

MEDICAL GRAND ROUNDS

University of Texas Southwestern Medical Center at Dallas

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**The Biotechnology Industry in 1994:
Moving from the Surreal (*Gene Product*)
to the Real (*Therapeutic Product*)**

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The Biotechnology industry began 20 years ago soon after the discovery of three powerful techniques – gene cloning, DNA sequencing, and monoclonal antibodies. Its growth, whether measured intellectually or economically, has been phenomenal, and its influence on four sectors of our society – Wall Street, academia, the pharmaceutical industry, and the health care industry – has been impressive.

In this Grand Rounds, I will discuss the Biotechnology industry, focusing on its dreams and its realities. Much of the success and creativity of the Biotechnology revolution can be attributed to the industry's style of operation. Biotechnologists have assumed a style that is reminiscent of an earlier revolution in art called Surrealism. Like the Surrealist artists of the 1930's and 40's, today's biotechnologists live and think in a world of fantasy and dreams.

Table 1

Medicine at the Millennium: Three Human Projects

- **Genome Project** – Technological Effort to Map All the Genes
- **Biology Project** – Experimental Effort to Understand Function of All the Genes
- **Biotechnology Project** – Pharmaceutical Effort to Create Therapeutic Products from Gene Products

Table 2**The Biotechnology Industry in 1994**

- 1300 Companies - 18% public
- Employees - 97,000
- Product Sales - \$7 billion
- Market Capitalization - \$45 billion
- Net Losses - \$3.6 billion

Table 3**Industry Comparisons - 1994**

	<u>Employees</u> No.	<u>Net</u> <u>Sales</u>	<u>Income</u> \$ Billion	<u>R & D</u>
Biotech Industry (aggregate of 1300 companies)	97,000	\$ 7	(\$3.6)	\$5.7
Merck	36,200	\$10	\$2.5	\$1.1
BristolMyersSquibb	52,600	\$11	\$2.0	\$1.1

Table 4**What's In A Name?****Gene-based**

Genentech, Amgen, Biogen, Synergen, Genzyme, Calgene

DNA-based

DNA Sciences, DNAX, DNX

Product-based

Amylin, Autoimmune, Cholestech, Collagen, Cor, Free Radical Sciences, Insulin Mimetic, Interferon Sciences, T Cell Sciences

Futuristic

Alkermes, ImClone, Myriad, Vertex, Maganin, Millennium

Chauvinistic

Texas Biotech

Table 5**Biotech Companies by Location**

California	370	28 %
San Francisco Bay Area	196	
San Diego	103	
Los Angeles/Orange Co.	71	
Boston Area	175	13 %
Washington D.C. Area	115	9 %
New Jersey/Philadelphia	101	8 %
New York State	86	7 %
Texas	54	4 %
Seattle	52	4 %
Research Triangle, N.C.	47	4 %
Iowa	23	2 %
Other	271	21 %

*Table 6***Biotech's R & D Spending Levels - 1994**

<u>Companies</u>	<u>Amount</u>	<u>% of Sales</u>
All 1300 Biotech	\$ 5.7 Billion	81 %
Top 150 Biotech	\$ 3.1 Billion	890 %
Immunex	0.42	340 %
Genentech	0.30	49 %
Amgen	0.26	19 %
Chiron	0.14	58 %
Top 15 Pharmaceutical	\$12 Billion	10 %
NIH	\$12 Billion	—

*Table 7***Biotechnology Successes - FDA Approved Molecules**

<u>Product</u>	<u>Approved</u>	<u>Company</u>	<u>Use</u>
Insulin	1982	Genentech/Lilly	Diabetes
Growth Hormone	1985	Genentech	GH Deficiency (1985) Kidney Disease (1993)
α -Interferon	1986	Biogen/Schering Genentech/Roche	Hairy Cell Leukemia (1986) Kaposi's Sarcoma (1988) Genital Warts (1988) Hepatitis B and C (1991)
OKT3	1986	Ortho/J & J	Kidney Transplant Rejection (1986) Heart & Lung Rejection (1993)
Hepatitis B Vaccine	1986	Chiron/Merck	Hepatitis B
tPA	1987	Genentech	Heart Attacks
Erythropoietin	1989	Amgen	Anemia
γ -Interferon	1990	Genentech	Granulomatous Disease
G-CSF	1991	Amgen	Cancer-related Leukopenia
GM-CSF	1991	Immunex	Cancer-related Leukopenia
Ceredase/Ceredex	1991/94	Genzyme	Gaucher's Disease
IL-2	1992	Chiron	Kidney Cancer
Factor 8	1992	GI & Genentech	Hemophilia A
DNase	1993	Genentech	Cystic Fibrosis
β -Interferon	1993	Chiron	Multiple Sclerosis

Table 8

**The Biotechnology Industry in 1994:
From the Surreal to the Real**

1 New Gene per Day
1 New Company per Week
1 New Drug per Year

Table 9

Biotech's Top Sellers - 1994

<u>Drug</u>	<u>World-wide Sales/Year</u>
Erythropoietin	\$1,125 Million
G-CSF	725
Hepatitis B Vaccine	725
Insulin 625	
Growth Hormone	575
α -Interferon	565
tPA	544
GM-CSF	250

Table 10

**RECOMBINANT ERYTHROPOIETIN:
A BIOTECH SUCCESS STORY**

- 1840 - Association between anemia and renal failure
(Richard Bright)
- 1906 - Plasma of anemic animals contains RBC-elevating activity
- 1957 - Kidney is primary source of erythropoietin - cobalt
- 1977 - Erythropoietin purified from urine in trace amounts
- 1985 - cDNA cloning and expression of recombinant erythropoietin in animal cells
- 1989 - FDA approval

Table 11**Turning a Biotech Profit**

Company	Market Capitalization	Net Income in 1993
Amgen	\$5.95 Billion	\$383 Million
Genentech	5.61	59
Genzyme	0.63	43
Biogen	0.93	32
Chiron	1.74	18

Table 12**Biotech Drugs: Costs to Patients**

Ceredase	\$150,000	
Factor 8	20,000	
Growth Hormone	16,000	
β -Interferon	10,000	per Year
DNase	8,000	
Erythropoietin	5,000	
G-CSF	5,000	
Insulin	300	
tPA	\$2,200	— per Dose

Table 13**Ceredase: Anatomy of Costs**

Item	Cost	% of Price
Materials (20,000 placentas)	\$47,900	32 %
Taxes	14,600	10 %
Overhead	12,600	8 %
Selling/reimbursement	12,200	8 %
Distribution	10,500	7 %
R & D Costs	6,500	4 %
Mgr. Labor	5,300	4 %
Other	9,200	6 %
	<u>\$118,800</u>	<u>79 %</u>

Table 14**Biotechnology Medicines in Development - 1994**

- Research Projects in Major Pharmaceutical Companies
 - 1980 - 2% } Based on Biotechnology
 - 1994 - 33% }
- 2000 Drugs in Early Development
- 270 Therapeutics in Clinical Development
 - Monoclonal Antibodies
 - Cytokines & Interferons
 - Vaccines
 - Growth Factors
- Development Status in 1994
 - 300 New Drug Application Filed
 - 33 Phase III Studies
 - 11 Applications at FDA Review
- 2100 Biotechnology Patents Issued
 - 70% U.S.
 - 13% Japan

Table 15**From Pipe Dreams to Pipelines**

- Stem Cell Growth Factor - CellPro, Systemix, Amgen
- Cancer Cures - p53, p16, BRAC gene product, Ras
- Nerve Regeneration - Genentech, Regeneron, Cephalon
- Catalytic Monoclonal Antibodies (high-speed chemistry)
- Protein Pills - Alkermes
- Slow Aging (Bcl-2)
- Universal Organ Transplants - DNX
- Baldness - Sequana

Table 16**Biotech's Second Generation - Cooking Up New Recipes**

- Rational Drug Design - Agouron, Vertex
- Molecular Diversity - Gilead, Affymax, Selectide
- Humanized Antibodies - Genentech, Protein Design Labs,
Cell Genesys, GenPharm
- Code Blockers
 - Anti-Transcription - Tularik
 - Antisense - ISIS, Hybridon, Genta
 - Ribozymes - Ribozyme Pharmaceutical
- Intracellular Messengers - Ariad, Sphinx

Table 17**Who's Who in the Gene Therapy Business**

<u>Company</u>	<u>Main Scientists</u>
Somatix Therapy	Richard Mulligan, Inder Verma
Genetic Therapy	French Anderson
Transkaryotic Therapies	Seldin (<i>not Donald</i>), Goodman, Szostak
Vical	Alain Schreiber, Gary Nabel
GeneMedicine	Savio Woo
GenVec	Ron Crystal

Table 18**Who's Who in the Genome Business**

<u>Company</u>	<u>Main Scientists</u>
Darwin Molecular	Hood, Pearson, Joyce
Genome Systems	David Smaller
Human Genome Sciences	Bill Haseltine, Craig Venter
Incyte	Randy Scott
Mercator Genetics	David Cox, Rick Myers
Millennium	Lander, Cohen, Friedman
Myriad Genetics	Mark Skolnick, Walter Gilbert
Nanotronics	Glen Evans
Sequana Therapeutics	Goodfellow, Lehrach, Monaco

SMITH BARNEY

SMITH BARNEY SHEARSON
A PRUDENTIAL COMPANY

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APPENDIX

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BIOTECHNOLOGY INDUSTRY PRODUCT REPORT

1994

This report reviews the product pipelines of 80 public biotechnology companies. The report presents and organizes the product pipeline by individual company, by stage of development and by corporate partnerships. These presentations allow the reader to analyze the product status of biotechnology companies individually and within the context of the overall biotechnology industry.

Of a total of 1,157 products presented in this report, 58 products are currently on the market, 21 products are filed for approval, 57 products are in Phase III testing, 16 products are in Phase II/III, 87 products are in Phase II, 66 products are in Phase I/II and 91 products are in Phase I. An additional 286 products are in the pre-clinical stage of development and 326 products are in the research stage.

These presentations facilitate a comparative analysis of biotechnology companies in terms of their latter stage product development status. Although this report does not present all public biotechnology companies, the information provided herein does provide a reference source comprehending the product status of many of the more prominent companies.

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Products on the U.S. Market

Product	Tradename	Indication
Amgen, Inc.		
EPO	Procrit®	anemia associated with AIDS/AZT
EPO	Procrit®	chemo.-assoc. anemia in non-myeloid malignancies
EPO	Epogen®	end-stage renal disease anemia
G-CSF	Neupogen®	adjunct to chemotherapy
G-CSF	Neupogen®	bone marrow transplants
Athena Neurosciences, Inc.		
Bromocriptine mesylate	—	Parkinson's disease
Carbamazepine	Atretol®	anticonvulsant for epilepsy
Carbidopa/levodopa	Atamet™	Parkinson's disease
Pergolide mesylate	Permax®	Parkinson's disease
Bio-Technology General Corp.		
Injectable testosterone	Delatestyl®	delayed puberty in boys, hypogonadism
Biogen *		
Alpha interferon	Intron® A	genital warts
Hepatitis B vaccine	Engerix-B	hepatitis B prevention
Hepatitis B vaccine	Recombivax	hepatitis B prevention
Alpha interferon	Intron® A	hepatitis B treatment
Hepatitis B Antigens	—	Hepatitis B detection
Alpha interferon	Intron® A	hepatitis C treatment
Alpha interferon	Intron® A	Kaposi's sarcoma
Alpha interferon	Intron® A	17 indications in 61 countries
Alpha interferon	Intron® A	hairy cell leukemia
Hepatitis B antigens	--	hepatitis B detection
Biomira, Inc.		
MAbs in vitro, blood test kit	TRUQUANT® OV2™	diagnosing ovarian cancer
MAbs in vitro, blood test kit	TRUQUANT® OV2™	diagnosing ovarian cancer
Chiron Corp. *		
HCV and HIV immunoassay	RIBA®	confirmatory use
Pilocarpine Hydrochloride	Salagen™	treat chemo. assc. dry mouth
IL-2	Proleukin®	metastatic renal cell carcinoma
Hepatitis B vaccine	Recombivax	hepatitis B prevention
Beta interferon	Betaseron®	relapsing/remitting multiple sclerosis
Hepatitis C Elisa test	ELISA HCV 3.0	diagnose hepatitis C
Cytogen Corp.		
Indium-111 labelled antibody	OncoScint® OV103	imaging - ovarian cancer
Indium-111 labelled antibody	OncoScint® CR103	imaging - colorectal cancer
Enzon, Inc.		
PEG-L-asparaginase enzyme	Oncaspar™	acute lymphoblastic leukemia
PEG-adenosine deaminase	Adagen®	ADA-deficient SCID
Genentech, Inc.		
DNase	Pulmozyme™	cystic fibrosis
Factor VIII	Kogenate®	hemophilia A
Human growth hormone	Nutropin®	short stature in children with inadequate GH

Products on the U.S. Market

Product	Tradename	Indication
Human growth hormone	Nutropin®	short stature, children w/ chronic renal insufficiency
Human growth hormone	Protropin®	growth hormone inadequacy
Human insulin	Humulin®	Type I diabetes
Interferon gamma	Actimmune®	chronic granulomatous disease
t-PA	Activase®	myocardial infarction
t-PA	Activase®	pulmonary embolism
Alpha interferon	Roferon®-A	hairy cell leukemia
Genetics Institute		
Factor VIII:C rAHF	Recombine™	hemophilia A
Gensia, Inc.		
laryngeal mask airway	—	medical device (used while admin. anesthesia)
Genzyme Corp. *		
Ldl cholesterol assay	—	direct ldl cholesterol test
Recombinant glucocerebrosidase	Cerezyme™	Type I Gaucher Disease
Hyaluronic acid	Provisc®	ophthalmic surgery
Glucocerebrosidase	Ceredase®	Type I Gaucher Disease
Immunex Corp. *		
GM-CSF	Leukine®	bone marrow transplant engraftment or failure
Leucovorin calcium	—	modulation of 5-FU drug therapy - colorectal CA
Leucovorin calcium	—	methotrexate rescue
Methotrexate sodium (IV)	—	various neoplastic diseases
Methotrimeprazine	Levoprome®	moderate/severe pain - analgesic
Mitoxantrone HCl	Novantrone®	acute non-lymphocytic leukemia (ANLL)
Thiotepa	—	cancer (tumors)
Aminocaproic acid	Amicar®	hemostasis enhancement
Interneuron Pharmaceuticals Inc.		
Protein/carbo. food product	Hearty Balance	nutritional food product-Parkinson's disease
MedImmune, Inc. *#		
CMV immune globulin	CytoGam®	CMV prevention in kidney transplant patients
Piperacillin & tazobactam	Zosyn™	anti-infective
Vertex Pharmaceutical Incorporated		
CLEC enzyme technology	—	industrial processes/biogenesis/reagents

Products Filed for U.S. Approval

Product	Tradename	Indication
Amgen, Inc. G-CSF	Neupogen®	severe chronic neutropenia
Athena Neurosciences, Inc. Tizanidine HCl	Zanaflex™	spasticity associated w/ MS and spinal cord injury
Bio-Technology General Corp. Human growth hormone	Bio-Tropin™	short stature in children
Centocor Inc.* Ilb/IIIa MAb (7E3)	ReoPro™	prevent acute cardiac events (high-risk) post-angio.
Genetics Institute GM-CSF	Leucomax®	low white blood cell counts
GM-CSF	Leucomax®	low white blood cell counts
Gensia, Inc. Acadesine (IV)	Protera™	coronary bypass surgery
Arbutamine	GenESA™ System	diagnosis of coronary artery disease
Gensia Labs - generic products	—	multiple uses
Immunex Corp. * Thiotepa (lyophilized form)	Thioplex	cancer (tumors)
Levoleucovorin	Isovorin	methotrexate rescue in osteosarcoma
GM-CSF	Leukine®	prevention of chemo.-induced neutropenia
Immunomedics Inc. MAb antibody	ImmuRAID™-CEA	imaging-colorectal cancer
Interneuron Pharmaceuticals Inc. Dexfenfluramine	--	obesity
MedImmune, Inc. *# CMV immune globulin	—	CMV prevention in solid organ transplants
RSV immune globulin	RespiGam™	RSV disease prevention in children
NeoRx Corporation NR-LU-10 Ab w/ technetium-99m	OncoTrac® SCLC	imaging - small cell lung cancer
T Cell Sciences CD4 test kit	TRAx®CD4 test kit	CD4 cell enumeration
Telios Pharmaceuticals, Inc. RGD-containing peptide gel	Argidine™ gel	chronic dermal foot ulcers in diabetic patients
Univax Biologics, Inc. Polyclonal anti D antibodies	WinRho SD™	idiopathic thrombocytopenic purpura (ITP)
Xoma Corp. * Anti-endotoxin antibody	E5®	gram-negative sepsis

Products in U.S. Phase III Trials

Product	Tradename	Indication
Alpha-1 Biomedicals, Inc.		
Thymosin alpha 1	—	chronic hepatitis B
Amgen, Inc.		
Consensus interferon	—	hepatitis C treatment
G-CSF	Neupogen®	acute myeloid leukemia (AML)
G-CSF	Neupogen®	neutropenia associated with AIDS therapies
G-CSF	Neupogen®	infectious disease
G-CSF	Neupogen®	support periph. blood progenitor cell transplants
G-CSF	Neupogen®	prevent neutropenia, myelosuppressive chemo.
Athena Neurosciences, Inc.		
Diazepam solution	Diastat®	anticonvulsant epilepsy
AutoImmune Inc.		
AI 100 (animal protein)	Myloral™	multiple sclerosis
Bio-Technology General Corp.		
Oxandrolone (testosterone analog)	Oxandrin®	constitutional delay of growth and puberty-boys
Oxandrolone (testosterone analog)	Oxandrin®	Turner syndrome
Oxandrolone (testosterone analog)	Oxandrin®	alcoholic hepatitis
Anti-psoriasis agent	SILKIS™	psoriasis, contact dermatitis, other skin disorders
Sublingual testosterone	Androtest-SL®	hypogonadism
Ethinyl estradiol	—	Turner syndrome
Biogen *		
Modified leech anti-coagulant	Hirulog™	unstable angina
Modified leech anti-coagulant	Hirulog™	acute closure post-angioplasty
Beta interferon	—	hepatitis B, hepatitis C
Alpha interferon	Intron® A	various cancers
Beta interferon	—	multiple sclerosis
Celtrix Pharmaceuticals, Inc.		
TGF-Beta-2	BetaKine™	retinal wounds (macular holes)
Centocor Inc.*		
Anti-endotoxin MAb	HA-1A®	fulminant meningococcemia
IIb/IIIa MAb (7E3)	ReoPro™	refractory unstable angina
Mouse MAb frag. to fibrin	Fibriscint®	blood clot imaging agent
Mouse MAb frag. to myocin	Myoscint®	cardiac imaging agent
Cephalon, Inc.		
Modafinil	—	narcolepsy
Chiron Corp. *		
Beta interferon	Betaseron®	chronic progressive multiple sclerosis
Ganciclovir implant	—	CMV retinitis
Hepatitis C diagnostic	RIBA® HCV 3.0	diagnose hepatitis C
HIV-1,2 diagnostic	RIBA® HIV-1,2	diagnose HIV
IL-3	Proleukin®	malignant melanoma, infectious diseases
Platelet-derived growth factor (PDGF) —	—	decubitus/diabetic ulcers
Recombinant pertussis vaccine	—	pertussis infection

Products in U.S. Phase III Trials

Product	Tradename	Indication
Two-antigen HSV-2 vaccine	--	prevention/treatment of genital herpes
Bay-x-1351 (anti-TNF antibody)	--	septic shock
COR Therapeutics *		
IIb/IIIa antagonist (IV)	Integrelin™	adverse cardiac events post-angioplasty
Cytogen Corp.		
CYT-424 (samarium ED™P)	--	bone pain associated with metastatic cancer
Indium-111 labelled antibody	OncoScint® PR356	imaging - prostate cancer
Enzon, Inc.		
PEG-SOD (superoxide dismutase)	Dismutec™	closed-head injuries
Genentech, Inc.		
Interferon gamma	Actimmune®	renal cell carcinoma
DNase	--	chronic obstructive pulmonary disease
Human growth hormone	Nutropin®	Turner's syndrome
Insulin-like growth factor	--	growth hormone insensitivity
Gensia, Inc.		
Acadesine (IV)	Protera™	adverse cardiac events - non-cardiac surgery
Genzyme Corp. *		
Thyroid stimulating hormone	Thyrogen®	detect/treat thyroid cancer metastasis
Immunex Corp. *		
PIXY321	Pixykin™	prevent chemo-assoc. neutropenia, platelet deficiency
ImmunoGen, Inc. *#		
Anti-B4-bR (blocked ricin)	Oncolysin® B	B-cell non-Hodgkin's lymphoma post-ABMT
Immunomedics Inc.		
MAB antibody	ImmuRAID™-CEA	imaging-lung
MAB antibody	ImmuRAID™-MN3	imaging-infectious diseases
Magainin Pharmaceuticals *#		
MSI-78 (topical)	--	infected diabetic foot ulcers
MedImmune, Inc. *#		
T10B9 monoclonal antibody	--	acute transplanted kidney rejection
NeoRx Corporation		
NR-LU-10 Ab w/ technetium-99m	OncoTrac® NSCLC	imaging - non small cell lung cancer
Neurex Corp.		
Fenoldopam	Corlopam®	acute hypertension
RIBI ImmunoChem Research, Inc.		
Melanoma-associated Ags + DETOX	Melacine	therapeutic vaccine-late-stage malignant melanoma
Melanoma-associated Ags + DETOX	Melacine	therapeutic vaccine-early-stage malignant melanoma
Scios Nova, Inc.		
Atrial natriuretic peptide (ANP) anariti	AURICULIN™	acute kidney failure
Xoma Corp. *		
Antibody-ricin conjugate	CD5 Plus™	graft vs. host disease (GvHD) therapy

1994 Product Portfolios of 4 largest Biotechnology Companies

Product	Tradename	Indication	Status
Amgen, Inc.			
EPO	Procrit®	anemia associated with AIDS/AZT	market
EPO	Procrit®	chemo.-assoc. anemia in non-myeloid malignancies	market
EPO	Epogen®	end-stage renal disease anemia	market
G-CSF	Neupogen®	adjunct to chemotherapy	market
G-CSF	Neupogen®	bone marrow transplants	market
Brain-derived neurotrophic factor (BDNF)	--	Lou Gehrig's disease (ALS)	Phase I
Hepatitis B vaccine	--	hepatitis B infection	Phase II
IL-2	--	undisclosed	Phase II
Stem cell factor	--	hematopoietic disorders	Phase II
Consensus interferon	--	hepatitis C treatment	Phase III
G-CSF	Neupogen®	acute myeloid leukemia (AML)	Phase III
G-CSF	Neupogen®	infectious disease	Phase III
G-CSF	Neupogen®	neutropenia associated with AIDS therapies	Phase III
G-CSF	Neupogen®	prevent neutropenia, myelosuppressive chemo.	Phase III
G-CSF	Neupogen®	support periph. blood progenitor cell transplants	Phase III
G-CSF	Neupogen®	severe chronic neutropenia	PLA
Brain-derived neurotrophic factor (BDNF)	--	Parkinson's, Alzheimer's, retinal degeneration	pre-clinical
Brain-derived neurotrophic factor (BDNF)	--	peripheral neuropathies, stroke	pre-clinical
Keratinocyte growth factor	--	burns, gastric ulcers, bowel disease	pre-clinical
Neu differentiation factor	--	breast cancer	pre-clinical
NT-3	--	CNS and PNS disorders	pre-clinical
Platelet-derived growth factor	--	unspecified	research
Receptor-based drugs	--	neurobiology, megakaryocytopoiesis	research
Biogen *			
Alpha interferon	Intron® A	17 indications in 61 countries	market
Alpha interferon	Intron® A	genital warts	market
Alpha interferon	Intron® A	hairy cell leukemia	market
Alpha interferon	Intron® A	hepatitis B treatment	market
Alpha interferon	Intron® A	hepatitis C treatment	market
Alpha interferon	Intron® A	Kaposi's sarcoma	market
Hepatitis B antigens	--	hepatitis B detection	market
Hepatitis B Antigens	--	Hepatitis B detection	market
Hepatitis B vaccine	Recombivax	hepatitis B prevention	market
Hepatitis B vaccine	Engerix-B	hepatitis B prevention	market
Alpha interferon w/ AZT	--	AIDS	Phase II
Alpha interferon w/ DDI	--	AIDS	Phase II
Beta interferon	--	cervical dysplasia	Phase II
Beta interferon	--	genital warts, basal cell carcinoma	Phase II
Modified leech anti-coagulant	Hirulog™	adjunct to thrombolytics	Phase II
Modified leech anti-coagulant	Hirulog™	clots post-orthopedic surgery	Phase II
Alpha interferon	Intron® A	various cancers	Phase III
Beta interferon	--	hepatitis B, hepatitis C	Phase III
Beta interferon	--	multiple sclerosis	Phase III
Modified leech anti-coagulant	Hirulog™	acute closure post-angioplasty	Phase III
Modified leech anti-coagulant	Hirulog™	unstable angina	Phase III
5A8 (anti-CD4 antibody)	--	AIDS	pre-clinical
Anti-VLA4 antibody	--	autoimmune diseases	pre-clinical
Anti-VLA4 antibody	--	inflammatory disorders	pre-clinical
Gelsolin (mucolytic)	--	respiratory diseases	pre-clinical
LFA3TIP	--	autoimmune diseases	pre-clinical
LFA3TIP	--	inflammatory disorders	pre-clinical
TBAM	--	inflammatory and autoimmune conditions	pre-clinical
Unspecified anti-inflam. drugs (oral)	--	inflammation	research
Unspecified small molecules	--	thrombosis, viral infection, inflammation	research

Product	Tradename	Indication	Status
Genentech, Inc.			
GM1925, GM2296	--	inflammatory disease	discontinued
GM1998	Celadin™	adult respiratory distress syndrome	discontinued
CD18 humanized antibody	--	hemorrhagic shock	IND
Alpha interferon	Roferon®-A	hairy cell leukemia	market
DNase	Pulmozyme™	cystic fibrosis	market
Factor VIII	Kogenate®	hemophilia A	market
Human growth hormone	Protropin®	growth hormone inadequacy	market
Human growth hormone	Nutropin®	short stature in children with inadequate GH	market
Human growth hormone	Nutropin®	short stature, children w/ chronic renal insufficiency	market
Human insulin	Humulin®	Type I diabetes	market
Interferon gamma	Actimmune®	chronic granulomatous disease	market
t-PA	Activase®	myocardial infarction	market
t-PA	Activase®	pulmonary embolism	market
Aerosolized CF vector	--	cystic fibrosis	Phase I
Hyperimmune immunoglobins	--	neutralize HIV-1	Phase I
IgE humanized antibody	--	asthma	Phase I
Nerve growth factor	--	peripheral neuropathy	Phase I
QS-21 Stimulon™	--	for use in gp120 vaccine against HIV-1	Phase I
HER2 humanized antibody	--	breast/ovarian cancer	Phase II
Human growth hormone	Nutropin®	growth hormone inadequacy-adults	Phase II
IgE humanized antibody	--	allergic rhinitis	Phase II
Insulin-like growth factor	--	diabetes	Phase II
MN gp120	--	AIDS vaccine - prevention and therapy	Phase II
t-PA (intracoronary administration)	Activase®	unstable angina N/A	Phase II
t-PA	Activase®	ischemic stroke	Phase II/III
DNase	--	chronic obstructive pulmonary disease	Phase III
Human growth hormone	Nutropin®	Turner's syndrome	Phase III
Insulin-like growth factor	--	growth hormone insensitivity	Phase III
Interferon gamma	Actimmune®	renal cell carcinoma	Phase III
Activin/Inhibin	--	sickle-cell anemia, reproductive disorders	pre-clinical
Anti-interferon alpha (MAb)	--	Type I diabetes	pre-clinical
Atrial natriuretic peptide	--	renal disease	pre-clinical
CD11a humanized antibody	--	organ transplant rejection	pre-clinical
CD18 humanized antibody	--	ARDS, transplantation	pre-clinical
NT-4/5	--	sensory neuropathy	pre-clinical
Oral IIb/IIIa inhibitor	--	myocardial infarction, unstable angina	pre-clinical
Platelet antagonist	--	coronary reocclusion	pre-clinical
Ras inhibitors (farnesyl transferase)	--	cancer	pre-clinical
Second-generation human GH	--	linear growth	pre-clinical
Second-generation t-PA	--	thrombolytic (heart attack)	pre-clinical
TGF-Beta (DePuy)	--	bone healing	pre-clinical
Tissue factor	--	hemophilia	pre-clinical
Vascular endothelial growth factor	--	ischemic injury	pre-clinical
Argatroban	--	restenosis	research
CD11a humanized antibody	--	psoriasis, autoimmune disease	research
Hepatocyte growth factor	--	liver disease	research
Heregulin	--	neurodegenerative disease	research
IL-8 inhibitor	--	lung inflammation	research
NT-3	--	peripheral neuropathy	research
NT-4/6	--	peripheral neuropathy, ALS	research
Oral IIb/IIIa inhibitor	--	restenosis	research
Selectin inhibitors	--	chronic inflammation	research
Small molecules	--	hypertension, heart disease, arteriosclerosis	research
TGF-beta	--	ophthalmic indications	research
Vascular endothelial growth factor	--	peripheral arterial disease	research

Product	Tradename	Indication	Status
Chiron Corp.*			
T-88 (endotoxin MAb)	--	septic shock	discontinued
Beta interferon	Betaseron®	relapsing/remitting multiple sclerosis	market
HCV and HIV immunoassay	RIBA®	confirmatory use	market
Hepatitis B vaccine	Recombivax	hepatitis B prevention	market
Hepatitis C Elisa test	ELISA HCV 3.0	diagnose hepatitis C	market
IL-2	Proleukin®	metastatic renal cell carcinoma	market
Pilocarpine Hydrochloride	Salagen™	treat chemo. assoc. dry mouth	market
Bi-specific antibodies	--	unspecified cancers	Phase I
Cytomegalovirus vaccine	--	cytomegalovirus-related birth defects	Phase I
Gene therapy	--	metastatic melanoma	Phase I
IGF-2	--	peripheral neuropathies	Phase I
M-CSF	Macrolin®	restore white blood cells in cancer patients	Phase I
HIV vaccine (gp 120 & env 2-3)	--	HIV infection	Phase II
IGF-1	--	Type II diabetes, kidney failure	Phase II
IGF-3	--	wasting syndromes	Phase II
IGF-4	--	osteoporosis	Phase II
IL-4	Proleukin®	cancer, T-cell deficiencies, HIV infection	Phase II
M-CSF	Macrolin®	fungal diseases in transplant/cancer patients	Phase II
Bay-x-1351 (anti-TNF antibody)	--	septic shock	Phase III
Beta interferon	Betaseron®	chronic progressive multiple sclerosis	Phase III
Ganciclovir implant	--	CMV retinitis	Phase III
Hepatitis C diagnostic	RIBA® HCV 3.0	diagnose hepatitis C	Phase III
HIV-1,2 diagnostic	RIBA® HIV-1,2	diagnose HIV	Phase III
IL-3	Proleukin®	malignant melanoma, infectious diseases	Phase III
Platelet-derived growth factor (PDGF)	--	decubitus/diabetic ulcers	Phase III
Recombinant pertussis vaccine	--	pertussis infection	Phase III
Two-antigen HSV-2 vaccine	--	prevention/treatment of genital herpes	Phase III
DHFR inhibitor	--	pneumocystis carinii pneumonia	pre-clinical
Fibroblast growth factor (FGF)	--	wound healing	pre-clinical
Gene therapy (IL-2, M-CSF, TNF, MDR)	--	unspecified cancers	pre-clinical
Hepatitis C vaccine	--	hepatitis C	pre-clinical
Meningitis vaccine	--	meningitis	pre-clinical
NGF receptor agonists/antagonists	--	CNS nerve degeneration	pre-clinical
Undisclosed viscoelastic substance	--	ophthalmic (cataract) surgery	pre-clinical
Antisense inhibitors (w/ Lynx)	--	cancer/infectious disease	research
Bone growth factors	--	bone defects	research
Cellular adhesion mol. inhib.	--	infectious disease, oncology, ophthalmology	research
Cellular adhesion mol. inhib.	--	inflammation, asthma, allergy, transplantation	research
Oncogenes	--	unspecified cancers	research
Protease enzymes	--	infectious disease	research
Septic shock mediators	--	septic shock	research
Single-chain Abs.	BABST™	breast cancer	research
TNF receptors	--	septic shock, inflammation	research

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