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If we believe, as many of us do, that the industry will indeed realize significant future sales of biotechnology products, we can then place a future value on these biotechnology companies in the conventional way in which we evaluate any industry group, such as the major pharmaceutical and drug sectors. We assume that not all future biotechnology product sales will be by these up-start start-ups—perhaps 50% would be a fair estimate. The balance of biotechnology product sales would be by the multi-national pharmaceutical and drug companies. Remember also that these large companies are acquiring, or investing in, these small biotechnology companies.

Another point should be made. Although new biotechnology companies will continue to start-up to exploit niche markets and specific product opportunity areas, the mainstream of biotechnology companies will already have been established in the markets and new entries will be few. It is expected that fully 2/3 of the companies presently in business today will be gone in 10 years—some will fail, many will be acquired by others. As a result, a smaller number of companies will cut up the biotechnology pie in the future markets.

The market value of the biotechnology companies (today \$9 billion) may possibly be \$100 billion in the year 2000—but divided among considerably fewer players. Assuming 50 biotechnology companies remain at that time, the average market value of each company would be \$2 billion—a 20-fold increase over the average market value today.

Investment Strategies

Before reaching for your checkbook to make an investment in biotechnology today, understand that any number of assumptions can be made and any number of differing results may be suggested. An investment today in every one of the biotechnology companies held until the year 2000, quite assuredly will not realize the 20-fold average increase suggested above. Even if the industry values came true in that year, dilution of the investment interests by the significant additions to equity capital that may be necessary along the way would change the returns. And how much is won or lost in those companies that are acquired or go out of business is anyone's guess.

The hint of significant values in biotechnology, however, is realistic. It may require considerable patience, some anguish, and a lot of luck, however, to realize your investment return dream in biotechnology.

The typical investment strategies can be suggested. This assumes considerable diligence on your part, a lot of sound advice from others, and a long-term investment posture. Invest in those undervalued biotechnology companies that have significant technologies and markets, excellent management, considerable capital, several corporate partner relationships, and various sales and marketing agreements that will result in significant growth in sales and earnings.

Investment Opportunities in U.S. Biotechnology Companies — High Upside Rewards Hand-in-Hand with Equally Great Downside Risk

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Until comparatively recently, biotechnology has been a subject of intense interest to a relatively narrow audience, namely, to that segment of the scientific community working at the leading edge of this "new biology." While there has been a growing amount of communication in the lay press of the progress and implications of biotechnology, attempts to convey the significance of recombinant DNA, monoclonal antibodies, hybridoma cells, and DNA probes have been a bit bewildering to the general reader. This bewilderment has only been compounded by discussions of high-potential new

products with esoteric sounding names and strange sets of initials; e.g., tissue plasminogen activator (TPA), tissue necrosis factor (TNF), colony stimulating factor (CSF), epidermal growth factor (EGF), angiogenesis inhibitor, and Factor VIII, being pursued by a great number of new companies with confusingly similar names such as Genentech, Genex, Integrated Genetics, Plant Genetics, Molecular Genetics, Biogen, Amgen, and Calgene. Excitement has nonetheless grown as the potential to employ this technology and these substances to treat diseases such as cancer, AIDS, and cardiovascular

disease has come into increasingly sharp focus. Along with this increasing awareness of a major new technology and major new business in the making, has come a growth in interest in the corresponding investment opportunities available.

While it is always dangerous to make dogmatic assertions, there can be no doubt that biotechnology is destined to be big business. The products of this technology will revolutionize agricultural, veterinary, healthcare, chemical, energy, and waste management businesses, to name a few. However, while one can make a safe bet on this proposition, it does not follow that equally certain investment returns will result from a bet on any particular participant, or group of participants, in this emerging industry. The technology is very dynamic, and is being pursued by a large and growing number of companies. Some of these companies will fail, others will succeed—either on their own or by virtue of being acquired by others. In targeting particular companies as investment options, one needs to make judgments about company management, financial underpinning, technology, markets, marketing capability, manufacturing capability, patent position, regulatory requirements, competition, and strength of corporate partners. Even if one appropriately judges this multiplicity of key success factors and identifies a number of companies which, in fact, ultimately emerge as business successes, an investment in the common stock of one or more of these companies could still bring the investor to grief.

In making common stock investments, it is important to view the stock as having a life of its own apart from the health and life of the underlying business. Thus, a company's business may be doing very well, with excellent prospects for future sales and profit growth. Investors, sensing these prospects, will generally bid the stock of such a company to levels at which an acceptable investment return is difficult to achieve. Subsequent reports of sales and earnings progress may be greatly improved over prior periods, but because such progress is less than anticipated, the stock declines in price. Conversely, a company's business may be experiencing some temporary hard times. But because investors are not certain whether, in fact, such times are temporary, or, even if temporary, how severe the hard times will be, the stock may be selling at such a discount to "fair value" that an investment made in the company's common stock yields excellent returns. Subsequent financial reports may show that the hard times are over sooner than expected and/or are less severe than anticipated, leading to a price rise in the common stock. Thus, it often happens that when a company's business looks the worst, the common stock is at a price that subsequently proves to have been very attractive. Yet, this is also the point at which the psychological frame of mind of most investors is least disposed to undertake investment risk. Again, it is important at any point to make separate judgments about the business and the stock. They do not often move in lockstep.

The importance of rigorously separating the judgment of business prospects from that of stock valuation is even more important in the case of biotechnology, an emerging industry populated with emerging growth companies. Few of these companies have any significant product revenue at this point, and even fewer—you can count them on one hand—are profitable. The stocks of these companies tend to be "expectations" driven and "key milestone achievement" driven, rather than current, or even near-term, earnings driven. Since expectations are frequently limited by very little more than our imaginations (or our greed), the stock of a company investigating a cancer cure, or an AIDS vaccine, or an agent to abort heart attacks, is frequently bid up to levels difficult to main-

tain, or justify, even in the face of progress towards the expected goal.

I will attempt to illustrate my point with an example. Amgen is considered to be one of the premier biotechnology companies, one of the elite group of biotechnology companies voted by most knowledgeable observers as "most likely to succeed," a judgment with which I have absolutely no reason to disagree. As this is written, Amgen common stock is selling at \$37 per share and the company has 16.3 million shares outstanding. In fiscal 1986, the company had \$23.4 million in total revenue—\$20.2 million from corporate partners in support of Amgen R&D programs, \$2.3 million in interest income from its cash, and a mere \$0.86 million in product revenue. The company was profitable, earning \$548,000, or \$0.05 per share, although it clearly would not have been had it relied on profitable operations stemming from product revenue. I do not follow the company closely, but the consensus earnings estimate of 12 analysts who do, is that the company will earn \$0.08 per share in fiscal 1987. Thus, the stock is selling at 463 times 1987 earnings. Considering that the overall market is currently selling at 15-16 times anticipated 1987 earnings, the current price of Amgen stock incorporates a considerable measure of assumed future success. As the industry and Amgen matures, this earnings multiple is going to decline. Let's just assume for the moment that Amgen was currently a solidly established business, with good, and growing, revenue and profits. Where should the company be in terms of revenue and profits to justify a multiple of 25 times earnings, still a near-70% premium to the market? Since the stock is selling at \$37, a multiple of 25 times earnings would imply earnings of 37/25, or \$1.48 per share. Given that the company currently has 16.3 million shares outstanding, \$1.48 per share would dictate \$24.1 million in net income. If we then assume that this net income amounts to a generous 15% of revenue, revenue would need to be more than \$160 million, considerably greater than the \$0.86 million achieved in fiscal 1986.

I would emphasize that the point of this example is not that Amgen will never achieve \$160 million in revenue; I have every reason to believe that it will. It is also not the point that Amgen common stock is not a good buy; I suspect that it will prove to be a good investment, particularly for investors who approach investing in such situations appropriately, a subject I will return to in a moment. Rather the point is that the prices of the expectations-driven stocks of emerging growth companies are subject to continuous, and frequently substantial, readjustment, reflecting investor reaction to the real or imagined impact of events on the previously assumed level of ultimate success. Some of these events will be completely beyond the company's control as, for example, a time of overall reduced interest in the biotechnology sector of the market; a pronounced overall bear market, wherein it is difficult for the stocks of any company to do well regardless of progress or prospects; the entrance of a competitor into the same markets; or a delay in receiving necessary regulatory approval for a product. Any such events can lead investors to be, at least momentarily, less optimistic and less willing to pay the same price for the stock. The bottom line result with respect to investors is that emerging growth stocks tend to be highly volatile. Investors, particularly individual investors, frequently do poorly in such stocks because they lose their nerve and the courage of their convictions, selling out their positions at a loss. As mentioned earlier, this is frequently the time at which such stocks should be bought. Not always, however!

If it seems that I am making every effort to scare potential biotechnology investors, let me emphasize my belief that excellent returns are available to investors who invest wisely

in this area. Since most people grasp very quickly the concept of exceptional return, but less quickly the concept of commensurate exceptional risk—and risk and return *do* go hand in hand—I intentionally spend more time discussing risk.

How should a person go about approaching investments in the biotechnology area, and what are the options? The first rule, important in any stock market investing, but particularly important with emerging growth stock investing, is not to venture any money that you cannot afford to have experience substantial erosion. As mentioned, growth stocks generally evince considerable volatility. Hence, you should not invest \$5,000 absolutely needed six months from now for a child's college tuition payment. While the \$5,000 could appreciate to \$10,000 three years from now, it could just as easily depreciate to \$2,500 in six months' time. While this first point is a *rule*, the second point is a *suggestion*. The suggestion is that once you have done adequate research to determine that the stock of "Biotech Company X" is an attractive buy, determine how much money you are prepared to invest/risk, then commit some fraction of that, say 1/3 or 1/2. Then resolve to commit the other half (or another third as the case may be) when and if the price goes against you by a predetermined amount. If the stock moves up and away from you, be satisfied with how smart you were, rather than despairing over not having committed everything originally. If events subsequent to your original investment provide added confirmation for your assessment of the business and the stock, buy more stock at higher prices. If, on the other hand, the stock declines to your predetermined price points, and you are confident that the rationale for making your original investment is still intact, buy some more stock and average down in anticipation of the upward price move you expect. So much for strategy. What are the investment options?

One investment option is to buy the stock of a "pure play" biotechnology company, a company whose future success is entirely dependent on its commitment to biotechnology. Depending on how you choose to count and characterize biotechnology companies, there are now at least 50 with publicly traded stock, with many others that are likely to come public in the days ahead. Many of these companies are nearly totally dedicated to therapeutic or pharmaceutical applications of biotechnology, others to diagnostic applications, some to agricultural and/or veterinary applications, and still others to chemical, energy, or other industrial applications. Some companies have strong commitments to more than one of these areas of application. A partial, and clearly incomplete, list of companies considered to be at the forefront of their particular areas would include Amgen, Calgene, Centocor, Cetus, Chiron, Genentech, Genetics Institute, and Integrated Genetics. Sources of information on companies of interest would include the recent annual reports and quarterly reports (readily obtainable directly from the investor relations department of the company), analyst reports on the company (obtainable through a brokerage firm), and a good business library such as the J.J. Hill Reference Library in St. Paul. Such libraries generally contain numerous investment resources including *The Wall Street Transcript*, which carries a lengthy "Roundtable" discussion of the biotechnology industry at least once a year.

The so-called "pure play" investment option carries the potential for the greatest—even spectacular—returns of any of the investment options to be discussed, assuming one "bets on the right horse." This option also carries the potential of the greatest—approaching total—loss, if you select poorly. The "pure play, all the eggs in one basket" approach entails both the prospects of exceptional return *and* exceptional risk.

A second approach would be to attempt to reduce potential risk, although at the same time reducing potential return, by taking an individual diversification approach. That is to say, rather than investing a given sum in one biotechnology stock, invest, for example, one-third of that sum in each of three biotechnology stocks. Assuming that you have done reasonably good homework, it is not likely that all the selections will perform dismally, although it is also unlikely that all will perform spectacularly. One excellent choice can still mask the "sins" of two poor to mediocre performers, yielding overall good investment returns. You should stay mindful that while this individual diversification approach can insulate you somewhat from issue-specific investment risk, it does not provide protection from overall market risk. As mentioned earlier, it is difficult to find any stocks that go up in the midst of a strong overall bear market. In fact, in such a market, emerging growth stocks with high levels of assumed future success incorporated into their stock prices tend to be the most vulnerable.

A third biotechnology investment option would be what can be called the "single stock diversification" approach. What is suggested here is to select common stocks of companies that are successfully established in existing businesses but that seek to enlarge those businesses or to establish new businesses through the application of biotechnology. Illustrative examples could include Abbott Laboratories, Eli Lilly, Bristol-Myers, Merck, Syntex, Johnson & Johnson, Becton Dickinson, and (surprise!) Eastman Kodak.

The so-called single stock diversification approach would be expected to reduce risk significantly. In the case of Abbott Laboratories, for example, this company is clearly well established, a near "blue chip," with leadership positions in pharmaceutical, diagnostic, and hospital supply businesses. Both the Abbott business and the common stock have been solid performers for years. The company is making substantial investments in biotechnology, both within its own research laboratories as well as through the support of research programs in the laboratories of various "pure play" biotechnology companies. Should this "drilling" for new biotech products strike a "dry hole," the base of solidly established businesses with good performances would substantially cushion the company and its investors. Conversely, a spectacularly successful new biotechnology product would not have the same positive impact on the financial performance of an Abbott Laboratories that it would have on a smaller, "pure play" company. The financial impact on a company the size of Abbott would be less, with a correspondingly reduced impact on the price of the stock, as well as on investor return. Again, if you insist on taking less risk, you should correspondingly reduce your return expectations.

The fourth, and final, approach to investing in biotechnology is to turn over your money to a professional money manager who is committed to investing in biotechnology stocks, i.e., a biotechnology mutual fund. To a certain extent, this particular option is more conceptual than real, since I am not aware of the existence of a mutual fund devoted exclusively to biotechnology. In time there probably will be. The closest you would come would be through a fund such as the H&Q Healthcare Investors Fund, a fund committed to investing primarily in biotechnology, diagnostics, healthcare services, and pharmaceutical stocks. If the diagnostics and pharmaceutical stocks selected for the Fund turn out to be companies seeking to achieve their business objective through biotechnology, this could approximate a pure biotechnology fund. In addition, this fund is committed to investing approximately 25% of its cash in venture capital situations, a very high return/

high risk approach rarely available to most people on an individual basis. The mutual fund approach offers a much more diversified, risk-reduced approach than is achievable via the previously mentioned individual diversification approach. However, I would again emphasize that in a strong bear market, even an investment in a large universe of stocks, each of which is itself high risk, is vulnerable.

To summarize, before choosing to invest in any common stocks, but particularly volatile, potential high risk/high return, emerging growth stocks such as biotechnology stocks, "know thyself." Know what you are prepared to risk, and how much risk you are prepared to take. Do not risk more than you are prepared to lose. Second, do your homework. Third, should you choose to invest in biotechnology stocks, choose an approach, be it the "pure play" or the three forms of diversification strategy, which most closely matches your risk

tolerance, while bearing in mind that diversification among a universe made up solely of high risk stocks can only achieve so much risk reduction; a certain return with essentially zero risk is obtainable only through U.S. Treasury bills. Fourth, once you have committed your hard-earned cash to the market, keep an open mind and a cool head—an open mind ready, willing, and able to continuously assess the impact of new information on original investment assumptions, and a cool head able to stay with an originally determined investment strategy as long as no new contrary information has come to light. Fifth, specific company names used during the course of these remarks are not intended nor should they be taken as investment recommendations, but rather as illustrative examples and as places to begin making your own assessment.