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Equity Research

Americas | **U.S./Health Care/Medical Devices** | **February 7, 2001**

BUY
USD 37.05

LARGE CAP

Beckman Coulter

BEC

Initiation of Coverage with a Buy Rating

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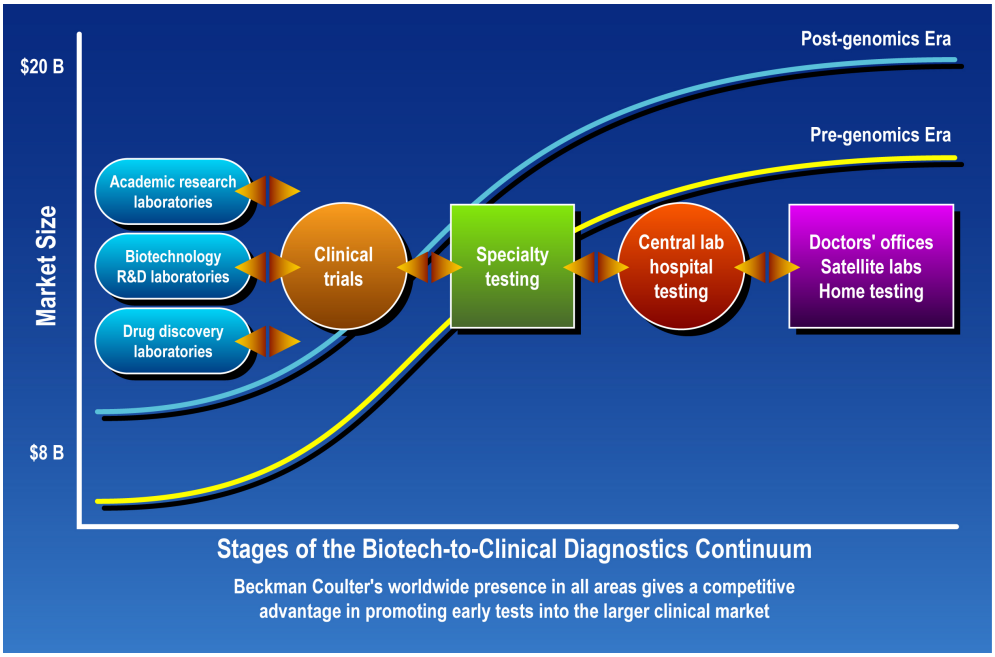

Source: CSFB

- On January 23, we launched coverage on Beckman Coulter (BEC), a leading manufacturer of laboratory automation technology and *in vitro* diagnostics, with a Buy rating and price target of $50.
- We believe that BEC's strong technology platform and huge installed base in the traditional *in vitro* diagnostics market will allow BEC to leverage meaningful growth opportunities in the more profitable and faster-growing biotechnology/drug discovery lab automation sector.
- At current prices, we believe that the market is not discounting any acceleration in BEC's long-term operating profit growth from the low double-digit rates that the company generates today, despite mounting evidence to the contrary. Our $50 price target assumes that the longer-term growth rate for BEC can increase to the midteens and higher.

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Statistical Abstract

Price 2/2/01[1]	Target (12 Months)	Dividend	Yield	Mkt. Value (Millions)		52-Week Price Range
USD 37.05	$50	$0.085	0.2%	$2,297.1		$43–23
	Annual EPS	Prev. EPS	Abs. P/E	Rel. P/E	EV/ EBITDA	EBITDA/ Share
12/01E	$2.24	—	16.5X	79%	—	—
12/00A	2.01		18.4	80		
12/99A	1.78		20.8	87		
	March	June	September	December		FY End
2001E	$0.39	$0.57	$0.54	$0.73		Dec. 31
2000A	0.35	0.53	0.47	0.67		
1999A	—	—	—	—		
	Total Debt (12/00)		$910 mil.	**Book Value/Share (12/00)**		$5.5
	Debt/Total Capital (12/00)		73%	**Common Shares**		62 mil.
	Est. 5-Yr EPS Growth		12%			

[1]On 2/2/01 DJIA closed at 10864.1 and S&P 500 at 1349.5.
[2]Economic profit trend.

Beckman Coulter is a leading manufacturer of automated laboratory systems for the biotechnology and drug discovery labs, and is a leading maker of *in vitro* diagnostic instruments for hospitals and reference labs. Seventy seven percent of its revenue is from the traditional IVD market and a growing portion is from the life sciences. BEC has a number-three or number-four market share in IVD—a market that consists of six major competitors.

12 Month Stock Performance

Source: BigCharts.com

Investment Thesis and Valuation

Our investment thesis on Beckman Coulter has four central tenets:

1. That BEC's leadership position in *in vitro* diagnostics (IVD) is sustainable longer-term despite the perceived threats from molecular diagnostics, Abbott's reentry into the immunodiagnostics area, and tough competition from Roche.
2. That BEC's life sciences business is well positioned for long-term growth owing to both internal technology platforms and external collaborations that capitalize on BEC's installed base in labs across the world.
3. That a lack of focus by traditional medical technology analysts on the life sciences sector has inappropriately pegged BEC as a slow growth IVD company.
4. That further industry shake-ups should be expected among the top six companies in IVD, and that BEC stands to benefit as the most stable franchise in this area.

Valuation

BEC currently trades at 17 times 2001 EPS and six times 2001 EBITDA/share. There are no pure-play publicly traded comparables, as the competition is either private or wrapped up in larger companies such as ABT, JNJ, Bayer or Roche. The purer-play life sciences automation companies such as Tecan are trading at close to 50 times 2001 EPS, and the smaller life-sciences tools companies such as Waters are also trading at 50 times 2001 EPS. We believe that the current stock price for BEC discounts low double-digit operating profits for what we call the company's valuation horizon, which is a term that describes the number of years of discounting it takes to arrive at today's stock price. Calculating this number allows us to eliminate the need for terminal values, which more often than not are such large drivers of a company's value that it makes little intuitive sense. We assume stable returns on incremental invested capital in our DCF and an increase in the long-term growth rate for the company to the midteens and higher beginning in 2004. These assumptions lead us to our $50 price target. Top line growth this coming quarter should be 5.5% and operating profit growth should be 10%.

Investment Thesis Point By Point

1. ***BEC's leadership position IVD is sustainable longer term despite the perceived threats from molecular diagnostics, Abbott's re-entry into the immunodiagnostics area or tough competition from Roche . . .*** We believe that Beckman's core IVD franchise is in good competitive shape and that it should be able to surpass the IVD industry average market growth rates of 4-5%. Beckman's product portfolio, size and service capabilities make it one of the toughest competitors. BEC is the market leader in hematology and second in chemistry and flow cytometry. Excluding glucose monitoring, BEC has the #3 or #4 worldwide market share in the total IVD market, and we believe that the threats to its core business from emerging technologies or re-emerging competition are minimal.

   BEC has a three-year strategic plan to grow the IVD core business. Workstation consolidation will unite chemistry and immunodiagnostics, increasing automation and expanding testing menus. With hematology, several new lines will be shipped in 2001 and 2002 and BEC's new strength in the reference lab customer base will be reinforced. In hematology, tetramers and IVD uses for HIV diagnoses should fuel the high single to low double-digit growth rates.

Beckman's pipeline of new products includes:

1. the Synchron-LX20 PRO—the only chemistry system that can process test tubes without a human opening the top (a health risk),
2. later in second half 2001 a fully combined chemistry and immunodiagnostic workstation with a much larger menu of tests,
3. upgraded hematology systems that will continue to solidify BEC's market share leading position in hematology.

The new chemistry lines will continue BEC's pressure on Roche in chemistry. The new Access2 immunodiagnostic line and the chemistry/ immunodiagnostic workstation will solidify the market share gain that BEC has enjoyed since the recall of Abbott's immunodiagnostic line. Every Access and Access2 system that BEC can place in Abbott's market absence will likely remain in place as a BEC customer after Abbott's reentry to the market. And lastly, the new hematology lines will build on BEC's market share gains in the reference lab customer base that BEC has enjoyed after the recalls of the Bayer hematology lines.

Molecular diagnostics represents one of the fastest growth segments within the industry and it is made up of technologies that essentially analyze the genetic material in cells: the DNA. Molecular diagnostics as a whole is a completely new segment of IVD that does not cannibalize on existing segments, therefore it poses no direct market share threat to BEC. PCR is by far the biggest market within molecular diagnostics, and PCR predominantly deals with infectious disease diagnoses (HIV, Hepatitis C, etc.). BEC has no significant market share in infectious disease microbiology, and therefore PCR is not a direct threat. However, PCR represents an opportunity in the longer term, as the DNA preparation steps for PCR will require lab automation that BEC provides. The market potential is estimated to be $1 billion in 2004. The other uses for molecular diagnostics will be for gene testing, which is a small and fragmented market still in the specialty testing phase. BEC has DNA sequencer product lines that will allow it to enter this space if the market ever becomes more than a specialty market. If it does, we expect BEC to be a player in the IVD genetic testing market.

2. ***BEC's life sciences business is well positioned for long term growth due to both internal technology platforms and external collaborations that capitalize on BEC's installed base in labs across the world . . .*** BEC will benefit from the large and growing biotechnology and drug discovery (life sciences) markets for two reasons, in our opinion. First, BEC will continue to leverage its expertise in designing automated system solutions for the IVD industry to designing systems and technologies for the faster growing and more profitable life sciences sector. Secondly, BEC will leverage its installed base in the hospital and reference labs around the world, with crucial superior sales and service support, as a distribution pipeline for a n increasing list of high growth companies that can run their reagents (DNA extraction kits, DNA probes, etc.) on BEC machines or need better access to the life science labs.

   BEC's current core life sciences business constitutes sales of liquid handlers and integrated robotic systems that are involved in many steps of the functional genomics and drug discovery research process. While revenues from this sector are only 22% of 2000 sales, a growing body of evidence suggests that this segment will be a meaningful contributor to growth over the next three to five years. The most obvious evidence to support this thesis is BEC's sales of liquid handling machines, which are growing at 40-50%. BEC's flow cytometry line, which also has IVD uses, is growing at nearly 10% and this does not include the tetramer revenue growth wildcard.

In addition to equipment sales, the development of proprietary reagents and tools to serve new market opportunities will also help drive growth. Examples of this include BEC's tetramer technology for T cell detection that can be leveraged across BEC's installed flow cytometry base in life sciences and eventually into the IVD market as tetramers become a clinical test. On January 16, BEC launched the first three lines of tetramer reagents to be used by AIDS and melanoma clinical trials. Tetramers have potential a market opportunity of more than $15 million within 18 months and $100 million within five years. Leveraging BEC's installed base of lab automation technology should be another growth driver in the future. Numerous collaborations with drug discovery companies have been signed supporting this thesis. Promega and XTRANA have recently formed alliance with BEC to load their reagents for DNA work onto BEC microtiter plates that will be run on BEC machines. These early alliances represent important steps toward BEC gaining more of the high margin reagent and consumable markets.

Beckman Coulter describes a biomedical continuum to explain how its strong worldwide presence in life sciences and clinical markets will provide a unique ability to leverage IVD strengths into life science growth (and vice versa in some cases). Usually, the IVD market potential for a test is greater than the basic research or specialty testing markets. Therefore, Beckman's strength in the slower growth IVD markets (distribution channels, service, cash flow, etc.) will facilitate development of new faster growing clinical tools and tests taken from its life science product lines.

3. ***A lack of focus by traditional medical technology analysts on the life sciences sector has inappropriately pegged BEC as a slow growth IVD company*** . . .The consolidation in the IVD industry along with the development of the genomics and life sciences fields has left BEC as the only public company in its "space". The current revenue base has prevented BEC from having the pure play life sciences tag that would put it in the company of Applied Biosystems, Waters, or Packard Bioscience. The lack of any other stand-alone IVD companies means, that for most of the analysts covering the company, BEC represents a universe of one. Investors do not own JNJ, ABT or Bayer for the diagnostic businesses and therefore the visibility of these businesses is relatively low. We believe the lack of focus on BEC (11 analysts cover the company versus over 30 for Medtronic) represents a huge opportunity. While it is true that the manifestation of these new growth opportunities will take time to develop, we believe that enough evidence exists to suggest an accelerating growth profile for BEC longer-term. Table 1 highlights the faster growing divisions of Beckman Coulter and Table 2 shows the revenue mix.

Table 1
Emerging Technology Growth Drivers in Life Sciences

	2000	growth	2001	growth	2002	growth	2003	growth	2004	growth	2005
Flow Cytometry (without tetramer revenue)	$162	7%	$173.34	10%	$190.7	10%	$209.7	11%	$232.8	12%	$260.8
Tetramers	$0	5000%	$5.10	200%	$15.3	125%	$34.4	100%	$68.9	75%	$120.5
Total Flow Cytometry	$162	10%	$178	15.43%	$206	18.54%	$244	23.55%	$302	26.38%	$381
Liquid Handlers	$121	21%	$146.41	24%	$181.5	22%	$221.5	22%	$270.2	40%	$378.3
Medium Throughput DNA Sequencers	$5	20%	$6.00	50%	$9.0	30%	$11.7	45%	$17.0	60%	$27.1
Alliances with Drug Discovery and Reagent Companies	$0	3000%	$3.10	75%	$5.4	30%	$7.1	100%	$14.1	150%	$35.3
Total Robotics/Genetic Analysis	$126	23.32%	$156	26.02%	$196	22.59%	$240	25.41%	$301	46.28%	$441
Total Potential of Fast Growers	$450	14%	$512	19%	$608	20%	$729	24%	$905	40%	$1,203
BEC Total Revenue	$1,889.10	5.3%	$1,989.10	7.0%	$2,127.70	7.9%	$2,296.30	9.1%	$2,506.40	12.3%	$2,815.00

Source: CSFB.

4. **Further industry shake-ups should be expected among the top six companies in IVD, and that BEC stands to benefit as the most stable franchise** . . . As is well known, the IVD industry has been under pressure for a number of years now, and the consolidation that resulted from these pressures has created an industry with six major competitors. Except for one private company—Dade Behring—all of the major companies except BEC are part of larger organizations. Dade has been struggling with financing issues and Bayer has been a rumored seller creating the possibility of further consolidation within the space. It is too early to speculate on the myriad of possibilities, but BEC has arguably the most stable franchise and stands to benefit from the turmoil as it has with ABT's recent immunodiagnostic line recall.

In Vitro Clinical Diagnostics Market Overview

Table 2
Beckman Coulter Revenue Mix

	2001E	growth	% of total revenue
Clinical Diagnostics			
Routine Chemistry	$551	4.1%	28%
Immunodiagnostics	$371	5.9%	19%
Hematology	$405	1.8%	20%
Flow Cytometry	$179	9.2%	9%
Particle Characterization	$40	1.9%	2%
Total diagnostics	$1,546	4.7%	78%
Life Sciences Research			
Robotics/Genetics	$155	27.2%	8%
Centrifuge	$288	-0.2%	14%
Total Life sciences	$443	8.1%	22%
Total revenue	$1,989	5.2%	100%

Source: CSFB and Beckman Coulter.

Description

Beckman Coulter's main business is in clinical diagnostics. Estimated at approximately $20 billion, the IVD market is one of the largest markets in health care. Virtually every hospital patient receives a diagnostic test during the course of an illness. IVD encompasses all of the medical tests that are performed on patient fluid or tissue specimens and processed in hospitals, doctor's offices, or homes. *In vitro* means "Within a glass, or observable in a test tube artificial environment". In essence, in vitro diagnostics refers to tests performed outside of the body on samples. Procedural tests performed on the entire patient, such as radiology or endoscopic tests, are separate categories that can be referred to as *in vivo*.

Historical and Estimated Future Growth

Reimbursement cutbacks took their toll in the 1990's on the IVD industry. However, we see reason to be optimistic that the IVD companies have adjusted to these hits and are restructured to grow under the new rules and managed care restraints. Overall, the IVD industry is estimated to grow at 6% from 2000 to 2004—several hundred basis points faster than what was seen in the last decade. Certain segments of IVD, such as molecular diagnostics, flow cytometry, and glucose monitoring are expected to grow significantly faster in the low teens. Beckman Coulter has positioned itself to compete in the new marketplace (consolidation, lab automation, etc.) and has a strong presence in all of the established IVD segments and most of the emerging markets. We expect BEC to beat the IVD industry average for growth and we will discuss this segment by segment below.

Consolidation to improve margins as a growth driver

Consolidation Trend

The challenge for the leading diagnostics companies has been to implement new growth strategies. Over the last four years, the industry has undergone significant consolidation in an effort to grow in the short-term by reducing operating margins through economies of scale. In the long-term, managed care and preferred purchasing agreements will reward the diagnostics companies that can supply a comprehensive list of products. Consolidation will be necessary to fill in the product line gaps of the companies, and therefore essential to survival in a managed care climate. The top ten companies are now responsible for 80% of the reve-

nues, as compared with only 67% of the revenues in 1995. The major remaining players in the IVD market, by total revenue, are listed in Table 3.

Table 3
The Big Six in IVD
revenue excluding diabetes monitoring

	2000E Rev.	2000 Growth	2000E Rev excluding diabetes	1999-2000E growth excluding diabetes
Roche Diagnostics	$3,800	8%	$2,000	10%
Abbott Diagnostics	$2,980	-3%	$2,500	-5%
J&J-Ortho	$2,000	4%	$980	5%
Bayer	$1,700	5%	$1,700	5%
Beckman Coulter (IVD only)	$1,500	5%	$1,500	5%
Dade Behring	$1,400	NA	$1,400	NA

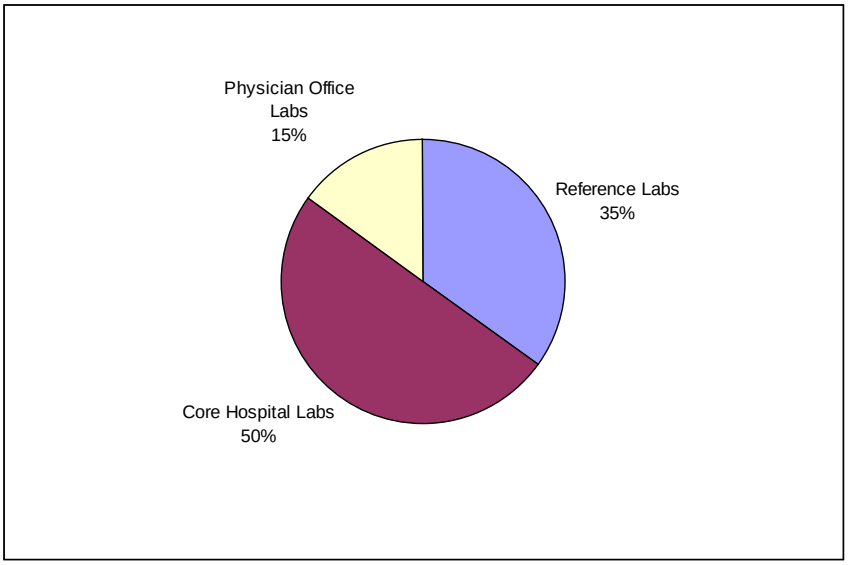
Source: CSFB.

More shake-ups are almost certain. Dade Behring has been close to bankruptcy (debt ratio of approximately 110%) and its main investor, Bain capital, has reportedly stopped supporting Dade. Also, the Bayer diagnostics division has been rumored to be a divestiture candidate and has had recent recall troubles with its hematology lines. In this climate, we expect that one or two of Beckman Coulter's main competitors to suffer major setbacks. As a profitable stand alone IVD company, BEC is one of the most stable companies in the industry and should gain market share as more consolidation occurs.

Changes in the Customer Base

Most IVD tests have been well established for up to 30 years and are in mature markets. Tremendous financial pricing pressures under the managed care system have hit the industry hard. As a result, overall growth for the IVD industry has been in the mid-single-digit range. Targeting the diagnostic testing expenses, managed care systems and HCFA have cut reimbursement rates and limited the ability of the doctor to order tests. HCFA has set limited approved panels of tests for reimbursement. Under the capitated payment systems, health care systems have turned to reference labs and ambulatory care treatment to cut costs. Both of these moves have shifted approximately 10% of the diagnostics business out of the hospital core lab. The Physician Office Lab (POL) market has also decreased and many of its functions have been transferred to the reference lab base, primarily owing to the CLIA-88 legislation that regulated which tests were allowed in the POL base. (See Figure 2.)

Figure 1
IVD Market by Customer Base



Source: CSFB.

We believe that this change in customer base from the hospital lab to the reference lab has stabilized and has partially reversed. BEC was not hurt by the transfer and possibly benefited from the shift. Last year, BEC took advantage of Bayer's woes in its hematology system recalls and formed an agreement with Quest Diagnostics, the largest reference lab, to be its sole provider of hematology. BEC also supplies Laboratory Corporation of America with most of its hematology and immunodiagnostics needs, even though Roche was majority owner at one point.

Total Lab Automation (TLA) Trend

With the strong pricing pressures from managed care and HCFA, the second near-term growth opportunity for clinical diagnostics should continue to be in automation systems that reduce the cost of manual labor in the laboratory. The reduction of occupational exposure risks by automation is another source of demand. Total Lab Automation (TLA) involves large capital equipment systems linked together by robots and conveyers. Core labs in tertiary care centers are the main customers. Smaller satellite labs that wish to gradually phase in automation can purchase less radical work cell stations.

The companies that develop successful automation systems should also be able to leverage market share growth with all of the tests that run on the automated systems. In other words, automation can potentially provide not only the revenue from the automation machines alone, but also the increased revenue from the gained market share in testing (reagents, test kits) as a result of leveraging the new tests that run on the automation. BEC has some of the strongest product lines in all segments of IVD to provide total lab automation. These will be discussed in more depth below.

IVD Segment Overview and Estimates

IVD tests are most commonly categorized into hematology, flow cytometry, coagulation, routine chemistry, and immunodiagnostics. Table 4 lists the top IVD companies ranked by IVD segment. Note that BEC has a strong presence in 100% of the routine IVD segments. This is crucial to compete for managed care contracts and one of the reasons for the consolidation in the industry.

Table 4
Major IVD Players and Rank by Market Share

	Beckman Coulter	Roche	Abbott	J&J	Bayer	Dade Behring
Routine Chemistry	2	1	4 or 5	4	NP	3
Immunodiagnostics	4	5	1	6	3	2
Hematology	1	3	2	NP	4	NP
Flow Cytometry	2*	NP	NP	NP	NP	NP
Molecular Diagnostics	NP	1	3	NP	NP	NP
Diabetes	NP	2	4	1	3	NP

NP= not a player

* Becton Dickinson is first

Source: Company reports, CSFB.

Hematology

Hematology

The Coulter company invented many of the principles still used today in hematology and was the hematology market leader as a stand-alone entity. After the merger in 1997, Beckman Coulter then became the market leader in hematology ($400 million hematology revenues for 2000). More important, BEC became a comprehensive IVD company that can provide 100% of the common IVD tests and more than 70% of the specialty tests, capable of meeting the needs of the new managed care customers.

Hematology is the division of diagnostics that analyzes the red and white blood cells. If a patient is anemic (low red blood cells) or has an infection or leukemia (high white blood cells), a panel of hematology tests can diagnose the ailment. Hematology tests are important to any basic medical workup. The assays work with the actual cells (huge particles compared with small molecules like DNA inside the cell or free-floating molecules in the blood serum) and fundamentally involve a counting process of the cells. The technology has not changed considerably for 20 years, and as a result growth has been stagnant. Automated counting, replacing human microscope slide counting, was a source of growth decades ago, but growth is now nearly flat.

For 2000, the overall hematology industry growth rate was flat at 0%. BEC hematology was down 2% because of foreign exchange and tough comparisons in 1999. Many labs had just upgraded with new versions of hematology machines and were not in the market for more. The estimated growth from 1999 to 2004 is 4%. We expect BEC to beat the industry average in 2001 owing to missteps by competitors (Bayer recalls in the reference lab market) and new product launches.

New hematology product launches in 2001

Several new product lines will be launched in 2001 that should drive the BEC hematology growth above the industry average of 4% by our estimates. The U.S. launch of the Ac•T Diff5, a small unit for POC labs, is scheduled for first half 2001 after it receives the closed-tube sample capability. Closed tube capability should be a significant development that would allow for complete automation from the receipt of the sample to the completion of the test and it will provide sig-

nificant occupational safety. Also, at the AACC meeting in second half 2001, the replacement line for the Gen•S launch is expected.

Coagulation

Coagulation tests measure how well a patient can clot their blood and stop a hemorrhage. A large patient population takes medication (Warfarin/Coumadin, etc.) that intentionally "thins" the blood to reduce the risk of life threatening clots on heart valves or leg veins. In these cases, frequent coagulation monitoring is needed to maintain the drug dosing within the therapeutic range. A test that could monitor the prothrombin time (needed for coumadin monitoring) in the home testing POC setting would have a large demand. Another common indication for coagulation tests is the preoperative evaluation to rule out coagulation disorders that would cause excessive bleeding during the operation.

Coagulation is a small segment of the IVD market ($700 million, or 3%) The estimated growth rate for the coagulation segment for 1999 through to 2004 is 5%, in-line with the hematology segment. BEC sells the ACL and Electra lines and stopped its distribution in the Japan market in 2000.

Tetramers and AIDS will propel double digit growth

Flow Cytometry

Flow cytometry, as used in IVD, is similar to hematology technology in that it involves working with whole blood cells. The cells are placed in a flowing column and detected by a laser system as they exit the flow stream. Various labels and fluorescent tags can be attached to cell surface markers to allow for cell differentiation. Flow cytometry is mostly used in the life science research lab arena for a multitude of different assays that detect specific surface markers on cells; however, AIDS has created a clinical use as well. T helper lymphocyte cells are the key cells depleted by the disease and measuring the level of T helper cells is an indication of the progression of AIDS. T helper cells can be distinguished by a surface molecule called CD4 and flow cytometry is the technology to detect CD4. Because of the size of the AIDS epidemic, the growth in flow cytometry has been in the 10% range and is projected to maintain that rate for the next two years or more.

The two main players in flow cytometry are Becton Dickinson and BEC, with Becton Dickinson (BDX) being the leader. BEC's flow cytometry revenue for 2000 was $162.7 million. We believe that BEC has gained ground in both the life science and IVD markets for flow cytometry by leveraging from its success with the IVD use in AIDS. Sales and service support are a significant deciding factor for a lab. BEC is uniquely capable of providing a strong sales and support service to both types of lab customers by leveraging its skill in the larger IVD market. Thus, we believe BEC has a competitive advantage and can continue to make progress in market share. Becton Dickinson flow cytometry revenues grew only 3% for fourth quarter 2000. Our estimated growth rate for BDX flow cytometry for full-year 2001 is 8%. The BEC flow cytometry growth rate for 2000 was 8% (13% in constant currency) and we estimate 2001 to be near 10%. Of note, BEC will introduce 36 new tests to the flow cytometry menu within two years.

Tetramer technology

Another reason we expect BEC's flow cytometry division to exceed industry average growth rates is the potential of its proprietary tetramer technology. Tetramers attach to cells of the immune system and allow a measurement of activated immune cells. Clinical trials evaluating new vaccines or drugs would benefit from rapid methods to determine whether the product being studied activates the immune system. One of the most direct methods to do this is to somehow measure the activation of the T cells. Tetramers do just this. By binding to specific T cell surface receptors that normally would bind to the vaccine or drug of interest, the tetramer complex can fluorescently label activated T cells. The detection takes

place on a flow cytometer. The tetramer proteins are made from recombinant DNA engineering using bacteria.

Beckman Coulter's strong alliances with university research provided them with the early opportunity with Stanford University to market tetramers. Now, BEC is the sole producer of commercial tetramers. BEC launched three lines of tetramers in early January. iTAg™ is the name of the product line. iTAg™ HIV gag and iTAg™ HIV pol are for AIDS research. Each has a portion of the HIV coat, serving as an antigen, complexed into the tetramer that is known to elicit an immune response. The third product launched was the iTAg™ Melanoma MART-1 for cancer research. It has an antigen in the tetramer that elicits an immune response like that seen with melanoma cancer cells.

The success of the tetramer lines will not only mean revenue from the iTAg™, but also an increase in flow cytometry equipment. 2001 will be a ramp up year with only $2 million in revenues and 2002 will conservatively have $25 million in revenue.

Routine chemistry

Routine Chemistry

Routine chemistry is responsible for approximately 40% of the total $20 billion worldwide *in vitro* diagnostics market. BEC, with revenue of $527.1 million in 2000, is second only to Roche in this segment. Chemistry encompasses thousands of different tests that analyze the noncellular plasma (or fibrinogen and platelet-free serum) portion of blood that is obtained after spinning down a whole blood sample using a centrifuge. In general, a routine chemistry test involves adding a certain reagent to the sample that invokes a visible color change reaction that can be measured by an optical spectrophotometer. Some common panels of tests approved by HCFA for reimbursement are listed in Table 5.

Table 5
Common HCFA-Approved Chemistry Panels

Basic Metabolic
BUN/Creatinine BUN calcium creatinine glucose sodium potassium chloride CO2
Comprehensive Metabolic
A/G ratio globulin albumin alkaline phosphatase bilirubin total bilirubin direct SGOT/AST SGPT/ALT total protein BUN/Creatinine BUN calcium creatinine glucose sodium potassium chloride CO2
Lipid Profile
LDL Cholesterol Glucose Triglyceride
Hepatic Function
alkaline phosphatase bilirubin total bilirubin direct SGOT/AST SGPT/ALT total protein
Electrolytes
sodium potassium chloride CO2
Renal Function
albumin BUN calcium creatinine glucose phosphorous sodium potassium chloride CO2

Source: CSFB and Cindy Hall.

Routine chemistry has taken the biggest hit from the reimbursement clampdowns from HCFA and managed care. Growth has been barely positive and estimated to remain that way at 2% from 1999 to 2004.

Total lab automation and workstation consolidation are the important growth strategies in the chemistry segment. BEC has a strong product line in both, and in addition will launch a new chemistry/immunodiagnostics platform at the AACC meeting in late July of 2001. As a result, we estimate BEC's chemistry division revenues to grow at more than 5%, slightly faster than the industry average.

Synchron LX-20

The Synchron LX-20 has been the featured high volume chemistry line over the last two years. Roche offers the best competition with its Integra line. The BEC LX-20 requires less maintenance, is faster at processing critical care tests, and offers a menu of 100 tests. The Roche Integra line can perform certain tests for proteins that the LX-20 cannot so it offers a larger menu of 150 tests. The Abbot chemistry line offers no significant advantage over the BEC LX-20 in our opinion. The LX-20 PRO will be the only chemistry line with closed tube sampling capabilities and will be shipped in 1H:01. This will be a significant feature that should capture market share from Roche. The sample preparation steps in IVD (opening the tubes, labeling the tubes, sample inspection, etc) account for 65% of the labor and time in testing. Additionally, a fully integrated chemistry/immunodiagnostic workstation called the LXI line will be featured at the AACC this year and shipped in second half 2001.

Immunodiagnostics

Immunodiagnostics

Immunodiagnostics is one of the fastest growing segments of IVD at 6 to 8%. It is also one of the largest segments at approximately 40% of the entire $20 billion diagnostics market.

Immunodiagnostics describes the groups of tests that use antibodies to detect specific molecules (antigens) in blood or fluid samples. The antigens can be molecules of drugs, surface markers of cancer cells, hormones, unique proteins secreted with a certain disease, etc. Antibodies are large molecular weight proteins produced in humans by the B cells (a type of white blood cell) as important mediators of the immune system. They can be engineered in mice or bacteria as well. Portions of an antibody fit hand and glove to a region of the antigen molecule being detected by the clinical test.

Immunodiagnostics is a broad term and can be further segmented as follows:

- Cancer Diagnostic Tests (e.g., PSA, CEA, CA-125)
- Drugs of Abuse Screening
- Therapeutic Drug Monitoring (e.g., Digoxin, Theophylline, Vancomycin, Lithium)
- Endocrinology Tests (e.g., Testosterone, Thyroid hormone T3 & T4, Prolactin, ß HCG for pregnancy, FSH, LH)
- Immune Diseases Testing
- Blood Typing

Unlike the relatively stagnant development of new tests in the other segments, many new immunoassays are being launched and new tests can be a source of growth. BEC's free PSA test for prostate cancer, drugs of abuse screens, and cardiac enzyme panels for heart attack have been newly developed test with large market size. In 2001BEC will release more cardiac tests (troponin, enhanced CK MB, and myoglobin) that will continue the growth.

Within the immunodiagnostic menu of tests, different technologies and instrument lines are used depending on the molecule being for which the test is aimed.

Larger proteins of interests, such as prealbumin or immunoglobulins are too large for spectrophotometry and are detected by tests that use nephelometry. Nephelometry detects the amount of light scatter that occurs when the large antibody-antigen complexes form and precipitate out of solution. For smaller molecules, spectrophotometry is used to detect the chemiluminescent antibody-antigen reactions.

The Access system and Abbott's missteps

The Access ® line, purchased from Sanofi in 1997, is Beckman Coulter's chemiluminescent immunodiagnostic system. Access is a high throughput system that can process 100 tests per hour. BEC was second in market share in immunodiagnostics behind Abbott until Abbott's flawed production process was issued with an FDA decree on November 2 of 1999 forcing the halt of marketing. The result for BEC was an opportunity to gain temporary, and perhaps long-term, market share over Abbott. An estimated $10 million in market share for BEC immunodiagnostics in 2000 can be attributed to the Abbott recall. The Access line revenue grew 20% in 2000. Abbott's latest estimates for returning to the market are mid 2001. Since many of Abbott's customers have switched to BEC lines, the switching cost back to Abbott will be great. To help retain the market share growth BEC has enjoyed in the absence of Abbott, the Access2 line will be launched in 1H:01. The LXI workstation mentioned in the chemistry section will be another product to solidify the market share gains that BEC has made.

The Image® and Array® lines are BEC's nephelometry instruments. Recent trends in the European IVD market have negatively affected these lines. In Europe, the nephelometry assays have switched over to chemistry instrument platforms rather than immunodiagnostic platforms. In addition, reimbursement for these tests has been cut. As a result, the nephelometry business fell by 13% in 2000 offsetting the 20% gain in the Access lines giving a total immunodiagnostic growth of only 2%. The LXI workstation consolidation platform, to be introduced in late 2001 by BEC, could reclaim some of this lost business. For BEC's total immunodiagnostic segment, we project a 6% to 8% growth rate for the next three years.

PCR can revolutionize microbiology

Microbiology

Microbiology is the segment of IVD that involves detection of infectious disease microorganisms such as bacteria, fungus, and viruses. The traditional tests have changed very little fundamentally over decades. They involve the culturing of a specimen to grow up the organisms to detectable levels in a petri dish. These techniques are usually too slow and require considerable manual labor. Most antibiotic drug therapy is initiated long before the final results of the cultures are known. Moreover, viruses and some bacteria are very difficult and expensive to culture at all. In most cases, the instrumentation system for microbiology tests is essentially just a microscope and a petri dish, which is the reason many IVD companies have neglected this segment. To address these problems, molecular diagnostic methods, in particular Polymerase Chain Reaction (PCR), have been developed as much quicker and more accurate ways to perform microbiology diagnostics. (See molecular diagnostic section.)

Beckman Coulter does not have a significant presence in the microbiology segment. As a result, the growing market of PCR and other DNA probes, as discussed previously, will not pose a direct threat to Beckman revenues.

New Market Opportunities

In addition to consolidation and lab automation as growth sources, we will discuss throughout this report several emerging technologies that have the potential to be growing new markets in IVD.

Molecular diagnostics

Molecular diagnostics has been around for decades and the technology is now improving to the point where it can be a clinical tool. Molecular diagnostics refers

to the group of technologies that deal with nucleic acids (DNA, RNA). The word "molecular" can be thought of as synonymous to "nucleic acid" or "DNA" for the purposes of this report. The most notable molecular diagnostic technologies are:

- DNA sequencing
- Polymerase chain reaction (PCR)
- Single Nucleotide Polymorphisms (SNPs)

Combined, we believe that these segments have a potential market in excess of a billion dollars in the next two years. BEC has a strong direct presence in the DNA sequencing and SNP technologies as well as an indirect presence in PCR through its products that prepare DNA for PCR. BEC is in planning on obtaining FDA approval to use its liquid handlers in the clinical labs for clinical PCR preparation. Tecan is doing this now.

DNA sequencing for HIV genotyping

DNA sequencing, the workhorse technology from the genomics industry (*see appendix for description*), is finding an IVD clinical application with sequencing the HIV (human immunodeficiency virus) of AIDS. HIV mutates frequently causing resistance to therapeutic drugs, and determining the type of HIV strain by its DNA sequence has a direct therapeutic impact. Visible Genetics and Applied Biosystems are currently obtaining FDA approval for small automated DNA sequencers to fit into the IVD lab setting. BEC recently launched a line of DNA sequencers (the CEQ, discussed in more detail in the life science instrument section) for life science genomics use that will also potentially allow BEC to compete down the road in this IVD market. The Oncotech alliance BEC formed last fall should be a step in this direction.

PCR

PCR has the largest market opportunity in molecular diagnostics over the next three years. In 1999, the worldwide market was greater than $600 million and expected to grow at a pace of more than 15%, or double the IVD industry average. The estimated 2004 total worldwide market is in excess of $1 billion. Roche is the owner of the key intellectual property for PCR, and as a result dominates this market. Through a license agreement with Roche, Applied Biosystems (ABI) is also making a move for the IVD market of PCR, in addition to their life science research PCR line. ABI recently hired a top executive from Roche to spearhead their sales efforts into the IVD market.

BEC does not have a direct presence in PCR with a PCR line of its own, therefore PCR is not a direct threat to market share for BEC. Moreover, PCR is not a threat to any of BEC's IVD segments since PCR is used predominantly for infectious disease microbiology purposes now, and BEC has no significant microbiology division. Indirectly, PCR is an opportunity, although more in the life science application of PCR, since the numerous steps required to prepare the DNA sample for PCR require lab automation instruments such as BEC's Biomek liquid handler and Sagian robotic systems. As we mentioned, BEC is planning on obtaining 510K FDA approval for this purpose in the clinical PCR application. The new Roche clinical PCR machines are more automated than the instruments in the life science labs and do not require the same extent of sample preparation and lab automation.

PCR was popularized by the forensic science industry in famous criminal cases. PCR amplifies very small quantities of DNA to levels that can be detected by analyzing equipment. Since each organism has a unique genetic code that can serve as a fingerprint, PCR provides one of the most precise ways to identify organisms. Certain infectious disease agents, such as HIV, chlamydia, Hepatitis C, and others have been difficult to identify by traditional culture methods. HIV and hepatitis pose a risk to the blood supply, and the ability to monitor HIV levels during therapy facilitates treatment, therefore PCR has emerged as a test with a large sustainable growth rate for several years to come. Another emerging mar-

ket for PCR is genetic screening studies for cancer and other inheritable diseases and is discussed below.

SNP "snips"

Single Nucleotide Polymorphism's (SNP) are discussed in more detail in the Biotechnology/Drug Discovery appendix, but briefly, a SNP is a single alteration in one of the "letters" of DNA that creates a unique DNA pattern for each organism. Although each person is more than 99% identical genetically, SNPs are the most common type of variability responsible for the 1% difference (other polymorphism's exist other than SNP). This variability is responsible for different responses to drug therapy (e.g., adverse reactions or no response at all) or may cause a susceptibility to certain diseases such as cancer or diabetes. The ability to detect and score the SNPs of a patient would allow more custom drug therapies, reduce adverse reactions, and earlier detection of disease. In the research phase of product development, SNPs can allow the clinical trials to focus on the patients likely to respond to the therapy and expedite trials by reducing enrollment requirements.

SNP screening is years away from becoming a new IVD segment by our estimates. However, one of the likely platforms that will be used to detect SNPs is DNA sequencing, and BEC has a product line in sequencing. Sequencing a short fragment of DNA is in many ways easier than amplifying it with PCR or screening with microarrays, therefore sequencing may be the method of choice in the near future. The Beckman Coulter CEQ 2000 is a medium throughput sequencing machine for the life science labs. While Applied Biosystems dominates 80% of this market currently, a future underappreciated benefit of the CEQ is that it will give BEC an excellent platform from which to develop sequencers for SNP product lines in IVD. Beckman is already significantly involved with SNPs on the life science side with the collaboration with Orchid Biosciences (an SNP company). BEC provides the laboratory instruments (fluid handlers, robotic systems, other analytical systems) for the Orchid SNP system. BEC has a uniquely strong worldwide presence in both the lifesciences, such as with Orchid Biosciences SNP technology, and the IVD business that will create leveraging opportunities to transfer life science products into the IVD market.

Microarrays

DNA microarrays (*see Biotechnology/Drug Discovery appendix*) are another technology that can analyze for SNPs. But in our opinion, microarrays will serve the postgenomic industry best where investigating thousands of SNPs simultaneously is essential. Once the few clinically relevant SNPs are identified, the ability to screen for thousands of SNPs on an array will not be as crucial, and DNA sequencing should be the preferred method.

BEC has a foot in the door with microarrays if they do become an appreciable IVD market. BEC holds crucial patents from the famous Dr. Southern (inventor of Southern Blot, microarrays, etc.) and has negotiated arrangements with Affymetrix, the leader in microarrays, to codevelop other array systems in addition to the GeneChip® line of Affymetrix. Essentially, BEC has the right to either license technology from AFFX or develop its own microarray platform when BEC so desires.

Automated histology

Almost all IVD tests are performed on fluid samples and we think that solid tissue pathology specimens are a huge untapped market for IVD. Histology is the process of preparing solid tissue and slicing it into thin sections for viewing under a microscope. It has been a manual and labor-intensive process until recently. Ventana Medical Systems has pioneered an automated histology system that promises to create a much larger market for histology. Genetic screening of tumor specimens is one of the many types of assays that will use this technology. BEC has no product line in this space and automated histology poses no direct market share threat to any of BEC's divisions in our opinion.

In situ hybridization and immunohistochemistry

Immunohistochemistry (IHC) uses antibodies designed to bind to specific disease markers in or on cells of a solid tissue specimen. The advantage is that, since the tissue is in tact, the cells with the marker can be localized. For example, under a microscope one can determine whether the markers are in cells within a tumor or outside of a tumor.

Similar to IHC, *in situ* hybridization (ISH) uses solid tissue histology. Rather than antibodies, ISH uses probes (short single stranded portions of DNA or RNA that bind to any complementary mirror-image strands in a specimen) to detect for the presence of a genetic marker in a solid tissue sample. The Her-2/neu gene for breast cancer is the only IVD product currently, but in addition to the IVD uses, there are many applications for ISH in the drug discovery industry.

BEC is not in this space, however we feel it is significant enough to mention. As with PCR, BEC has no current IVD segment that will be threatened by ISH or IHC. The other major IVD companies are also not involved significantly with automated histology and IHC and ISH. Ventana Medical Systems is the pioneer in IHC, ISH, and automated histology. An estimated 20 million slides are processed with IHC or ISH technology worldwide, and less than half are processed using automated histology. Therefore, the market has significant penetration potential.

Genetic screening for disease markers

Genetic screening assays for disease markers, such as the BRCA and Her-2/neu genes for breast cancer, are an emerging type of IVD test. This is currently a fragmented market with the tests performed by reference labs on a specialty testing basis. PCR is the most common technology used to detect the markers. DNA sequencing and In Situ Hybridization (ISH) are others. BEC has the CEQ DNA sequencer line that could serve as an excellent platform to enter the genetic testing market if it ever pans out to be more than a specialty testing market.

Microfluidics

Many investors have recently been interested in microfluidics as it pertains to either a threat or an opportunity to the IVD industry. Microfluidics is another technology from the genomics/biotech industries. Microfluidics essentially is a mechanical and electrical technology that allows microvolumes (nanoliters) of reagents to be used to run assays. Reagents are costly and the main benefit to microfluidics is cost reduction. Conceivably, many of the current chemistry and, immunodiagnostics IVD testing platforms could be replaced by microfluidics. Technological limitations will prevent much current IVD testing (such hematology and many immunodiagnostic assays) from being run on the microfluidics platform, as larger volumes are required.

Regarding this threat potential, Caliper Technologies (partially owned by Roche) is the leader in this field and we are confident that they neither have any known plans nor are capable of going after the IVD market. ACLARA Biosciences is the other key player and also cannot (or does not want to) go after the IVD market. Therefore, the threat to IVD from microfluidics is nonexistent for at least the next two years, by our analysis.

In addition to the technological hurdles, significant FDA and other regulatory hurdles are in the way of any IVD opportunity with microfluidics. At this time, BEC does not have any significant projects in microfluidics.

Revenue Sources

Razor/Razorblade: Reagents are most of the revenue

Much like the razor and razorblade cliche, approximately 70% of the overall diagnostics revenue comes from the reagent solutions and consumable throwaways that are required for the processing of each test. The instrumentation systems make up most of the remaining revenue. BEC's total revenue is 68% reagents/consumables and 32% instrument capital equipment.

Customer Segment Bases

The consumers of IVD reagents and instruments are in four major settings:

Central Core Labs These are the traditional labs based on the premises of the hospitals. They process the common tests for the patients admitted in the hospital. Specialty tests, such as genetic tests, are sent out to reference labs.

Labs are moving out of hospitals

Reference and Ambulatory Labs Reference labs (*aka* commercial labs) are usually located outside of the hospital setting in an independent location. They perform tests on a contract basis for many institutions, HMO's, and PPO's and therefore can achieve certain economies of scale. They also perform relatively uncommon specialty tests for hospitals that do not want to invest in the equipment. Various regulatory differences also allow the reference labs to cut corners in some ways to reduce costs more than the central hospital core labs. Mainly, reference labs do not need to meet FDA requirements to run many of their tests. Hospital labs are limited only to running tests that have been FDA approved. Ambulatory refers to the outpatient, non-admitted, setting such as a clinic or doctor's office. The ambulatory tests usually are sent to reference labs for processing. Pricing pressures of managed care (*discussed below*) had led to a transfer of some testing from the central labs to the less expensive reference labs but this trend has stabilized. BEC supplies the two largest reference labs, Quest and Laboratory Corporation of America, with most of their instruments and reagents for the routine studies in hematology and immunodiagnostics. For the routine chemistry tests, Hitachi supplies the reference labs with much of the equipment.

Point of Care (POC) POC refers to labs in settings that perform the tests at the site of patient care (emergency rooms, physician offices, patient homes, etc.) and return rapid results. The purpose of POC is two-fold:

1. to improve therapeutics with rapid results (e.g., heart attack markers like troponin), and
2. to hopefully provide cost reductions.

The latter has yet to pan out in most cases. Most POC tests are sold at a premium to standard tests. However, the stringent pricing pressures and lack of effect on the overall therapeutic outcome have made many POC products an unjustifiable expense and the POC market a disappointment. Eventually, advances in technology should make POC tests more prevalent whether or not they result in large revenue growth.

Patient Self Testing (PST) Diabetes blood glucose self-testing comprises a significant portion of the PST market. For 1999 it was more than $3.6 billion and growing at 15%. BEC does not have a diabetes monitor line and is the main reason for the differences in total revenue and growth rates between Abbott, Roche, and J&J that do have glucose products. One must be careful to compare apples to apples when looking at each company's performance. (See Tables 2 and 3.)

The New Paradigm of Comprehensive Disease Management Companies

Disease management

Disease management is the concept of capturing the entire spectrum of the disease from prevention and screening to diagnosis, to therapy and monitoring of therapy, and finally to monitoring for recurrence.

Synergies are back

Diagnostic Synergies of the Disease Management Paradigm

In the 1980's, many larger industries acquired IVD companies seeking synergies to their various health care divisions. Then, the DRG's of HCFA and managed care reimbursement cutbacks hit the diagnostic divisions hard and the parent companies lost patience. They divested the IVD companies. Now with a bit more of a cautious approach, those synergies are being sought once again, but the pharmaceutical companies are not necessarily going as far as acquiring IVD companies this time. Skeptics point out that the lower profit margins and slower growth of the *in vitro* clinical diagnostics industry slow down the growth of the more profitable pharmaceutical sector. Proponents point out that the entire "Disease Management" market (diagnostic tests, disease monitoring tests and drugs) is larger than each subcomponent, and that by incorporating IVD with pharmaceuticals they can together synergistically create the larger disease management market.

Examples of synergy

Synergies that Increase Demand

- Because of the frequent development of HIV drug resistance, the ability to monitor virus levels throughout therapy has improved the treatment of AIDS by allowing the physician to tailor the treatment. PCR is the technology that monitors HIV levels. Combining the PCR diagnostics with the HIV drug therapy has improved the effectiveness of therapy and increased the demand for both drug and diagnostic products.
- The "flu" (influenza) is a devastating seasonal illness and also treatable. However, it is often treated too late and many cases of false flu are treated drugs meant for the real flu virus. Flu virus genotyping that could rapidly identify those with the real flu would increase the success rate of treatment and ultimately increase usage of the drugs.

Synergies that Increase Market Size

Many IVD tests not only make the initial diagnosis, but are used to monitor the drug treatment effectiveness and disease recurrence. By realizing this larger disease management use of both drug and test, the overall market for each test can be increased. BEC has several disease management products that include:

- Hemoccult® test for colon cancer
- Hybritech® free PSA for prostate cancer, recognized as the superior test
- Hybritech® Ostase® for osteoporosis
- FlexSure HP for peptic ulcer disease (H. Pylori diagnosis)

Synergies that Expedite New Products to Market

As mentioned earlier, SNPs have the potential of greatly expediting and lowering the cost of new drug development by selecting trial subjects that have the disease targeted by the drug in development.

Beckman Coulter's Biotechnology/Drug Discovery Product Lines

Before we begin our analysis of Beckman Coulter's life science divisions, we refer investors interested an overview of these areas to the Biotechnology/Drug Discovery Appendix.

Beckman Coulter's fastest growing divisions are in the life science side. The mapping of the human genome has moved us into the postgenomics era and has created a tremendous demand for instruments and reagents that work with DNA and proteins. The functions of each of the 60,000-80,000 genes of the human still need to be determined (functional genomics) before any clinical application and products can be developed. An even larger task is to determine the functions of the proteins made from the genes (proteomics). The key to accomplishing these efforts in a timely fashion is to use automated high throughput tools. Beckman Coulter is the leader with many of these instruments and positioned very well to take advantage of theses rapidly growing markets. Table 6 summarizes the equipment and ranks the competition. Table 7 shows the revenue and growth rates for the BEC lines.

Table 6
Life Science Instrument Makers by Market Share

	Beckman Coulter	Tecan	Packard	Zymark	ABI	Amersham	MicroMass
Liquid handlers	1	2	3	NP	NP	4 or lower	NP
Robotic systems	1	3	3 or lower	2	NP	4 or lower	NP
DNA sequencers	new entrant	NP	NP	NP	1	2	NP
Flow cytometry	2	NP	NP	NP	NP	NP	NP
Capillary electrophoresis	1*	NP	NP	NP	NP***	NP	NP
Mass Spectrometry	NP	NP	NP	NP	2	new entrant	1
Centrifuges	1**	NP	NP	NP	NP	NP	NP

NP = not a player
* number 2 is Agilent
** Hitachi is number 2, Kendro is number 3
*** not a player in CE other than sequencers

Source: CSFB.

Table 7
BEC Revenue and Growth in Life Sciences

Beckman Coulter	2000 Revenue	99-00 Growth Rate
Liquid handlers, Robotis systems, DNA sequncers	$128 mill	40%
Flow cytometry	$161 mill	3%
Centrifuges	$295 mill	-2%

Source: Company reports, CSFB.

Tools of the Genomics Industry

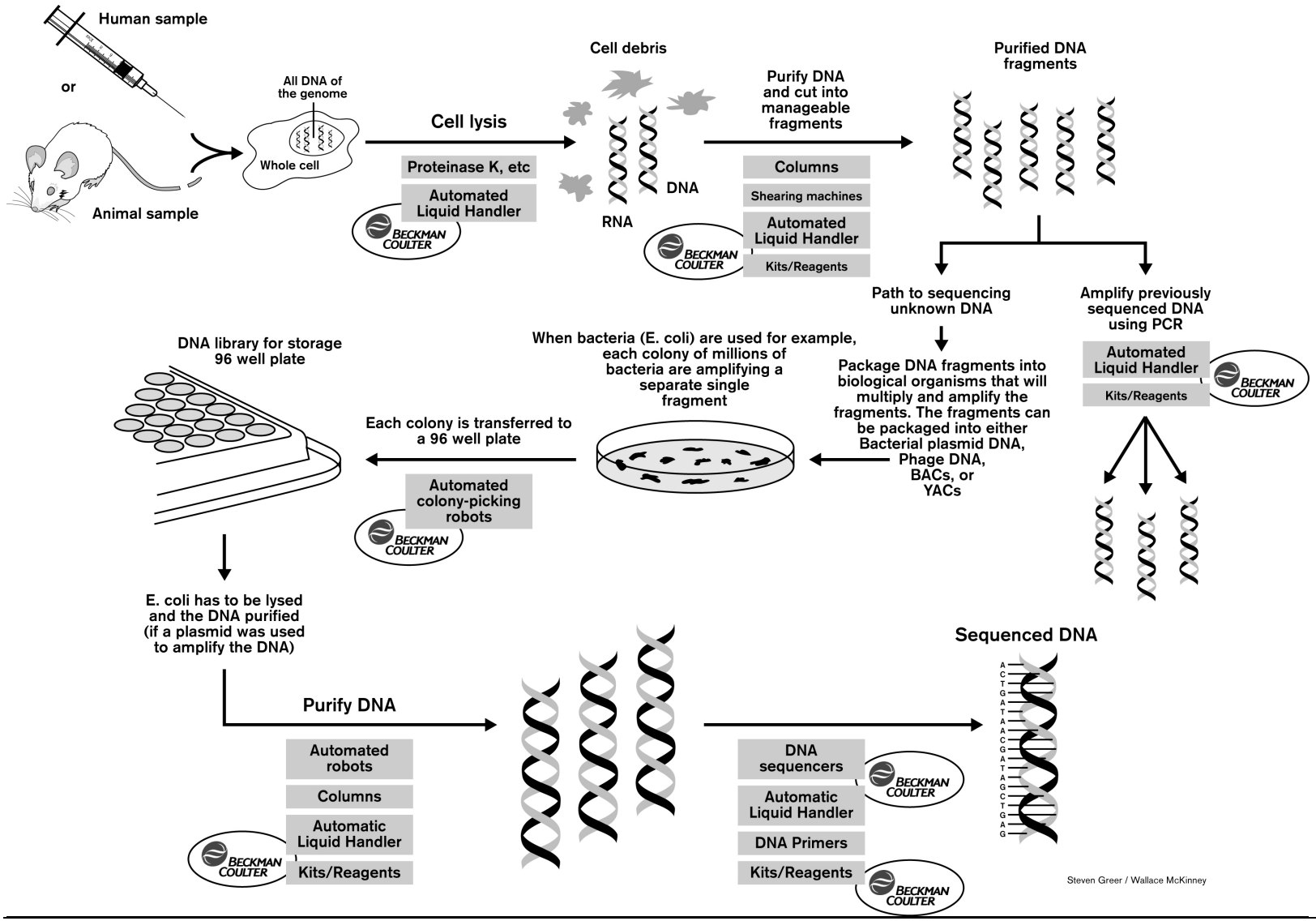
The genomics industry consists of the group of companies that are working primarily on understanding the functions of human genome or make the instruments required for the process. The genomics industry companies do not actually develop clinical products, such as drugs, as do the biotech and drug discovery companies.

Preparation for sequencing

DNA Preparation Reagents and Instruments

Before actual DNA sequencing occurs, preparation requires that the very small quantities of DNA in each cell be isolated from the rest of the cellular material, purified, fragmented, and stored in a DNA library. Also, to initiate each sequencing reaction a short stretch of DNA called a primer is required. DNA preparation is fundamental to almost all aspects of genomics. Virtually every step of this process can be automated, and liquid handlers and integrated robotic systems are the workhorses of the process. Figure 3 is a schematic that lists most of the major steps common to genomics work and shows where the tools fit in. In addition to the instrumentation, many reagents and consumables are required. It is evident from this figure that BEC, through its leading product lines, is positioned to grow as the genomics industry grows.

Figure 2
Where Beckman Coulter Products Are Used in DNA Preparation



Source: CSFB.

Biomek FX Automated Liquid Handling System

As demonstrated in Figure 3, many steps in the process of working with DNA and proteins require transferring fluid reagents and samples from one station to another. This was performed in the past by manual pipetting and was very labor intensive until lab-automated liquid handlers were developed. Liquid handlers typically move a head of suction tips in X, Y, Z grid coordinates to transfer small volumes of fluid between microtiter plates. The automated sample preparation market is approximately a $2 billion market growing in excess of 20%. Beckman Coulter is neck and neck with the Swiss company Tecan as the leading manufacturer of liquid handlers. The BEC line of Biomek liquid handlers is growing at 40-50% in terms of revenue. The Biomek FX began shipping last year in July and the fast revenue ramp of 2000 will create tough comparisons and slower growth in second quarter or third quarter of 2001, but the growth should still be in excess of 20%.

The Biomek FX series and has been the star of the life science division for 2000. Units have been placed in a wide range of labs from small academic labs to large drug discovery labs. As shown in Table 5, revenue for this division is soaring as the demand from the biotech and drug discovery companies grows. BEC does not break out revenue by product line, but the Biomek was responsible for most of the 39% growth in the life science division in 2000. An additional growth driver could come with the addition of a new clinical IVD application for the liquid handlers. The molecular diagnostics tests (PCR, DNA sequencing) require extensive preparation of the samples to obtain adequate DNA samples. The Biomek is the instrument that can automate this complex process. BEC is working on the 510K approval for this application. Tecan is already in this clinical market with its liquid handlers for PCR preparation.

The worldwide service and support of Beckman Coulter is perhaps the biggest competitive advantage if the Biomek. This cannot be emphasized enough. In addition, the Beckman liquid handlers are modular and can be "plugged and played" to provide custom systems to each lab's different needs. This is important in integrating each lab with an automated robotic core lab described in the next section.

Depending on how the market is defined, Tecan is number one or two and Packard Biosciences is number three in market share. Tecan has what is regarded as a fine line of liquid handlers and is often the innovator in new design. The Biomek of BEC and the Genesis of Tecan have similar designs with the service of BEC being a major differentiating factor. The strong cash flow from BEC's IVD and centrifuge divisions allows BEC to have a service team that is ten times larger per installed unit base than Tecan. Tecan formed a distribution alliance with Abbot to combine the Tecan Genesis preanalytical sample preparation system (automated test tube top removal, tube labeling, etc.) with the Abbot immunodiagnostics IVD system. Of note, the BEC Synchron PRO automated chemistry system will have closed tube capabilities where the tops are not removed at all, adding safety and convenience. The Packard liquid handlers are more similar to the BEC Multimek line (OEM'd by Packard for BEC). Packard has been a leader with smaller volumes (384, 1536 well microtiter plates) and tips that distribute very small volumes using the same technology as in ink jet printers. Packard is in the same position as Tecan regarding service.

Innovations to the Biomek line will include tube-to-plate capability and 384 well microtiter plate capability. Tube-to-plate will be very important for BEC's strategy of moving products from the research to clinical markets. Automating the handling of the patient blood tubes will be a key feature.

Consumable revenue comes from the disposable pipette tips and microtiter plates. In addition, BEC has been forming key strategic alliances with the many suppliers of the reagents and kits required for genomic and proteomic work. The reagent market is fairly fragmented, and most of the reagent companies would benefit from using BEC's large established distribution network with the genomics, biotech, and drug discovery labs. The Promega distribution agreement last year will give BEC a DNA purification reagent kit to distribute with the Biomek line. The revenues will be split between the companies. Figure 3 shows how fundamental and ubiquitous reagents of this nature are in the genomics industry. The XTRANA deal announced in January 2001, for DNA extraction reagents, is another example of BEC expanding into the reagent market. The total market for reagents used in the drug discovery, biotech, and genomics industries is $1 billion. As the functional genomics and proteoimcs (*see appendix*) companies grow in the postgenomics era, so will the demand for reagents. In addition to the current alliances, we expect several more per year to be announced. As clinically relevant SNPs and genetic disease markers are discovered, the IVD applications should greatly expand the market. We expect that by 2004 all of this will occur and BEC will have $14 million or more in molecular diagnostic reagent revenue.

Figure 3
Biomek FX

Source: Beckman Coulter.

Sagian™ Integrated Robot Systems

To transfer the microtiter plates to different stations, such as from a liquid handler to a DNA sequencer, robotic arms that move on tracks can be integrated into a core-automated system. BEC's Sagian systems were the leaders in modular automation. Buy standardizing the systems and software (SAMI®), separate units can be added simply by "plug and play". This, and BEC's well-known service support, are the strong advantages of the Sagian system and the reason biotech companies, such as Orchid Biosystems chose BEC. Orchid uses the BEC Sagian integrated robotic system and liquid handlers internally to develop its SNP products. On an OEM basis, Orchid uses BEC products as part of its SNP-IT system.

Table 5 illustrates the rapid revenue growth in this segment. Tecan does not have its own robotic arm line and recently got into this market by distributing the Mitsubishi robot. BEC's Orca robot is made internally.

Figure 4
Sagian Integrated Robotic System

Source: Beckman Coulter.

Making the primers

Oligonucleotide Synthesizers and Reagents

Oligonucleotides are short fragments of DNA. When synthesized in single strands, they are the probes required to initiate DNA sequencing, PCR, and many other reactions common in genomic work. Beckman has been in this market for more than a decade. BEC provides a high margin DNA synthesis reagent line that is used on the large lines of machines by Applied Biosystems and others. This market is fragmented small portion of the overall $1 billion reagent market. The competition consists of many relatively small companies, such as Qiagen and Gene Machines.

PCR

Polymerase Chain Reaction (PCR)

DNA Sequencers Mapping the genome first requires the DNA samples to be prepared into manageable fragment sizes as we just outlined. After that, the sequencing machines and massive bioinformatic computer systems are put to work. To summarize the process, DNA sequencing method used by the fastest Human genome teams involves randomly breaking up the fragments of DNA into smaller fragments, then attaching known fluorescently labeled nucleic acids to the ends of each fragment. These fragments are then run through long capillary tubes filled with gel. Electric current is applied to pull the molecular fragments through the tube in a process known as faster, and therefore the size of the fragments can be determines by the rate of capillary electrophoresis (CE). The smaller fragments consistently travel passage through the tube. With a known-labeled nucleotide at each end, the size (length of the strand as measured by molecular weight) and type of nucleotide at the end can be correlated. With sophisticated mathematical analysis, the entire continuous strand sequence can be deduced. For an excellent beginning overview of the process, we recommend the flash movie on the Celera Corporation Web site:

(http://cds.celera.com/genomics/geneed/c/c/geneed/geneed.cfm)

BEC launched the CEQ 2000XL medium throughput DNA sequencer last year and it received a “strong acceptance” according to BEC. Although Applied Biosystems dominates this market, the medium throughput machine is a niche market for the smaller labs. The main advantage of the CEQ is that it can sequence longer fragments of DNA (700 base pairs) at higher degrees of accuracy using BEC’s superior capillary electrophoresis tubes and gels.

Specifications DNA sequencer specifications are as follows:

1. *Dye-Terminator Cycle Sequencing (DTCS).* Optimized 4-color DTCS methods:
   - 700 bases at better than 98% accuracy
   - At least 100 runs per capillary; eight capillaries/array
   - 100 samples/gel cartridge
   - 100 samples/DTCS kit
2. *Fragment Analysis.* Optimized fragment analysis methods:
   - Eight samples read to 350 bases in approximately 45 minutes
   - At least 100 runs per capillary; eight capillaries/array
   - 100 samples/gel cartridge
   - Detectability; ± 1 base at 400 bases, ± 2 bases at 600 bases

A long-term benefit of the CEQ line that we feel is unappreciated is that it gives BEC a platform to enter molecular diagnostics on the IVD side of the business. Although most estimates have the high throughput sequencer market, which is dominated by Applied Biosystems, growing at only 5% and then declining after several years, we believe the smaller medium throughput machines have a different market opportunity. These are the types of machines that will most likely be used in the clinical labs for genetic screening of disease markers. As mentioned previously, Visible Genetics and Applied Biosystems are currently developing small automated sequencers for this purpose. BEC formed its first alliance with a genetic marker company, Oncotech, in 2000 and we expect more to come over the next several years. By the nature of the low prevalence and numerous different types of diseases that will have markers, the genetic screening DNA sequencing market should remain in the specialty testing labs for most of this decade. However, we estimate that the market will be sizable enough, at $400 million by 2004, to drive considerable growth in the medium throughput DNA sequencer markets, of which the BEC CEQ 2000 fits. Table 1 shows our estimated growth for the BEC CEQ line.

Figure 5
CEQ 2000XL DNA Sequencer

Source: Beckman Coulter.

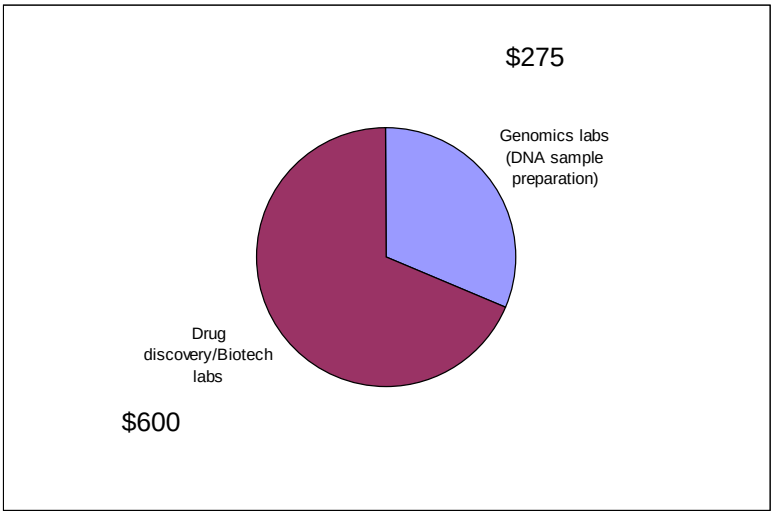
Capillary electrophoresis

Capillary Electrophoresis The same capillary electrophoresis technology inside the CEQ DNA sequencer can be used to separate and characterize carbohydrates and proteins. The P/ACE™ system of BEC is the leading capillary electrophoresis system. In addition, BEC provides on an OEM basis the capillary electrophoresis systems for Amersham's successful DNA sequencer lines.

Tools of the Proteomics and Drug Discovery Industries

As we shown in the Figure 7, drug discovery and biotech labs represent a considerable portion of the market for automated equipment. In reality, most of these labs are also "genomics" labs and will use the same instruments (liquid handlers, robotic systems) plus additional types of instruments not required by the pure genomics efforts. The appendix gives an overview of these industries.

Figure 6
Drug Discovery and Genomic Markets (in Millions)



Source: Beckman Coulter.

Discovering the proteins

Proteomics

Proteomics is the general term that describes the large-scale study of proteins. The ultimate goal for understanding the genome is to understand the products of the genes, which are proteins. Proteins are the molecules responsible for almost all of the steps in disease processes and are also the vast majority of potential drug targets. We think that proteomics may turn out to be a bigger market for instruments than the genomics market.

Proteins are currently considerably more difficult to work with in a high throughput manner than DNA. The mass spectrometer (there are several types) may be the key to rapid expansion in proteomics, and therefore growth of all of the instruments and reagents that are required, such as liquid handlers and robots. Directly in mass spec, BEC has an undisclosed R&D arrangement with ThermoFinigan but no current product line. Indirectly, the automation systems of BEC can be used for the steps surrounding the mass spec step of proteoimcs.

Academic Labs

Centrifuge

We have focused on the drug discovery/biotechnology and genomics markets because of its growth; however, a significant portion of BEC's life science sales (55%) is to the smaller custom laboratories in academic labs that use many of the same products. In addition to the instruments we have already covered, centrifuges are a big source of revenue in this market (although centrifuges are also used in the other labs). Beckman is the dominant leader in centrifuges. Although centrifuges have a low growth rate—2% in 2000—it is profitable and provides essential cash flow to facilitate the other higher-growth products. The smaller companies such as Tecan do not have this advantage.

Beckman Coulter's Strategic Planning

Beckman Coulter has four main strategies for growth.

Bigger is better

1) Consolidation

With Sanofi, Coulter, and others, Beckman Coulter has made several smart mergers and acquisitions to lead the pace in IVD consolidation. As we discussed in the IVD section, IVD companies need to be able to provide a comprehensive menu of instruments and test to compete for managed care contracts. The industry is in for more consolidation and shake ups as leaders such as Dade Behring and Bayer continue to struggle.

2) Grow the Core Business

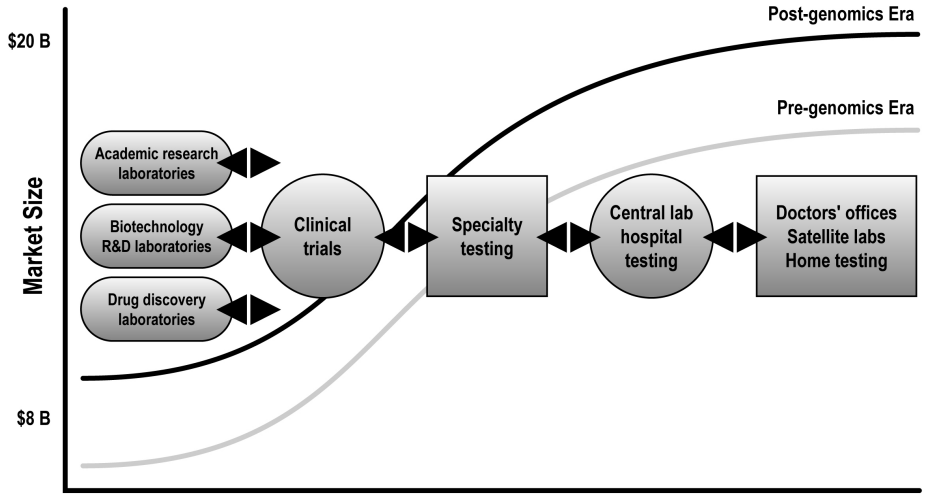
BEC has a three-year strategic plan to grow the IVD core business. We have discussed each point in the IVD section previously. We mentioned the move toward workstation consolidation that will unite chemistry and immunodiagnostics, increasing automation and expanding testing menus. With hematology, several new lines will be shipped in 2001 and 2002, and BEC's new strength in the reference lab customer base should be reinforced. In hematology, tetramers and IVD uses for HIV diagnoses should fuel the high-single to low-double-digit growth rates.

It's easier to sell to existing customers

3) Leverage the Biomedical Continuum

Beckman Coulter describes a biomedical continuum to explain how its strong worldwide presence in life sciences and clinical markets should provide a unique ability to leverage IVD strengths into life science growth (and vice versa in some cases). Usually, the IVD market potential for a test is far greater than the basic research or specialty testing markets. (See Figure 8.) Therefore, Beckman's strength in the slower growth IVD markets (distribution channels, service, cash flow, etc.) should facilitate development of new faster growing clinical tools and tests taken from its life science product lines. Some examples include:

Figure 8
Beckman Coulter



Source: CSFB.

Paragon CZE

Capillary Electrophoresis Beckman's capillary electrophoresis technology (P/ACE System) was first used in research in the 1980's and is now the Paragon CZE system used for serum protein analysis in the clinical lab.

Tetramers

Tetramers The new Tetramer reagents for T cell detection will migrate first from research, where they are currently used in clinical trials, into specialty testing (within reference labs). The plan is to then enter the clinical patient care and blood bank screening markets.

Liquid handlers

Biomek The new tube-to-plate capability of the Biomek will allow that line to automate the clinical process of taking the blood sample from the tube and applying it to the microtiter plates in clinical trials. This will transfer the Biomek from the pure research setting into the clinical trial setting.

Flow cytometry

Flow Cytometry The leveraging can work in the reverse direction as well: from clinical to basic research. Beckman Coulter is currently strong in clinical flow cytometry testing for CD4 and CD8 testing of HIV/AIDS monitoring. Through Tetramers and other areas being explored for cell analysis, BEC is strengthening its position in flow cytometry in the research market and specialty testing markets.

CEQ 2000 XL

DNA Sequencers Longer term, the CEQ 2000 XL DNA analysis system for DNA sequencing and fragment analysis is planned to be a platform for patient genetic testing.

4) Continued Strong R&D and Investment in Emerging Opportunities

BEC's strong cash flow and many connections in academia have allowed it to invest in most of the new technologies with promising markets worthy of R&D investment. IVD workstation consolidation, tetramers, microarrays, and cell-based drug target validation are prime examples. Strong R&D will provide the needed fuel for long-term growth.

Discussion of Models

Revenue

As shown in our models on pages 37 and 38, our 2001 revenue estimate is $1.99, or 5.3% higher than 2000. Management's official guidance is for 5-7% revenue growth in 2001. From this mid-single-digit base we expect emerging technologies and life sciences to drive high single-digit growth by 2003 and reach double digits by 2005. Table 1 on page 8 illustrates the growth contribution from new business. For example, tetramers, a new tool that measures immune system responses to new compounds are being used in clinical trials and could contribute up to $30 million in revenue by 2003, with a potential of more than a $100 million by 2005. Alliances with numerous biotechnology genomics companies should be another growth driver. Combined with the DNA sequencing instrument line, the total robotic/genetic analysis line is expected to grow in excess of 20% with the postgenomic explosion in drug discovery. The total life science division is not shown as growing as fast as the robotic/genetic analysis segment because of the slower growing centrifuge and analytical systems divisions that BEC lumps in with life sciences. A snapshot of BEC's revenue breakdown is shown in Table 2 and Table 8. During the first quarter of 2001 revenue growth will continue to be hampered by currency as 27% of BEC's business comes form Europe and 12% comes from Japan. We look for revenue growth in the 1-2% range overall. As explained below, BEC uses a hedging strategy to protect profits.

Table 8
Beckman Coulter Revenue Mix

	2001E	growth	% of total revenue
Clinical Diagnostics			
Routine Chemistry	$551	4.1%	28%
Immunodiagnostics	$371	5.9%	19%
Hematology	$405	1.8%	20%
Flow Cytometry	$179	9.2%	9%
Particle Characterization	$40	1.9%	2%
Total diagnostics	$1,546	4.7%	78%
Life Sciences Research			
Robotics/Genetics	$155	27.2%	8%
Centrifuge	$288	-0.2%	14%
Total Life sciences	$443	8.1%	22%
Total revenue	$1,989	5.2%	100%

Source: Beckman Coulter and CSFB.

Margins

We estimate the cost of goods sold margin for 2001 to be steady at 52% and we conservatively assume relatively stable margins over time despite the leverage that should manifest as more disposables are sold across BEC's installed base of instrumentation. In the near term as the equipment sales in flow and others areas continue to ramp, we believe that our conservatism is warranted, but in the out years there is plenty of room for upside. The SG&A should stay at 25% or improve slightly as the Coulter merger synergies continue to develop and the R&D spend should maintain a healthy 9.8% rate or more. We expect the tax rate to decrease to 31% in 2001.

Hedging and Nonoperating Income

We expect the Euro to rebound in 2001. BEC is 80% hedged in the Euro and Yen, therefore the non-operating income should decrease from hedging investments in 2001. The other non-operating expenses from interest should continue to decrease as debt paydown progresses. For 2000, debt was reduced by $116 milion. We do not expect major changes in nonoperating expenses in the future. We are forecasting $53.8 million in non-operating expense for 2001 versus $50.7 million in 2000 owing to lower hedging gains.

Risks

In our experience, the threats to BEC most often mentioned are in molecular diagnostics. As we explained in the IVD section, PCR poses no direct threat to any BEC product market. DNA sequencing-based studies are too fragmented for BEC to enter this market now, and if the opportunity ever does make financial sense, BEC has the distribution, in-house instrumentation, and alliances to have a running start. For microfluidics, the risk is nonexistent for the next two years from the two major players in microfluidics.

Foreign exchange risks always exist with IVD and life science companies with a worldwide presence. Beckman Coulter is more protected with hedging than most. BEC has hedged an estimated 80% of its risk. Moreover, most economists expect the Euro to continue its rebound in 2001.

Competition is also always a threat. We explained how BEC has been the market share aggressor and gaining on Abbott, Bayer, and Becton Dickinson.

Valuation

BEC currently trades at 17 times 2001 EPS and six times 2001 EBITDA/share. There are no pure-play publicly traded comparables, as the competition is either private or wrapped up in larger companies such as ABT, JNJ, Bayer or Roche. The purer-play life sciences automation companies, such as Tecan, are trading at close to 50 times 2001 EPS, and the smaller life-sciences tools companies like Waters are also trading at 50 times 2001 EPS. We believe that the current stock price for BEC discounts low-double-digit operating profits for what we call the company's valuation horizon, which is a term that describes the number of years of discounting it takes to arrive at today's stock price. Calculating this number allows us to eliminate the need for terminal values, which more often than not are such large drivers of a company's value that it makes little intuitive sense. We assume stable returns on incremental invested capital in our DCF and an increase in the long-term growth rate for the company to the midteens and higher beginning in 2004. These assumptions lead us to our $50 price target. Top-line growth this coming quarter should be 5.5% and operating profit growth should be 10%.

Table 9
Beckman Coulter Earnings Model

Beckman Coulter **Earnings Model** (in millions)	**1998**	**1999**	Q1 00	Q2 00	Q3 00	Q4 00	**2000**	Q1 01E	Q2 01E	Q3 01E	Q4 01E	**2001 E**	**2002 E**	**2003 E**	**2004 E**	**2005 E**
Total Revenue	$1,718.2	1,808.7	$434.4	$469.4	$457.8	$525.3	$1,886.9	$448.4	$497.4	$483.7	$559.5	$1,989.0	$2,127.7	$2,296.2	$2,506.5	$2,815.3
Cost of Products Sold	920.6	942.1	231.5	245.8	243.2	275.1	995.6	237.2	259.6	253.9	290.9	1,041.7	1,095.7	1,173.4	1,268.3	1,399.2
Gross Profit	797.6	866.6	202.9	223.6	214.6	250.2	891.3	211.2	237.8	229.7	268.6	947.3	1,031.9	1,122.9	1,238.2	1,416.1
Operating Expenses:																
Sales, General & Administrative	492.3	476.9	115.2	117.4	116.4	127.1	476.1	115.7	123.4	119.0	137.6	495.7	531.9	574.1	626.6	703.8
Research and Development	171.4	173.4	40.9	45.8	43.3	55.0	185.0	43.9	46.8	46.4	52.6	189.6	205.7	224.5	245.1	273.1
In-process research and development	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Restructure (credit) charge	19.1	(0.2)	0.0	0.0	0.0	(2.4)	(2.4)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Operating Expenses	682.8	650.1	156.1	163.2	159.7	179.7	658.7	159.5	170.1	165.4	190.2	685.3	737.7	798.6	871.7	976.9
Operating Income	114.8	216.5	46.8	60.4	54.9	70.5	232.6	51.7	67.6	64.3	78.3	262.0	294.3	324.3	366.5	439.2
Interest Income	(13.4)	(7.8)	(1.4)	(2.1)	(1.4)	(1.4)	(6.3)	(1.0)	(1.8)	(1.4)	(2.0)	(6.2)	(6.0)	(6.0)	(6.0)	(6.0)
Interest Expense	87.8	73.8	18.6	17.9	17.7	17.7	71.9	17.0	16.3	16.0	15.6	64.9	58.0	55.0	60.0	60.0
Other, net	(6.2)	(4.2)	(0.8)	(2.4)	(3.6)	(8.1)	(14.9)	0.0	(2.4)	(2.6)	0.0	(5.0)	0.0	0.0	0.0	0.0
Nonoperating (income) expense	68.2	61.8	16.4	13.4	12.7	8.2	50.7	16.0	12.2	12.0	13.6	53.8	52.0	49.0	54.0	54.0
Earnings (loss) before income taxes	46.6	154.7	30.4	47.0	42.2	62.3	181.9	35.7	55.5	52.3	64.7	208.2	242.3	275.3	312.5	385.2
Income Taxes	13.1	48.7	9.4	14.6	13.1	19.3	56.4	11.1	17.2	16.2	20.1	64.5	75.1	85.3	96.9	119.4
Tax Rate		31.5%	30.9%	31.1%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
Net Income (Continuing Ops)	$33.5	$106.0	$21.0	$32.4	$29.1	$43.0	125.5	$24.6	$38.3	$36.1	$44.7	$143.7	$167.2	$189.9	$215.6	$265.8
Net Income (As Reported)	33.5	106.0	21.0	32.4	29.1	43.0	125.5	24.6	38.3	36.1	44.7	143.7	167.2	189.9	215.6	265.8
Diluted Wghtd Avg Shrs & Securities Out	58.6	59.4	60.4	61.5	62.5	62.8	61.8	64.0	64.0	64.0	64.0	64.0	66.0	66.4	66.4	68.4
Diluted EPS (as reported)	**$0.57**	**$1.78**	**$0.35**	**$0.53**	**$0.47**	**$0.685**	**$2.03**	**$0.38**	**$0.60**	**$0.56**	**$0.70**	**$2.24**	**$2.53**	**$2.86**	**$3.25**	**$3.89**
Special nonrecurring items - (net tax)	(19.1)	0.2	0.0	0.0	0.0	1.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Per share effect of special nonrecurring items	($0.33)	$0.00	$0.00	$0.00	$0.00	$0.026	$0.026	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Diluted EPS (Continuing Ops)	**$0.90**	**$1.78**	**$0.35**	**$0.53**	**$0.47**	**$0.67**	**$2.01**	**$0.38**	**$0.60**	**$0.56**	**$0.70**	**$2.24**	**$2.53**	**$2.86**	**$3.25**	**$3.89**
MARGIN ANALYSIS:																
Cost of Products Sold	53.6%	52.1%	53.3%	52.4%	53.1%	52.4%	52.8%	52.9%	52.2%	52.5%	52.0%	52.4%	51.5%	51.1%	50.6%	49.7%
Sales, General & Administrative	28.7%	26.4%	26.5%	25.0%	25.4%	24.2%	25.2%	25.8%	24.8%	24.6%	24.6%	24.9%	25.0%	25.0%	25.0%	25.0%
Research and Development	10.0%	9.6%	9.4%	9.8%	9.5%	10.5%	9.8%	9.8%	9.4%	9.6%	9.4%	9.5%	9.7%	9.8%	9.8%	9.7%
Gross Profit Margin	46.4%	47.9%	46.7%	47.6%	46.9%	47.6%	47.2%	47.1%	47.8%	47.5%	48.0%	47.6%	48.5%	48.9%	49.4%	50.3%
Operating Margin	6.7%	12.0%	10.8%	12.9%	12.0%	13.4%	12.3%	11.5%	13.6%	13.3%	14.0%	13.2%	13.8%	14.1%	14.6%	15.6%
Pre-tax Income	2.7%	8.6%	7.0%	10.0%	9.2%	11.9%	9.6%	8.0%	11.2%	10.8%	11.6%	10.5%	11.4%	12.0%	12.5%	13.7%
Net Profit Margin (continuing ops)	1.9%	5.9%	4.8%	6.9%	6.4%	8.2%	6.7%	5.5%	7.7%	7.5%	8.0%	7.2%	7.9%	8.3%	8.6%	9.4%
Tax Margin	28.1%	31.5%	30.9%	31.1%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
ANNUAL GROWTH																
Total Revenue	43.4%	5.3%	7.2%	5.2%	4.0%	1.5%	4.3%	3.2%	6.0%	5.7%	6.5%	5.4%	7.0%	7.9%	9.2%	12.3%
Operating Income	(148.4%)	88.6%	8.1%	11.6%	10.9%	1.6%	7.4%	10.4%	12.0%	17.2%	11.1%	12.6%	12.3%	10.2%	13.0%	19.8%
EPS (from continuing ops)	(111.9%)	212.2%	20.4%	20.4%	13.6%	5.5%	13.9%	10.5%	13.6%	21.2%	4.2%	10.48%	12.8%	12.9%	13.5%	19.7%

Source: Company reports, CSFB.

Table 10
Beckman Coulter Revenue Model

Beckman Coulter **Revenue Model** (in millions)	**1998**	**1999**	**2000**	Q1 01E	Q2 01E	Q3 01E	Q4 01E	**2001E**	**2002E**	**2003E**	**2004E**	**2005E**
TOTAL WORLDWIDE												
Clinical Diagnostics												
Routine Chemistry	$457.7	$470.4	$527.1	$137.2	$135.8	$135.0	$142.8	$550.7	$581.0	$613.0	$646.7	$679.0
Immunodiagnostics	$323.2	$338.3	$346.1	$80.6	$93.5	$92.9	$103.3	$370.3	$396.2	$427.9	$462.2	$499.1
Hematology	$384.8	$413.4	$397.3	$96.9	$100.0	$98.9	$109.6	$405.4	$415.5	$430.1	$445.1	$458.5
Flow Cytometry (including tetramer revenue)	$143.6	$157.6	$162.7	$41.0	$46.2	$41.1	$50.6	$179.0	$206.6	$244.9	$302.6	$382.4
Particle Characterization	$0.0	$38.3	$39.0	$8.0	$10.1	$10.0	$11.7	$39.8	$41.0	$42.9	$45.0	$47.8
Life Sciences Research												
Robotics/Genetics	$75.0	$90.9	$126.0	$28.5	$37.6	$37.4	$52.3	$155.7	$196.4	$240.8	$302.2	$442.8
Centrifuge	$300.7	$299.8	$288.7	$56.3	$74.2	$68.3	$89.1	$288.0	$290.9	$296.7	$302.6	$305.5
Total Revenue	**$1,685.0**	**$1,809.2**	**$1,889.0**	**$448.9**	**$497.8**	**$484.0**	**$559.9**	**$1,989.2**	**$2,127.9**	**$2,296.5**	**$2,506.8**	**$2,815.6**
Clinical Diagnostics												
Routine Chemistry	NA	2.8%	12.1%	2.0%	5.5%	4.9%	5.6%	4.5%	5.5%	5.5%	5.5%	5.0%
Immunodiagnostics	NA	4.7%	2.3%	4.0%	6.5%	8.0%	9.0%	7.0%	22.6%	8.0%	8.0%	8.0%
Hematology	NA	7.4%	(3.9%)	1.0%	1.5%	2.0%	3.5%	0.0%	7.0%	8.0%	3.5%	3.0%
Flow Cytometry	NA	0.0%	3.2%	10.0%	10.0%	10.0%	10.0%	2.0%	0.0%	14.3%	23.6%	26.4%
Particle Characterization	NA	16.4%	1.8%	1.0%	1.0%	3.1%	3.0%	2.1%	2.5%	3.5%	5.0%	6.3%
Life Sciences Research												
Robotics/Genetics (including biotech alliances)	NA	21.2%	38.6%	35.0%	30.0%	19.0%	17.3%	23.6%	26.1%	18.5%	23.6%	26.4%
Centrifuge	NA	(0%)	(3.7%)	(6.5%)	1.0%	1.1%	2.0%	(0.2%)	1.0%	40.0%	9.2%	1.0%
Total % Growth	NA	7.4%	4.4%	(4.5%)	8.6%	(7.9%)	6.5%	5.3%	7.0%	7.9%	9.2%	12.3%
GEOGRAPHIC BREAKDOWN												
Clinical Diagnostics by Geography												
Americas	NA	$837.3	$920.9	$214.5	$214.5	$214.5	$214.5	$858.0	$1,287.0	$2,145.0	$3,432.0	$5,577.0
Europe	NA	$408.1	$395.5	$101.1	$101.1	$101.1	$101.1	$101.1	$101.1	$101.1	$101.1	$101.1
Asia and ROW	NA	$172.7	$172.5	$37.5	$37.5	$37.5	$37.5	$37.5	$37.5	$37.5	$37.5	$37.5
Total Clinical Diagnostics	NA	**$1,418.1**	**$1,488.9**	**$366.0**	**$383.0**	**$372.0**	**$427.0**	**$1,551.0**	**$1,635.0**	**$1,686.0**	**$1,764.0**	**$1,847.0**
ww growth	NA	5.62%	3.82%	2.99%	5.06%	5.34%	6.29%	4.96%	6.16%	7.22%	8.12%	8.69%
Life Sciences Research by Geography												
Americas	NA	$221.9	$258.5	$53.2	$66.8	$65.6	$87.8	$273.4	$426.8	$700.1	$1,126.9	$1,827.0
Europe	NA	$107.0	$111.0	$22.8	$28.7	$28.2	$37.7	$117.4	$183.3	$300.7	$484.0	$784.8
Asia and ROW	NA	$61.7	$48.4	$10.0	$12.5	$12.3	$16.4	$51.2	$79.9	$131.1	$211.1	$342.2
Total Lifesciences	NA	**$390.6**	**$418.0**	**$86.0**	**$108.0**	**$106.0**	**$142.0**	**$441.0**	**$460.0**	**$481.0**	**$504.0**	**$530.0**
ww growth	NA	4.0%	6.1%	7.0%	0.0%	9.8%	0.0%	7.0%	9.8%	10.3%	12.5%	23.7%
Total Beckman Coulter by Geography												
Americas	NA	**$1,059.2**	**$1,179.4**	**$267.7**	**$281.3**	**$280.1**	**$302.3**	**$1,131.4**	**$1,713.8**	**$2,845.1**	**$4,558.9**	**$7,404.0**
% of Total Revenue		58.5%	62.4%	59.6%	56.5%	57.9%	54.0%	56.9%	80.5%	123.9%	181.9%	263.0%
Europe	NA	**$515.1**	**$506.6**	**$123.9**	**$129.8**	**$129.3**	**$138.8**	**$521.8**	**$789.9**	**$1,311.7**	**$2,101.6**	**$3,413.4**
% of Total Revenue		28.5%	26.8%	27.6%	26.1%	26.7%	24.8%	26.2%	37.1%	57.1%	83.8%	121.2%
Asia and ROW	NA	**$234.4**	**$220.9**	**$47.5**	**$50.0**	**$49.8**	**$53.9**	**$201.2**	**$304.9**	**$506.1**	**$811.1**	**$1,317.2**
% of Total Revenue		13.0%	11.7%	10.6%	10.0%	10.3%	9.6%	10.1%	14.3%	22.0%	32.4%	46.8%

Source: Company reports, CSFB.

Table 11
Beckman Coulter Balance Sheet

Beckman Coulter

Balance Sheet (in millions)

	2000
ASSETS:	
Current Assets:	
Cash & cash equivalents	29.6
Accounts, Trade and other receivables	537
Inventories	332.1
Other current assets	29.4
Total Current Assets	927.8
Other Assets:	
Property, plant and equipment, net	298.2
Goodwill less accumulated amortization of $46.8 in 1999 and $27.6 in 1998	331.7
Other intangibles less amortization, net	382.7
Other assets, net	77.8
Total Other Assets	1,090.4
Total Assets	**$2,018.2**
LIABILITIES & S/H EQUITY:	
Current Liabilities:	
Notes Payable and Current maturities of LT debt	$52.1
Accounts payable, accrued expenses and other liabilities	$390.7
Income taxes payable	58.3
Total Current Liabilities	501.1
Long-term debt less current maturities	862.8
Other liabilities	310.4
Total Liabilities	1,674.3
Shareholders' Equity:	
Preferred Stock	0.0
Common stock	6.0
Additional paid-in capital	170.0
Retained earnings	226.3
Accum. other comprehensive loss:	
Cumulative foreign cx translation adjustment	(58.4)
Treasury stock, at cost	343.9
Total Shareholders' Equity	343.9
Total Liabilities & Shareholders' Equity	**$2,018.2**
KEY METRICS:	
Debt to Equity	251%
Debt to Capital	72%
DSO (days sales outstanding)	82
DSI (days sales in inventory)	120
Inventory Turns	3.00
days payable	99
Current ration	1.85
Cash Flow fromOperations	$209.0
Capital Expenditures	$141.0
Free Cash Flow	$95.7
Debt Paydown	$116.0

Source: Company reports, CSFB.

Appendix: Overview of Biotechnology and Drug discovery

Biotechnology

To begin with, biotechnology is a broad term with many definitions, but in general it refers to innovative basic life science research that becomes applied to product development (e.g., protein molecules from recombinant DNA, gene therapy, and monoclonal antibodies). There are industrial, agricultural, animal, and medical biotechnology products, all of which use much of the same technology and tools. The production of medically therapeutic drug molecules through biotechnology is a multibillion dollar market and of the most interest to investors.

How does biotech differ from big pharma?

Biotech and Big Pharma

The distinctions between pharmaceutical drug discovery, and biotechnology companies have become grayer. “Biotech” companies like Amgen are now as large (in terms of market capitalization) as the Big Pharma’s and have an impressive drug product line. A distinguishing characteristic between biotech and pharmaceutical products is that most biotech drugs are large molecule proteins that require injection or intravenous administration. They were engineered from basic science discoveries. Typically, drugs from pharmaceutical companies are not usually large molecule proteins and were created less by engineering and more by serendipitous discoveries in nature. For example, penicillin was discovered from bread mold.

However, as stated previously, these distinctions are blurring as Big Pharma companies develop in-house biotechnology and drug discovery programs. The companies that work purely with the genetic material and do not make a drug product form a subset industry known as genomics (e.g., Celera, Human Genome Sciences). Likewise, the companies that purely make the tools required to work with the DNA and cells in the biotechnology/drug discovery process form a subset best known as the “tools” companies (e.g., Beckman Coulter, Applied Biosystems).

The pharmaceutical and biotechnology industries each have public relations image problems from which the other wishes to be distanced. The cost of drug prescriptions is a perennial target of politicians trying to gain votes by demonizing the “Big Bad Pharma.” Fears of the unknown fuel protestors and activists that plague biotechnology, particularly in the agriculture market. Also for the biotech sector, many are speculating that the valuations of theses companies are excessive and similar to the dot-com sector before that bubble burst. If this sentiment persists, the biotech sector will undergo a correction.

The Human Genome Project: Why all the fuss?

The Human Genome

By far, the biggest event in all of science for the year 2000, and perhaps the last decade or more, was the completion of the sequencing of the entire human genome. The human genome refers to the entire genetic code of DNA on the 46 chromosomes (23 from each parent) in each cell of the body that contains in the order of 60,000 to 80,000 unique genes (down from prior estimates) and other regulatory and repetitive sequences of DNA. Each gene codes for the production of a protein that serves either as a building block substance or as a regulator in the chemical processes of the body. Virtually every disease process has a genetic component and will be potentially affected in the near future by the data from the human genome.

This daunting task of sequencing the tens of thousands of genes in the genome was initiated by the Human Genome Project in 1990, which was and still is the largest research project in biology ever funded by the government. In addition to the Human Genome Project, private industry was in pursuit of the same goal. The

Celera Corporation, headed by Craig Venter, Ph.D. led the pack. Using high throughput automated capillary electrophoresis DNA sequencers and massive computing facilities that rivaled the largest in the world at the U.S. Defense Department, Celera beat the government groups and completed the first rough draft of the entire human genome years ahead of schedule. The pioneering shotgun sequencing techniques of the rebel Craig Venter, in conjunction with the automated machinery, were the keys to success.

Why is the complete mapping of the human genome so revolutionary to all life science research and the diagnostics, biotechnology, and drug discovery industries? To explain this, let's use a roadmap analogy. If the human genome information is the roadmap of the United States, then each state is a chromosome (not exactly 50 chromosomes for each state but close enough) and each roadmap of a small town would be an individual gene. Before the mapping of the entire genome, we had a few scattered maps of towns developed but did not quite know where they fit in with each state. Mapping new genes was somewhat of a random process and very time consuming. Without a complete country map, we could only view the nation at a small scale. Moreover, the complex interactions among genes could not be studied.

Now, with a complete U.S. map, we can point to an unknown region and study it and learn how it interacts with the other regions of the country. We are no longer exploring the genome without a compass or large map. With the human genome map providing a rapid way to learn the map and function of each gene, thousands of new drug targets can be developed that translate into a tremendous growth in products and the quality of health care. Since almost al diseases have a genetic component, cures for cancer, diabetes, and virtually every other disease are now in the horizon.

The postgenomic era

Postgenomic Era

Functional genomics

Much like turning thousands of scientists loose in a new wing of the National Library of Medicine full of unread books, the sequencing of the human genome has created a tremendous amount of work yet to be done before meaningful data and products are made. This will be the work of the postgenomic era. The 60,000-80,000 genes that create proteins have to be separated from the rest of the 97% of the genome that regulates the genes or are simply redundant sections of DNA. Then, the functions of these genes and regulatory segments need to be discovered. Functional genomics is the term coined to describe this field. In addition, very valuable information regarding the individual variations in each person's genome can lead to custom tailored medications or improved clinical trials. All of this work will be the source of an explosion in growth in the life science industries.

To address the funding needs of the postgenomic era, the National Institutes of Health (NIH) and other government agencies have increased funding for research. Over the last five years, NIH funding was increased 57% and Congress is pushing to boost it another 50%, to $27 billion by 2003. Industry has also increased research and development spending.

"Snips" and pharmacogenomics

Pharmacogenomics

Pharmacogenomics (formerly pharmacogenetics) is the postgenomic era term to describe the study of genetic variations (polymorphism) and how they affect individual drug responses. Single Nucleotide Polymorphism's (SNPs), pronounced "Snips," are the most common type of genetic variation among individuals. A SNP is a variation of a single nucleotide base pair that occurs in more than 1% of the human population.

SNPs are significant because they can serve as useful markers for individuals that are more susceptible than others to diseases or who respond differently to drugs. An estimated 10 million SNPs probably exist, not all of them will be clinically useful. By creating a library of useful SNPs, individuals can be screened using high throughput instruments to determine whether they are more likely to develop disease, develop adverse drug reactions, or be more likely to respond to a drug in a clinical trial. In a collaborative effort to map the SNPs of the human genome, the SNP Consortium was created and funded by private industry and the world's largest medical research charity: The Wellcome Trust.

SNP scoring has the potential to become a major new market for *in vitro* clinical diagnostics. Once the mapping efforts discover the SNPs that serve as reliable markers for disease or drug responsiveness, the clinical hospital labs will be able to run the screening tests on patients. For the first time, many of the instruments only used in life science labs such as microarray chips, robotic liquid handling, and PCR systems could also become routine instruments of the clinical lab.

Proteins: The bottom line

Proteomics

Proteomics is the general term that describes the large-scale study of proteins. The ultimate goal for understanding the genome is to understand the products of the genes, which are proteins. Proteins are the molecules responsible for almost all of the steps in disease processes and are also the vast majority of potential drug targets. However, understanding the genome alone will not be sufficient for fully understanding the proteins because many modifications are made to the proteins after they are initially produced from a gene by messenger RNA. Moreover, the protein-protein interactions and the manipulation thereof are also sources for future therapeutic targets. Nearly 20 years ago the government almost made proteomics the target of research instead of the genome, but advances in molecular biology techniques made the Human Genome Project the prime focus instead.

The workhorse instrument of proteomics has been two-dimensional polyacrylamide gel assays. These are slow and low throughput. The biggest breakthrough in proteomics has been the mass spectrometer, which we will discuss in detail in the instrument section. Mass spectrometry is allowing for the first time high throughput large-scale analysis of proteins. Additionally, the actual three-dimensional structure of large complex proteins with intricate folding patterns can be determined by X-ray crystallography and nuclear magnetic resonance techniques (more accurately considered "structural genomics" than proteoimcs). All of this knowledge is crucial in understanding protein function, and thereby also understanding the function of the genes that code for the proteins.

Biotechnology and drug discovery industries

Drug Discovery

The biotechnology and drug discovery industries will use the information provided by Human Genome Project and the postgenomic era companies working on functional genomics, SNPs, and proteomics as a tremendous stockpile of data with which to develop new therapeutic compounds or disease markers. Both industries have already greatly increased spending on research and development in this area.

Steps in the drug discovery process

The drug discovery process can be divided into four phases:

1) Identifying a Valid Biological Target Biological targets are usually proteins that serve as cell membrane receptors or messengers for the internal workings of the cell. In the order of 500 drug targets are currently known, but this number could grow to more than 10,000 in five years as a result of the data from the human genome and functional genomics efforts. However, not all of these targets will be valid and have an effect on the disease of interest. The automation and

high throughput technologies previously discussed have allowed a new approach to drug target discovery. A shot gun approach to screening for thousands of molecules and seeing which are “hits”, then further testing them is one example of the new approach. To evaluate each hit, assays can be performed on whole living cells (the most information gained), tissue specimens (ISH or IHC). Target validation is perhaps the step of drug discovery that requires the most lab instrumentation.

2) Designing a Drug Molecule to Affect the Target Rather than finding naturally occurring molecules in nature, the biotech approach is to engineer a drug that will affect the target. This is where proteomics fits in.

3) Determining Effectiveness of the Drug Once a candidate drug is established, it must begin the trial process. The excitement here is that SNPs and other genetic screening methods can preselect candidates for trials that will favorably respond to the drug, thereby reducing the enrollment sizes and time of a trial.

4) Regulatory Approval If the clinical trials are effective, jumping the FDA and European regulatory hurdles is the last step.

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