge is not to leave the results of that research in the laboratory, but rather to move that technology

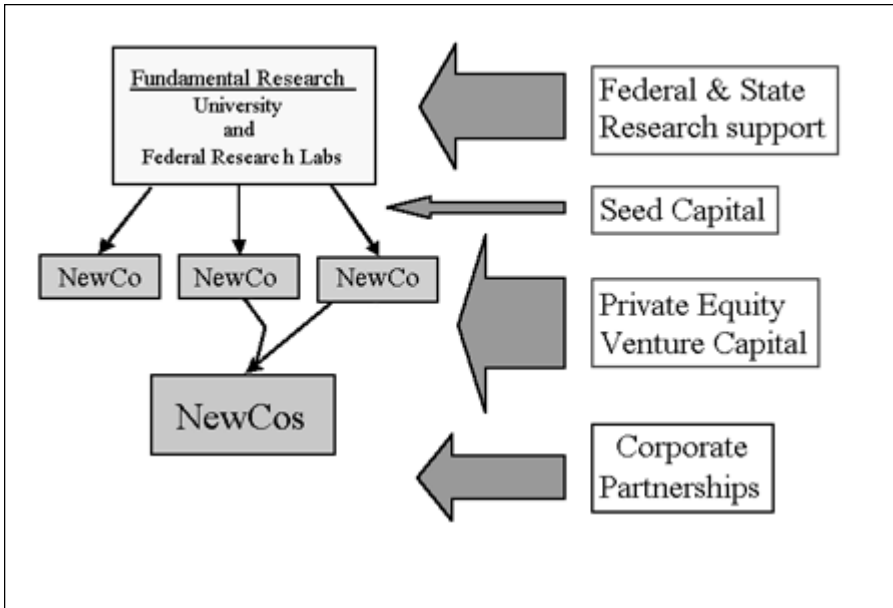


Figure 2. The Biobased Industrial R&D Pipeline: Funding and Financing

into the commercial world as quickly as possible. That transition requires sophisticated technology-transfer offices at our universities and access to seed capital, that early-stage financing so important to the formation of new companies. Indeed, the greatest challenges I see are the availability of such seed capital and the tradition of land-grant universities to provide free public access to new information rather than to form new companies.

Once a company is formed and has attracted its early round of seed financing, the next critical step is to access venture capital. In the past, agriculture has been an area in which venture capitalists did not expect a sufficient return on investment. Only in the last three years have venture capitalists become aware of the opportunities in the “new agriculture.” If we are to attract venture capital, it requires a business plan that demonstrates how the new technology will be moved into the marketplace, i.e., it must not only be a concept, but also an economically viable business. This reinforces my earlier point about timing and readiness of the market: you can have a great technology and potentially a great little start-up company, but if time-to-market is delayed, the interest of those with venture capital will be lost.

## THE MATING DANCE: THE IMPORTANCE OF PARTNERING

The next stage in financing for a new company is to establish partnerships with large corporations. This is critical to the development of a small company and is equally important to the large corporation. For the small company, it provides access to technology and capital. For the large company, it provides access to innovation and new products.

Such strategic partnerships are an important part of the new paradigm, but so also will be public/private partnerships. It is increasingly important that we encourage public universities to develop relationships with the private sector, large and small companies alike. This is an additional source of revenue for universities and an important source of innovation for the private sector, but we immediately run into the issue of conflict of interest. This age-old problem has been a significant barrier to productive relationships. I believe that *now* is the time to design business models that are consistent with the need for the unfettered pursuit of new knowledge at universities, and for the need of the American economy to expeditiously move that innovation into the private sector.

Some universities — Harvard, MIT, Stanford, Berkeley, UCSF — have developed comfortable ways of managing these relationships, and are still considered to be among the top research institutions in the United States. It is time for productive dialogue between universities and corporate America to understand the importance of these partnerships and how to make them work. This will be critically important, particularly for technologies that support a biobased industry. The large corporations must move into this new arena and must be supported by innovation. This will initially come from universities and later from start-up companies, but the relationship between the university and small and large companies will be a critical and vital part of the success of this initiative. Achieving these partnerships will be a significant hurdle for land-grant universities where the culture of transferring technology into new companies has been lacking.

Many communities look to biotechnology and the start-up of new companies as an important component of economic development. If those communities are to be prosperous, they must offer an attractive package: a complete, supportive, entrepreneurial environment for new companies that includes seed capital and a source of experienced mentors and CEOs who will provide leadership. The new company must be based on good science, but success will come only with good management. Good science is not sufficient. Seed capital and management teams are in short supply in agriculture and biobased companies. We must address these issues for this initiative to succeed. In addition to the management team, a supportive infrastructure — attorneys, accountants, and others — is needed for the small company to grow.

And, perhaps most important is a conducive environment in which it is understood that starting a new company is precarious and requires entrepre-

neurs willing to take risks. In the event of failure, a support structure is needed to encourage perseverance. Success will be more probable at the second attempt.

Several new companies have been formed in the area of biomaterials and bioprocessing. Most are in the relatively early stages — less than four to five years old. A few examples are noteworthy:

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| ProdiGene | At Texas A&M; engineering corn to produce enzymes and therapeutic proteins.  |
| Diversa   | Went public last year; identifies enzymes from organisms growing in extreme environments and, through a process of gene shuffling, engineers those enzymes to have important commercial characteristics. |
| Maxigen   | In San Francisco; similar technology to Diversa's, i.e. "molecular breeding" to engineer enzymes and biological pathways to produce unique compounds.  |
| Nexia     | A Canadian company that has genetically engineered goats to produce spider silk in their milk.   |

These are only a few of the examples where powerful new biotechnologies are being applied to this new sector.

Once a new company has been formed with a management team in place, and has received its first or second round of financing, continued growth and development are dependent on the formation of partnerships to either access additional technology or to gain access to the marketplace. This model, developed largely in the area of pharmaceuticals, over the last several years has been adopted also in agriculture. Consequently, large companies (Monsanto, Bayer, DuPont, Novartis, etc.) have entered into numerous relationships with small companies. Gradually we will see these partnerships develop in the area of livestock genomics and nutraceuticals, and will be key in the biomaterials/bioprocesses arena.

The structure of the partnership is critical to both parties. The larger partner needs to access technology and products in a cost-effective manner, while sustaining the growth and development of the smaller partner primarily because the latter provides the future product pipeline. Significant creativity has been exhibited in a number of partnering deals, all of which have a similar structure, i.e., up-front technology access, milestone payments as the technology or product is developed, and downstream royalty payments as the product moves into the marketplace. However, for any such deal, creativity is necessary to assure a sustainable partnership, strong communication for interaction between the research and development efforts of the two units, and to fairly share in the value created so that both companies are successful.

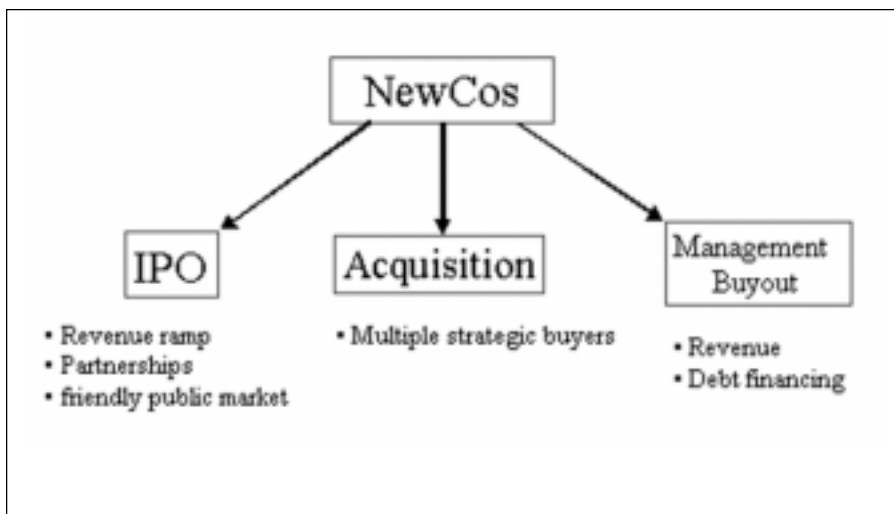


Figure 3. The Biobased Industrial R&D Pipeline: Exit Strategies

### SATISFYING INVESTORS: ENSURING RETURN ON INVESTMENT

Once the small company has developed a number of partnerships, with products moving into the market place, and has a sustained revenue growth, the investors begin to consider how to obtain a return on their investment. These so-called “exit strategies” fall into three categories: the IPO in the public equity markets (normally the NASDAQ,); acquisition by a larger company; financing through debt and a management buyout. Prior to 1999 there had been few, if any, successful public offerings of agriculturally related companies. However, late in 1999 and certainly early in 2000, the IPO window opened and a number of companies successfully went public, giving the venture investors handsome returns on their investments. As the public investor continues to have interest in genomics, there will be tremendous incentive to start new companies. The current investor interest in biotechnology and genomics companies bodes well for the future development of small companies in the area of biomaterials and bioprocessing. However, to date, the market has not yet been tested because no small company from this emerging sector has gone public.

The acquisition of a small company by a large one is an attractive exit strategy. The small company positions itself as a “must-have,” and the larger company uses the acquisition as a way to move into a new sector without fully developing the internal capabilities to discover and develop new technology and products.



Finally, the option of a management buyout certainly exists, but requires that the small company have sustained revenue growth to service the debt financing. The small company simply goes to the banks to finance the ongoing development of the company. Few examples of this exit strategy exist in the agricultural biotechnology area.

## PITFALLS OF THE NEW PARADIGM

This new paradigm of financing research and development in the agriculture, food, and biomaterials sectors has its vulnerabilities. For example, the public equity market can be fickle. We saw tremendous growth in the value of companies until approximately March 2000, and then there was a tremendous decline as the companies were perceived to be over-valued when President Clinton and Prime Minister Blair made their public statements concerning the patenting of genes.

Of additional concern is the growing public questioning of genetically modified organisms. As these issues remain, so decline the availability of private equity venture capital and the IPO as mechanisms to obtain returns on investment. Even as we access a new treasure trove of financing for agricultural research and development, it becomes a much more fickle source.

Furthermore, we must be aware that we are moving into a new biobased market — one that is largely undeveloped. The first companies to move into this space will not be small; DuPont, Dow, and Cargill have recently made major investments in biomaterials. These major corporations thus provide the wealth of resources to develop markets. This then provides the opportunity for small companies to flourish as they provide the innovation that the large multinationals need to sustain their growth in this market space. Initially these investments by the major corporations must be economically viable and, therefore, the concept of enterprise accounting is an important component of public policy. Enterprise accounting must take into account all of the benefits to moving to a biobased market, for example giving credits for lowering CO<sub>2</sub> emissions and reducing other adverse effects on the environment, or these early products will not be economically viable. This is a serious constraint to the development of biobased products.

It is a major constraint because time-to-market is important for capturing this new paradigm of funding. The market must be ready to pull products into it in a timely fashion or small companies will fail because venture financing will move to more attractive investments — quicker returns on their investment — if they see delays in the conversion of technology into successful businesses.

The development of the market and the maintenance of financing also require a consistent regulatory environment. Again, investment will not be forthcoming if public policy is insufficiently stable for that investment to be turned into a successful business. A useful analogy is the cost of crude oil; when priced in excess of \$30 a barrel, there is greater interest in alternative fuel

sources. However, when the price drops below \$15, interest in alternative fuels declines and many companies go out of business.

The challenge before us is to look at a broad initiative that develops the markets, provides an environment that will attract risk capital, and encourages state universities and federal laboratories to seek creative ways of moving new technologies out of the laboratory into an environment where small start-up companies can be developed and will flourish. This will require additional public financing for fundamental research, and public policies that are consistent with the long-term sustained growth of a biobased materials market. With such incentives, investors will be interested and this new area of biomaterials will capture the necessary funding to be successful.

Let me use Burrill & Company as an example. We are a private merchant bank, focusing entirely in the life sciences. We do three basic things: provide venture capital to small life sciences companies; help small companies partner with large ones (again an important part of the new paradigm in life science research and development); and help large companies spin technologies off that no longer fit their core of business. We are very active in partnering activities. We hold two meetings, at which small companies make presentations to large ones in a two-day format: a “mating dance.” We facilitate the interaction that is necessary for both parties to be successful.

Also, we organize CEO conferences, one in human healthcare and one in agricultural biotechnology. Actually, BIO, the Biotechnology Industry Organization, was spun off from one of these CEO meetings in the early 1980s when the subject for discussion was what needed to be done to make this industry successful. Agricultural biotechnology needed an organization. These meetings are useful for partnering, as well as building a community around the small companies in this area of endeavor.

In our venture-capital activity, we have a series of venture funds: the AgBio Fund is for plant biotechnology and the Biotech Fund is for human healthcare. We have one in nutraceuticals, also a purely financial fund, and we will be raising a biomaterials/bioprocesses fund later this year. We currently have about \$250 million dollars under management to invest in the areas we have been talking about. The numbers in the USDA and DOE budgets are paltry compared to what it is going to take to build this industry. Think about new ways of capturing money not only from companies like ours, but other sources of financing, and make that part of your overall strategy.

Thank you very much. I hope that what I have said will encourage you to think more broadly. In addition to going to Congress and initiative funding, think about building the community, not limited to academics, but with policy-makers, small companies and large companies to make this exciting new field a success.