Medicines in Development

CHILDREN

presented by america's biopharmaceutical research companies

2012 REPORT

More Than 300 Medicines are Being Researched in Clinical Trials to Meet the Unique Needs of Children

Biopharmaceutical research companies are testing 316 medicines to meet the special health needs of infants, children and adolescents. These medicines offer hope that the significant improvements achieved in children's health over the past few decades will continue and even accelerate.

Infant mortality has sunk to record lows. New vaccines protect children against many childhood diseases. Antibiotics prevent deaths from pneumonia and other infectious diseases that used to claim the lives of children. Thanks in part to major treatment advances, 82 percent of children diagnosed with cancer in recent years will survive five years or longer, compared to 58 percent 30 years ago. Biopharmaceutical research companies are working to continue this progress and to meet new challenges to children's health.

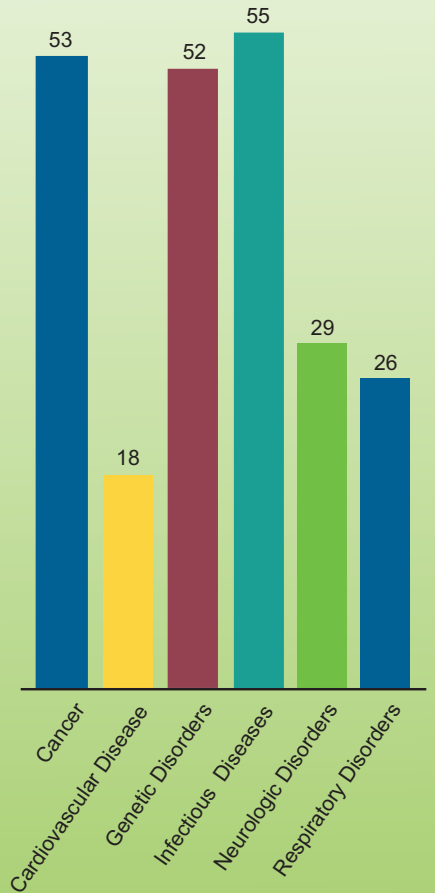
In addition to creating new medicines specifically for children, biopharmaceutical research companies are testing many existing medicines to determine safe and effective dosage levels for children. In 2007, Congress reauthorized both the "Pediatric Research Equity Act" (PREA) and the "Best Pharmaceuticals for Children Act" (BPCA), highly successful programs that generate new knowledge about medicines for use in children. PREA and BPCA are set to expire on October 1, 2012 unless reauthorized or made permanent by Congress.

BPCA and PREA have led to hundreds of pediatric studies covering more than 16 broad categories of diseases that affect children. Significant progress has been made in our ability to treat pediatric patients thanks to the research conducted as a result of BPCA and PREA. Today, pediatricians have more information than ever about which medicines are safe and effective for children and at what doses. Since 1998, BPCA and PREA have resulted in 424 pediatric labeling changes, according the U.S. Food and Drug Administration.

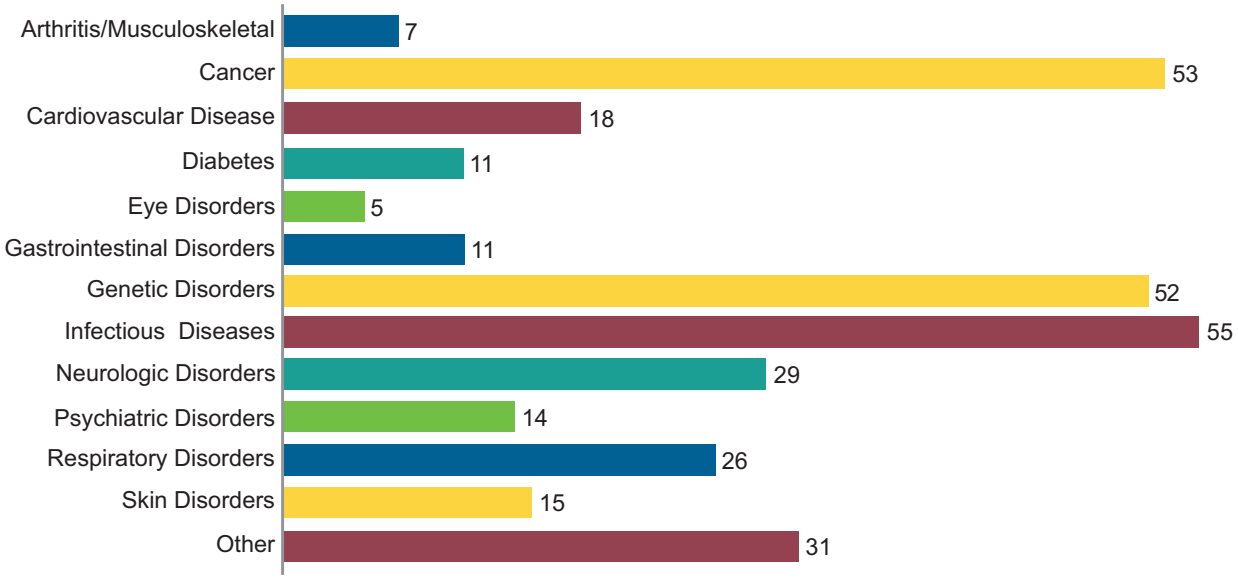
New medicines, and new knowledge about pediatric use of existing medicines, can offer hope that children today will recover from illnesses and grow into healthy adults.

PhRMA

Medicines in Development for Children



Medicines in Development for Children*



** Some medicines are listed in more than one category.*

Arthritis/Musculoskeletal Diseases

Product Name	Sponsor	Indication	Development Status†**
Actemra® tocilizumab	Roche *Nutley, NJ*	active systemic juvenile idiopathic arthritis	Phase I *up to 24 months* (973) 235-5000
Cymbalta® duloxetine	Eli Lilly *Indianapolis, IN*	juvenile primary fibromyalgia syndrome (see also psychiatric)	Phase III *13 years – 17 years* (800) 545-5979
Humira® adalimumab	Abbott Laboratories *Abbott Park, IL*	juvenile idiopathic arthritis (see also gastrointestinal)	Phase III *2 years – 4 years* (847) 937-6100
Ilaris® canakinumab **(Orphan Drug)**	Novartis Pharmaceuticals *East Hanover, NJ*	systemic juvenile idiopathic arthritis	Phase III *2 years and older* (888) 669-6682

† All of the products listed in this report are being tested in children. In most cases, we have identified in the "Development Status" column the ages for which the trials are being conducted.

**For more information about a specific medicine in this report, please call the telephone number listed.

Arthritis/Musculoskeletal Diseases

Product Name	Sponsor	Indication	Development Status
Orencia® abatacept	Bristol-Myers Squibb *Princeton, NJ*	juvenile rheumatoid arthritis	in clinical trials *pediatric patients* (800) 332-2056
		juvenile idiopathic arthritis	in clinical trials *2 years – 17 years* (800) 332-2056
		juvenile rheumatoid arthritis (subcutaneous formulation)	in clinical trials *pediatric patients* (800) 332-2056
Savella® milnacipran	Forest Laboratories *New York, NY*	primary fibromyalgia syndrome	Phase II *13 years – 17 years* (800) 678-1605
Simponi® golimumab	Janssen Biotech *Titusville, NJ*	juvenile idiopathic arthritis	Phase III *2 years – 18 years* (800) 526-7736

Cancer

Product Name	Sponsor	Indication	Development Status
AC220	Ambit Biosciences *San Diego, CA*	acute lymphoblastic leukemia (ALL), acute myelogenous leukemia (AML)	Phase I *1 month – 21 years* (858) 334-2100
Adcetris™ brentuximab vedotin **(Orphan Drug)**	Millennium Oncology *Cambridge, MA* Seattle Genetics *Bothell, WA*	Hodgkin's lymphoma (monotherapy) (Fast Track)	Phase II completed *12 years and older* (425) 527-4000
		refractory or relapsed anaplastic large cell lymphoma	Phase II *12 years and older* (425) 527-4000
		CD30-positive non-Hodgkin's lymphoma, CD30-positive nonlymphomatosus malignancies	Phase II *6 years and older* (425) 527-4000

Cancer

Product Name	Sponsor	Indication	Development Status
APN301 (hu14.18-IL2)	Apeiron Biologics *Vienna, Austria* National Cancer Institute *Bethesda, MD*	neuroblastoma	Phase II completed *pediatric patients* www.apeiron-biologics.com
ARC-100	Archer Biosciences *New York, NY*	medulloblastoma, neuroblastoma	Phase I/II *12 months – 21 years* (646) 747-9090
ARQ-197	ArQule *Woburn, MA*	microphthalmia transcription (MiT) factor tumors	Phase II completed *13 years and older* (781) 994-0300
AT-9283	Astex Pharmaceuticals *Dublin, CA*	solid tumors	Phase I *adolescents and children* (925) 560-0100
blinatumomab **(Orphan Drug)**	Micromet *Rockville, MD*	relapsed/refractory acute ALL	Phase I/II *up to 18 years* (240) 752-1420
CAT-8015 (moxetumomab pasudotox)	MedImmune *Gaithersburg, MD*	ALL, non-Hodgkin's lymphoma	Phase I *6 months – 25 years* (301) 398-0000
cintredekin besodotox **(Orphan Drug)**	INSYS Pharma *Phoenix, AZ*	glioma (Fast Track)	Phase I *adolescents and children* (602) 910-2617
cixutumumab (IMC-A12)	ImClone Systems *New York, NY* Eli Lilly *Indianapolis, IN*	advanced or metastatic sarcoma	Phase II *12 years and older* (212) 645-1405 (800) 545-5979
Clolar® clofarabine	Genzyme *Cambridge, MA*	AML	Phase II *pediatric patients* (617) 252-7500
CLT-008	Cellerant Therapeutics *San Carlos, CA*	hematological malignancies	Phase I *12 years and older* (650) 232-2122
Dacogen® decitabine	Eisai *Woodcliff Lake, NJ*	AML	Phase II *1 year – 16 years* (888) 442-4743
EZN-2208	Enzon Pharmaceuticals *Piscataway, NJ*	solid tumors	Phase I/II *1 year – 21 years* (732) 980-4500

Cancer

Product Name	Sponsor	Indication	Development Status
EZN-3042	Enzon Pharmaceuticals *Piscataway, NJ* Therapeutic Advances in Childhood Leukemia & Lymphoma *Los Angeles, CA*	ALL	Phase I *pediatric patients* (732) 980-4500
FANG™ autologous tumor cell vaccine	Gradalis *Carrollton, TX*	solid tumors	Phase I *12 years and older* (214) 442-8100
GliAtak™ cancer gene therapy **(Orphan Drug)**	Advantagene *Auburndale, MA*	malignant brain tumors	Phase I *3 years – 22 years* (617) 916-5445
GS 1101	Gilead Sciences *Foster City, CA*	Hodgkin's lymphoma	Phase II *12 years and older* (800) 445-3235
GSK2110183	GlaxoSmithKline *Rsch. Triangle Park, NC*	Langerhans cell histiocytosis	Phase II *12 years and older* (888) 825-5249
JX-594 (recombinant vaccinia virus)	Jennerex Biotherapeutics *San Francisco, CA*	refractory solid tumors	Phase I *2 years – 21 years* (415) 281-8886
KRX-0401 (perifosine)	Keryx Biopharmaceuticals *New York, NY*	solid tumors	Phase I *pediatric patients* (212) 531-5965
LDE225 (erismodegib)	Novartis Pharmaceuticals *East Hanover, NJ*	solid tumors	Phase I *12 months – 17 years* (888) 669-6682
Marqibo® vincristine sulfate liposomes injection	Talon Therapeutics *San Mateo, CA*	refractory cancer	Phase I/II *2 years – 20 years* (650) 588-6404
midostaurin (PKC412) **(Orphan Drug)**	Novartis Pharmaceuticals *East Hanover, NJ*	relapsed/refractory AML and ALL	Phase I/II *3 months – 18 years* (888) 669-6682
monoclonal antibody ch14.18	United Therapeutics *Silver Spring, MD* National Cancer Institute *Bethesda, MD*	neuroblastoma	Phase III *pediatric patients* (301) 608-9292
Nexavar® sorafenib	Bayer HealthCare Pharmaceuticals *Wayne, NJ*	glioma, neurofibromatoses	Phase II *pediatric patients* (888) 842-2937

Cancer

Product Name	Sponsor	Indication	Development Status
NiCord™ umbilical cord blood stem cell therapy	Gamida Cell *Jerusalem, Israel*	hematological malignancies	Phase I/II *8 years and older* www.gamida-cell.com
nimotuzumab **(Orphan Drug)**	YM Biosciences USA *Wayne, PA*	recurrent glioma	Phase II *3 years – 18 years* (610) 560-0600
PF-03084014	Pfizer *New York, NY*	cancer	Phase I *16 years and older* (860) 732-5156
PM00104	PharmaMar *Madrid, Spain*	Ewing's sarcoma	Phase II *16 years and older* www.pharmamar.com
propranolol	Pierre Fabre *Parsippany, NJ*	infantile hemangioma	Phase II/III *35 days – 150 days* (973) 898-1042
PTC299	PTC Therapeutics *South Plainfield, NJ* National Cancer Institute *Bethesda, MD*	central nervous system (CNS) cancer	Phase I *pediatric patients* www.ptcbio.com
Rexin-G™ tumor-targeted gene therapy **(Orphan Drug)**	Epeius Biotechnologies *San Marino, CA*	sarcoma	Phase I/II completed *10 years and older* (626) 441-6695
ridaforolimus **(Orphan Drug)**	Ariad Pharmaceuticals *Cambridge, MA* Merck *Whitehouse Station, NJ*	sarcoma	Phase III *13 years and older* (800) 672-6372
SAR3419	sanofi-aventis *Bridgewater, NJ*	ALL	Phase II *16 years and older* (800) 633-1810
SL-701 (brain cancer vaccine)	Stemline Therapeutics *New York, NY*	glioma	Phase I/II *pediatric patients* (212) 831-1111
Sprycel® dasatinib **(Orphan Drug)**	Bristol-Myers Squibb *Princeton, NJ*	chronic myeloid leukemia (CML), Philadelphia-positive ALL	in clinical trials *pediatric patients* (800) 332-2056
Tarceva® erlotinib	Genentech *South San Francisco, CA* OSI Pharmaceuticals *Farmingdale, NY*	recurrent/refractory ependymoma	Phase II *1 year – 21 years* (631) 962-0600

Cancer

Product Name	Sponsor	Indication	Development Status
Tasigna® nilotinib **(Orphan Drug)**	Novartis Pharmaceuticals *East Hanover, NJ*	ALL, CML	Phase I *up to 18 years* (888) 669-6682
TH-302	Threshold Pharmaceuticals *South San Francisco, CA*	soft tissue sarcoma	Phase III *15 years and older* (650) 474-8200
TheraCIM® nimotuzumab **(Orphan Drug)**	YM Biosciences *Lehigh Valley, PA*	recurrent diffuse intrinsic pontine glioma	Phase II completed *3 years – 18 years* (610) 560-0600
Torisel® temsirolimus	Pfizer *New York, NY*	solid tumors	Phase I/II *1 year – 21 years* (860) 732-5156
Treanda® bendamustine	Cephalon *Frazer, PA*	relapsed or refractory acute leukemia (ALL, AML)	Phase I/II *1 year – 20 years* (610) 344-0200
trivalent ganglioside cancer vaccine	MabVax Therapeutics *San Diego, CA*	sarcoma	Phase II *16 years and older* (858) 259-9405
Ultratrace™ MIBG Iobenguane I-131 **(Orphan Drug)**	Molecular Insight Pharmaceuticals *Cambridge, MA*	neuroendocrine tumors (Fast Track)	Phase II *12 years and older* (617) 492-5554
Vectibix® panitumumab	Amgen *Thousand Oaks, CA*	solid tumors	Phase I *1 year – 17 years* (800) 772-6436
vismodegib (GDC-0049)	Genentech *South San Francisco, CA* National Cancer Institute *Bethesda, MD*	medulloblastoma	Phase II *3 years – 21 years* (800) 626-3553
Xalkori® crizotinib	Pfizer *New York, NY*	ALK-positive tumors	Phase I *15 years and older* (860) 732-5156
Xeloda® capecitabine	Roche *Nutley, NJ*	gliomas	Phase I *3 years – 21 years* (973) 235-5000
Xerecept® corticorelin acetate injection **(Orphan Drug)**	Celtic Pharma *Hamilton, Bermuda*	brain edema associated with brain tumors	Phase I/II *1 year – 18 years* (212) 616-4000

Cancer

Product Name	Sponsor	Indication	Development Status
Xgeva® denosumab	Amgen *Thousand Oaks, CA*	recurrent or unresectable giant cell tumor of bone	Phase II *12 years and older* (800) 772-6436
Yervoy® ipilimumab **(Orphan Drug)**	Bristol-Myers Squibb *Princeton, NJ*	advanced/metastatic melanoma	in clinical trials *12 years – 17 years* (800) 332-2056
Yondelis® trabdectedin	Janssen Research & Development *Raritan, NJ*	soft tissue sarcoma	Phase III *15 years and older* (800) 526-7736

Cardiovascular Disease

Product Name	Sponsor	Indication	Development Status
Cardiolite® kit for the preparation of technetium Tc99m sestamibi for injection	Lantheus Medical Imaging *N. Billerica, MA*	Kawasaki disease	Phase I/II completed *4 years – 16 years* (800) 362-2668
CER-001	Cerenis Therapeutics *Ann Arbor, MI*	acute coronary syndrome (see also genetic)	Phase II *pediatric patients included* (734) 769-1110
cicletanine **(Orphan Drug)**	Gilead Sciences *Foster City, CA*	pulmonary arterial hypertension	Phase II *16 years and older* (800) 445-3235
Cozaar® losartan	Merck *Whitehouse Station, NJ*	hypertension	Phase III *6 months – 6 years* (800) 672-6372
Edarbi® azilsartan medoxomil	Takeda Pharmaceuticals North America *Deerfield, IL*	hypertension	Phase I *1 year and older* (877) 825-3327
Eliquis™ apixaban	Bristol-Myers Squibb *Princeton, NJ* Pfizer *New York, NY*	venous thromboembolism	in clinical trials *pediatric patients* (800) 332-2056 (860) 732-5156

Cardiovascular Disease

Product Name	Sponsor	Indication	Development Status
Fragmin® dalteparin	Eisai *Woodcliff Lake, NJ*	venous thromboembolism	Phase II *up to 18 years* (888) 442-4743
L-citrulline (intravenous)	Asklepion Pharmaceuticals *Brentwood, TN*	pulmonary hypertension in children undergoing heart bypass surgery	Phase I/II *up to 6 years* (615) 377-4617
Letairis™ ambrisentan **(Orphan Drug)**	GlaxoSmithKline *Rsch. Triangle Park, NC*	pulmonary arterial hypertension	Phase II *8 years – 18 years* (888) 825-5249
macitentan (ACT-064992) **(Orphan Drug)**	Actelion Pharmaceuticals US *South San Francisco, CA*	pulmonary arterial hypertension	Phase III *12 years and older* (650) 624-6900
mipomersen	Genzyme *Cambridge, MA* Isis Pharmaceuticals *Carlsbad, CA*	severe hypercholesterolemia (see also genetic)	Phase III *12 years and older* (617) 252-7500 (760) 931-9200
oral treprostinil **(Orphan Drug)**	United Therapeutics *Silver Spring, MD*	pulmonary arterial hypertension	Phase III *12 years and older* (301) 608-9292
Pradaxa® dabigatran	Boehringer Ingelheim Pharmaceuticals *Ridgefield, CT*	venous thromboembolism	Phase II *pediatric patients* (800) 243-0127
sildenafil citrate	Pfizer *New York, NY*	pulmonary arterial hypertension	Phase III *1 year – 17 years* (860) 732-5156
Tekturna® aliskiren	Novartis Pharmaceuticals *East Hanover, NJ*	hypertension	Phase III *6 years – 17 years* (888) 669-6682
Tracleer® bosentan **(Orphan Drug)**	Actelion Pharmaceuticals US *South San Francisco, CA*	pulmonary arterial hypertension --- pulmonary arterial hypertension --- persistent pulmonary hypertension in newborns	Phase III *3 months – 12 years* (650) 624-6900 --- Phase III *up to 7 days* (650) 624-6900 --- Phase III *up to 7 days* (650) 624-6900

Cardiovascular Disease

Product Name	Sponsor	Indication	Development Status
Xarelto® rivaroxaban	Bayer HealthCare Pharmaceuticals *Wayne, NJ* Janssen Research & Development *Raritan, NJ*	venous thromboembolism	Phase I *6 months – 18 years* (888) 842-2937 (800) 526-7736
Zetia® ezetimibe	Merck *Whitehouse Station, NJ*	primary hypercholesterolemia	Phase III *6 years – 10 years* (800) 672-6372

Diabetes

Product Name	Sponsor	Indication	Development Status
alogliptin	Takeda Pharmaceuticals North America *Deerfield, IL*	type 2 diabetes	Phase I *10 years and older* (877) 825-3327
autoimmune diabetes vaccine (rhGAD65) **(Orphan Drug)**	Diamyd Therapeutics *Stockholm, Sweden* *Pittsburgh, PA*	prevention of type 1 diabetes	Phase III *10 years and older* (412) 770-1310
Byetta® exenatide	Amylin Pharmaceuticals *San Diego, CA*	type 2 diabetes	Phase III *10 years – 17 years* (858) 552-2200
dapagliflozin	AstraZeneca *Wilmington, DE* Bristol-Myers Squibb *Princeton, NJ*	type 2 diabetes	in clinical trials *10 years – 17 years* (800) 236-9933 (800) 332-2056
Janumet® sitagliptin/metformin	Merck *Whitehouse Station, NJ*	type 2 diabetes	Phase III *10 years – 17 years* (800) 672-6372
Januvia® sitagliptin	Merck *Whitehouse Station, NJ*	type 2 diabetes	Phase I completed *adolescents* (800) 672-6372
Onglyza™ saxagliptin	AstraZeneca *Wilmington, DE* Bristol-Myers Squibb *Princeton, NJ*	type 2 diabetes	in clinical trials *10 years – 17 years* (800) 236-9933 (800) 332-2056
otelixizumab **(Orphan Drug)**	Tolerx *Cambridge, MA*	type 1 diabetes	Phase II *12 years and older* (617) 354-8100

Diabetes

Product Name	Sponsor	Indication	Development Status
Prochymal® remestemcel-L **(Orphan Drug)**	Osiris Therapeutics *Columbia, MD*	type 1 diabetes (see also other)	Phase II *12 years and older* (443) 545-1800
teplizumab (MGA031) **(Orphan Drug)**	MacroGenics *Rockville, MD*	type 1 diabetes	Phase III *8 years and older* (301) 251-5172
Victoza® liraglutide	Novo Nordisk *Princeton, NJ*	type 2 diabetes	Phase III completed *10 years and older* (609) 987-5800

Eye Disorders

Product Name	Sponsor	Indication	Development Status
AC-150	Aciex Therapeutics *Boston, MA*	allergic conjunctivitis	Phase II *10 years and older* (508) 439-4946
AC-170	Aciex Therapeutics *Boston, MA*	allergic conjunctivitis	Phase II/III *10 years and older* (508) 439-4946
Cystaran™ cysteamine HCl **(Orphan Drug)**	Sigma-Tau Pharmaceuticals *Gaithersburg, MD*	corneal cysteine crystal accumulation in cystinosis	application submitted *1 year and older* (800) 447-0169
Durezol™ difluprednate	Alcon Research *Fort Worth, TX*	inflammation following cataract surgery	Phase III *up to 3 years* (800) 862-5266
ocriplasmin (recombinant human microplasmin) **(Orphan Drug)**	ThromboGenics *New York, NY*	vitrectomy	Phase II *up to 16 years* (212) 201-0920

Gastrointestinal Disorders

Product Name	Sponsor	Indication	Development Status
Aciphex® rabeprazole	Eisai *Woodcliff Lake, NJ* Janssen Research & Development *Raritan, NJ*	gastroesophageal reflux disease (GERD) --- GERD --- GERD	Phase III *1 year – 11 years* (888) 442-4743 (800) 526-7736 --- Phase III *1 month – 11 months* (888) 442-4743 (800) 526-7736 --- Phase I *less than 44 weeks* (888) 442-4743 (800) 526-7736
Asacol® mesalamine delayed-release tablets (400mg)	Warner-Chilcott *Rockaway, NJ*	ulcerative colitis	Phase III completed *5 years – 17 years* (800) 521-8813
Asacol® HD mesalamine delayed-release tablets (800mg)	Warner-Chilcott *Rockaway, NJ*	ulcerative colitis	Phase III *5 years – 17 years* (800) 521-8813
Cimzia® certolizumab pegol	UCB *Smyrna, GA*	Crohn's disease	Phase II *6 years – 17 years* (770) 970-7500
crofelemer	Napo Pharmaceuticals *San Francisco, CA*	diarrhea	Phase I *pediatric patients* (415) 371-8300
dexlansoprazole	Takeda Pharmaceuticals North America *Deerfield, IL*	GERD	Phase I *1 year – 11 years* (877) 825-3327
Humira® adalimumab	Abbott Laboratories *Abbott Park, IL*	Crohn's disease (see also arthritis)	Phase III *7 years – 18 years* (847) 937-6100
MMX mesalamine	Shire Pharmaceutical *Cambridge, MA*	ulcerative colitis	Phase I *5 years – 17 years* www.shire.com
nepadutant oral solution	Menarini *Florence, Italy*	infant colic	Phase II *1 month – 4 months* www.menarini.com
oral viscous budesonide **(Orphan Drug)**	Meritage Pharma *San Diego, CA*	eosinophilic esophagitis	Phase II completed *2 years – 18 years* (858) 436-1660

Gastrointestinal Disorders

Product Name	Sponsor	Indication	Development Status
reslizumab **(Orphan Drug)**	Cephalon *Frazer, PA*	eosinophilic esophagitis (see also respiratory)	Phase III *5 years and older* (610) 344-0200

Genetic Disorders

Product Name	Sponsor	Indication	Development Status
A-001 (varespladib) **(Orphan Drug)**	Anthera Pharmaceuticals *Hayward, CA*	acute chest syndrome in patients with sickle cell disease (Fast Track)	Phase II *5 years and older* (510) 856-5600
AAV2-RPE65 **(Orphan Drug)**	Applied Genetic Technologies *Alachua, FL*	leber congenital amaurosis	Phase I/II *6 years and older* (386) 462-2204
AFQ056	Novartis Pharmaceuticals *East Hanover, NJ*	fragile X syndrome --- fragile X syndrome	Phase II/III *12 years – 17 years* (888) 669-6682 --- Phase I *3 years – 11 years* (888) 669-6682
arbaclofen (STX209)	Seaside Therapeutics *Cambridge, MA*	treatment of social withdrawal in patients with fragile X syndrome (see also psychiatric) --- treatment of social withdrawal in patients with fragile X syndrome	Phase III *12 years and older* (617) 374-9009 --- Phase II *5 years – 11 years* (617) 374-9009
Arimidex® anastrozole	AstraZeneca *Wilmington, DE*	McCune-Albright syndrome	Phase II *up to 10 years* (800) 236-9933
AT1001 (migalastat) **(Orphan Drug)**	Amicus Therapeutics *Cranbury, NJ* GlaxoSmithKline *Rsch. Triangle Park, NC*	Fabry disease	Phase III *16 years and older* (800) 825-5249

Genetic Disorders

Product Name	Sponsor	Indication	Development Status
ataluren (PTC124) **(Orphan Drug)**	PTC Therapeutics *South Plainfield, NJ*	cystic fibrosis (Fast Track) --- Duchenne/Becker muscular dystrophy (boys) (Fast Track)	Phase III *6 years and older* (908) 222-7000 --- Phase III *7 years and older* (908) 222-7000
AVI-4658 (eteplirsen) **(Orphan Drug)**	AVI BioPharma *Bothell, WA*	Duchenne muscular dystrophy (Fast Track)	Phase II *7 years – 13 years* (425) 354-5038
Berinert® C1 esterase inhibitor, human **(Orphan Drug)**	CSL Behring *King of Prussia, PA*	hereditary angioedema	Phase II/III completed *6 years and older* (610) 878-4000
BMN-110 **(Orphan Drug)**	BioMarin Pharmaceuticals *Novato, CA*	mucopolysaccharidosis IV A (Morquio A syndrome)	Phase III *5 years and older* (415) 506-6700
BMN-701 **(Orphan Drug)**	BioMarin Pharmaceuticals *Novato, CA*	late-onset Pompe disease	Phase I/II *13 years and older* (415) 506-6700
CER-001	Cerenis Therapeutics *Ann Arbor, MI*	homozygous familial hypercholesterolemia (see also cardiovascular)	Phase II *12 years and older* (734) 769-1110
Cinryze™ C1 esterase inhibitor (human) **(Orphan Drug)**	ViroPharma *Exton, PA*	hereditary angioedema --- hereditary angioedema	Phase II *2 years – 11 years* (888) 651-0201 --- Phase II *12 years and older* (888) 651-0201
conestat alfa (recombinant human C1 inhibitor)	Pharming *Leiden, The Netherlands*	hereditary angioedema (Fast Track)	Phase III *13 years and older* www.pharming.com
ecopipam **(Orphan Drug)**	Psyadon Pharmaceuticals *Germantown, MD*	Lesch-Nyhan disease	Phase I *6 years and older* (301) 919-2020
Elaprase® idursulfase-IT **(Orphan Drug)**	Shire Human Genetic Therapies *Lexington, MA*	central nervous system involvement in Hunter syndrome (mucopolysaccharidosis II)	Phase I/II *3 years – 18 years* (866) 888-0660

Genetic Disorders

Product Name	Sponsor	Indication	Development Status
ENB-0040 **(Orphan Drug)**	Enobia Pharma *Cambridge, MA*	hypophosphatasia (Fast Track) --- hypophosphatasia (Fast Track) --- hypophosphatasia	Phase II/III *up to 5 years* (617) 674-5720 --- Phase II *5 years – 13 years* (617) 674-5720 --- Phase II *6 months – 42 months* (617) 674-5720
EPI-743 **(Orphan Drug)**	Edison Pharmaceuticals *Mountain View, CA*	inherited mitochondrial diseases	Phase II *1 year and older* www.edisonpharma.com
Faslodex® fulvestrant	AstraZeneca *Wilmington, DE*	McCune-Albright syndrome (precocious puberty)	Phase II *up to 10 years* (800) 236-9933
Genz-112638 (eliglustat)	Genzyme *Cambridge, MA*	Gaucher disease type 1	Phase III *16 years and older* (617) 252-7500
GMI-1070/PF-06460031 **(Orphan Drug)**	GlycoMimetics *Gaithersburg, MD* Pfizer *New York, NY*	treatment of sickle cell pain crisis (Fast Track)	Phase II *12 years and older* (240) 243-1201 (860) 732-5156
GSK656933	GlaxoSmithKline *Rsch. Triangle Park, NC*	cystic fibrosis	Phase II completed *16 years and older* (888) 825-5249
GSK2402968 **(Orphan Drug)**	GlaxoSmithKline *Rsch. Triangle Park, NC*	Duchenne muscular dystrophy	Phase II *5 years and older* (888) 825-5249
HQK-1001 **(Orphan Drug)**	HemaQuest Pharmaceuticals *San Diego, CA*	sickle cell anemia	Phase II *12 years and older* (858) 356-5590
HuCNS-SC® adult neural stem cell therapy	StemCells *Newark, CA*	Pelizaeus-Merzbacher disease	Phase I *6 months – 5 years* (510) 456-4000
human-cl rhFVIII	Octapharma *Hoboken, NJ*	severe hemophilia A	Phase III *12 years and older* (866) 766-4860

Genetic Disorders

Product Name	Sponsor	Indication	Development Status
IB1001 (recombinant factor IX)	Inspiration Biopharmaceuticals *Laguna Niguel, CA*	hemophilia B	Phase III *up to 12 years* www.inspirationbio.com
idebenone **(Orphan Drug)**	Santhera Pharmaceuticals *Charlestown, MA*	Friedreich's ataxia (Fast Track)	Phase III *9 years and older* (617) 886-5161
		Duchenne muscular dystrophy	Phase III *10 years – 18 years* (617) 886-5161
		MELAS syndrome	Phase II *8 years and older* (617) 886-5161
immune globulin infusion (human)/recombinant human hyaluronidase (rHuPH20)	Baxter Healthcare *Deerfield, IL*	primary immunodeficiency disorders	Phase II/III *2 years and older* (800) 422-9837
inhaled mannitol **(Orphan Drug)**	Pharmaxis *Exton, PA*	cystic fibrosis (Fast Track)	Phase III *6 years and older* (610) 363-5120
Kogenate-PF® octocog alfa, plasma protein-free (recombinant factor VIII)	Bayer HealthCare Pharmaceuticals *Wayne, NJ*	hemophilia A	Phase III *up to 12 years* (888) 842-2937
L-glutamine powder for oral solution **(Orphan Drug)**	Emmaus Medical *Torrance, CA*	sickle cell anemia, thalassemia	Phase III *5 years and older* (877) 420-6493
mipomersen **(Orphan Drug)**	Genzyme *Cambridge, MA* Isis Pharmaceuticals *Carlsbad, CA*	familial hypercholesterolemia (hyperlipoproteinemia type IIa) (see also cardiovascular)	Phase III *12 years and older* (617) 252-7500 (760) 931-9200
Myozyme® alglucosidase alfa **(Orphan Drug)**	Genzyme *Cambridge, MA*	infantile-onset Pompe disease (glycogen storage disease-II)	Phase I/II completed *6 months – 36 months* (617) 252-7500

Genetic Disorders

Product Name	Sponsor	Indication	Development Status
NN1841 (recombinant factor XIII)	Novo Nordisk *Princeton, NJ*	congenital FXIII deficiency --- congenital FXIII deficiency	application submitted *6 years and older* (609) 987-5800 --- Phase III *1 year – 6 years* (609) 987-5800
NN7999 (glycopegylated rFIX)	Novo Nordisk *Princeton, NJ*	hemophilia B	Phase III *13 years and older* (609) 987-5800
oxalobacter formigenes (OC3)	OxThera *Fort White, FL*	primary hyperoxaluria	Phase II/III *2 years and older* www.oxthera.com
plasma-derived AT-III concentrate	Grifols Biologicals *Los Angeles, CA*	antithrombin III deficiency	Phase II/III *12 years and older* (888) 474-3657
rAvPAL-PEG **(Orphan Drug)**	BioMarin Pharmaceuticals *Novato, CA*	phenylketonuria	Phase II *16 years and older* (415) 506-6700
recombinant factor VIII-Fc fusion protein (rFVIIIFc) **(Orphan Drug)**	Biogen Idec *Weston, MA*	severe hemophilia A	Phase II/III *12 years and older* (781) 464-2000
recombinant factor IX-Fc fusion protein (rFIXFc) **(Orphan Drug)**	Biogen Idec *Weston, MA*	hemophilia B	Phase II/III *12 years and older* (781) 464-2000
Replagal® agalsidase alfa **(Orphan Drug)**	Shire Human Genetic Therapies *Lexington, MA*	Fabry disease (Fast Track)	Phase II/III *7 years – 17 years* (866) 888-0660
RP103 (cysteamine bitartrate delayed-release) **(Orphan Drug)**	Raptor Pharmaceutical *Novato, CA*	cystinosis	Phase III *6 years and older* (877) 727-8679
SBC-102 **(Orphan Drug)**	Synageva BioPharma *Lexington, MA*	Wolman disease (lysosomal acid lipase deficiency) (Fast Track)	Phase I/II *infants and children* (781) 357-9900

Genetic Disorders

Product Name	Sponsor	Indication	Development Status
Spiriva® HandiHaler® tiotropium bromide	Boehringer Ingelheim Pharmaceuticals *Ridgefield, CT*	cystic fibrosis (see also respiratory)	Phase III *pediatric patients* (800) 243-0127
taliglucerase alfa **(Orphan Drug)**	Pfizer *New York, NY* Protalix Biotherapeutics *Carmiel, Israel*	Gaucher's disease	Phase III *2 years and older* (860) 732-5156
thymosin beta 4 **(Orphan Drug)**	RegeneRx Biopharmaceuticals *Rockville, MD*	epidermolysis bullosa	Phase II *2 years and older* (301) 208-9191
turoctocog alfa (recombinant factor VIII)	Novo Nordisk *Princeton, NJ*	hemophilia A	Phase III *6 months and older* (609) 987-5800
vatreptacog alfa	Novo Nordisk *Princeton, NJ*	hemophilia A or B with inhibitors	Phase III *12 years and older* (609) 987-5800
VX-770 (ivacaftor) **(Orphan Drug)**	Vertex Pharmaceuticals *Cambridge, MA*	cystic fibrosis in patients with the G551D gene mutation (Fast Track)	application submitted *6 years and older* (617) 444-6100
Wilate® von Willebrand factor/ coagulation factor VIII complex (human)	Octapharma USA *Hoboken, NJ*	prevent bleeding during surgery in patients with von Willebrand disease	Phase III *6 years and older* (866) 766-4860
Zyntha® antihemophilic factor (recombinant), plasma/albumin-free (AF-CC) **(Orphan Drug)**	Pfizer *New York, NY*	hemophilia A	Phase III *up to 6 years* (860) 732-5156

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
33525 (antifungal topical cream)	Tinea Pharmaceuticals *Palo Alto, CA*	tinea corporis, tinea curis, tinea pedis	Phase III *12 years and older* (650) 473-3811
ADS-8902	Adamas Pharmaceuticals *Emeryville, CA*	influenza A infections	Phase II *1 year and older* (510) 450-3500

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
Aeroquin™ levofloxacin for inhalation **(Orphan Drug)**	Mpex Pharmaceuticals (Aptalis) *Birmingham, AL*	cystic fibrosis-associated respiratory tract infections --- cystic fibrosis-associated respiratory tract infections	Phase III *12 years and older* (800) 950-8085 --- Phase I *6 years – 16 years* (800) 950-8085
Agriflu® influenza virus vaccine	Novartis Vaccines & Diagnostics *Cambridge, MA*	influenza A & B virus infections	Phase III *pediatric patients* (617) 871-5500
Aptivus® tipranivir with low-dose ritonavir	Boehringer Ingelheim Pharmaceuticals *Ridgefield, CT*	HIV-1 infection treatment	Phase I completed *2 years – 18 years* (800) 243-0127
Avelox™ moxifloxacin	Bayer HealthCare Pharmaceuticals *Wayne, NJ* Merck *Whitehouse Station, NJ*	infections	Phase III *3 months – 17 years* (888) 842-2937 (800) 672-6372
Baraclude® entecavir	Bristol-Myers Squibb *Princeton, NJ*	chronic hepatitis B	in clinical trials *pediatric patients* (800) 332-2056
Besivance® besifloxacin ophthalmic solution	Bausch & Lomb *Madison, NJ*	bacterial conjunctivitis	Phase III *up to 31 days* (877) 442-6925
BSYX-A110 (pagibaximab) **(Orphan Drug)**	Biosynexus *Gaithersburg, MD*	Staphylococcal sepsis	Phase II/III *premature neonates* (301) 330-5800
Cayston® aztreonam lysine for inhalation **(Orphan Drug)**	Gilead Sciences *Foster City, CA*	chronic *Pseudomonas aeruginosa* infections in cystic fibrosis	Phase II *3 months and older* (800) 445-3235
ciprofloxacin dry powder for inhalation **(Orphan Drug)**	Bayer HealthCare Pharmaceuticals *Wayne, NJ* Novartis Pharmaceuticals *East Hanover, NJ*	cystic fibrosis-associated *Pseudomonas aeruginosa* infections	Phase II completed *12 years and older* (888) 842-2937 (800) 672-6372
CMX-001	Chimerix *Durham, NC*	adenovirus infections (Fast Track)	Phase II *3 months and older* (919) 806-1074

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
Cubicin® daptomycin	Cubist Pharmaceuticals *Lexington, MA*	skin and skin structure infections --- Gram-positive bacterial infections	Phase IV *2 years – 17 years* (781) 860-8660 --- Phase I *3 months – 24 months* (781) 860-8660
Doribax™ doripenem	Janssen Research & Development *Raritan, NJ*	complicated urinary tract infections, intra-abdominal infections, pneumonia --- bacterial infections	Phase III *3 months – 18 years* (800) 526-7736 --- Phase I *up to 12 weeks* (800) 526-7736
DTP-HepB-polio-Hib hexavalent vaccine	Merck *Whitehouse Station, NJ* sanofi-aventis *Bridgewater, NJ*	diphtheria, tetanus, pertussis, hepatitis B, polio, *Haemophilus influenzae* type b	Phase III *infants* (800) 672-6372
econazole nitrate foam 1%	AmDerma Pharmaceuticals *Bridgewater, NJ* Quinnova Pharmaceuticals *Newton, PA*	tinea pedis	Phase III *12 years and older* (877) 660-6263
Edurant™ rilpivirine	Tibotec Pharmaceuticals *County Cork, Ireland* Janssen Research & Development *Raritan, NJ*	HIV infection	Phase II *12 years – 18 years* (800) 526-7736
Eraxis® anidulafungin	Pfizer *New York, NY*	candidiasis	Phase III *1 month – 17 years* (860) 732-5156
Eraxis® anidulafungin/ **Vfend®** voriconazole combination	Pfizer *New York, NY*	invasive aspergillosis	Phase III *16 years and older* (860) 732-5156
FluBlok® trivalent recombinant hemagglutinin vaccine	Protein Sciences *Meriden, CT*	prevention of influenza virus infection	application submitted *children* (800) 488-7099
FluLaval® influenza virus vaccine	GlaxoSmithKline *Rsch Triangle Park, NC*	prevention of influenza	Phase III completed *3 years – 17 years* (888) 825-5249
Fluvirin® influenza virus vaccine (MF59-eH1N1)	Novartis Vaccines & Diagnostics *Cambridge, MA*	influenza A virus H1N1 subtype	Phase II/III completed *pediatric patients* (617) 871-5500

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
GSK134612 (Men ACWY)	GlaxoSmithKline *Rsch. Triangle Park, NC*	meningococcal infections	Phase III *15 years and older* (888) 825-5249
		meningococcal infections	Phase III *4 years – 16 years* (888) 825-5249
		meningococcal infections	Phase II *2 years – 6 years* (888) 825-5249
GSK1557484A (influenza virus vaccine)	GlaxoSmithKline *Rsch. Triangle Park, NC*	pandemic H5N1 influenza	Phase III *6 months – 17 years* (888) 825-5249
GSK2202083A (heptavalent combination vaccine)	GlaxoSmithKline *Rsch. Triangle Park, NC*	meningococcal group C infections, *Haemophilus influenzae* type b infection, diphtheria, hepatitis B, tetanus, pertussis and poliomyelitis	Phase II *infants* (888) 825-5249
Intelence® etravirine	Tibotec Pharmaceuticals *County Cork, Ireland* Janssen Research & Development *Raritan, NJ*	HIV infection	Phase III *6 years – 18 years* (800) 526-7736
Isentress® raltegravir	Merck *Whitehouse Station, NJ*	HIV infection	Phase I/II *2 years – 18 years* (800) 672-6372
ivermectin topical	Topaz Pharmaceuticals *Horsham, PA*	pediculosis (head lice)	application submitted *pediatric patients* (215) 672-7140
Ixiaro® Japanese encephalitis vaccine	Intercell *Gaithersburg, MD*	Japanese encephalitis	Phase III *2 months – 17 years* (301) 556-4500
Lexiva® fosamprenavir	Vertex Pharmaceuticals *Cambridge, MA* ViiV Healthcare *Rsch. Triangle Park, NC*	HIV infection	Phase II *2 years – 18 years* (617) 444-6100 (877) 844-8872
		HIV infection	Phase II *up to 2 years* (617) 444-6100 (877) 844-8872

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
MALG (malathion gel)	Taro Pharmaceuticals USA *Hawthorne, NY*	pediculosis (head lice)	Phase II/III *6 months – 24 months* (800) 544-1449
MEDI-534	MedImmune *Gaithersburg, MD*	prevention of respiratory syncytial virus infections and parainfluenza virus type-3	Phase I/II *1 month – 23 months* (301) 398-0000
MEDI-559	MedImmune *Gaithersburg, MD*	prevention of respiratory syncytial virus infections	Phase I/II *1 month – 23 months* (301) 398-0000
Men ABCWY conjugate vaccine	Novartis Vaccines & Diagnostics *Cambridge, MA*	invasive meningococcal disease	Phase II *10 years and older* (617) 871-5500
meninge ACYW conjugate vaccine (2nd generation)	sanofi pasteur *Stillwater, PA*	prevention of meningococcal disease	Phase II *infants* (800) 822-2463
meningococcal vaccine group B	Novartis Vaccines & Diagnostics *Cambridge, MA*	prevention of meningococcal disease	Phase II completed *11 years – 18 years* (617) 871-5500
MenHibrix® Hib-MenCY-TT conjugated vaccine	GlaxoSmithKline *Rsch. Triangle Park, NC*	*Neisseria meningitis* C and Y disease and *Haemophilus infleunzae* type B disease prevention	application submitted *pediatric patients* (888) 825-5249
Menveo® meningococcal (groups A, C, Y and W-135) oligosaccharide diphtheria CRM197 conjugate vaccine	Novartis Vaccines & Diagnostics *Cambridge, MA*	meningococcal meningitis	application submitted *2 months – 12 months* (617) 871-5500
MMR live attenuated vaccine	GlaxoSmithKline *Rsch. Triangle Park, NC*	prevention of measles, mumps and rubella	Phase II *pediatric patients* (888) 825-5249
Mosquirix® recombinant malaria vaccine	GlaxoSmithKline *Rsch. Triangle Park, NC*	prevention of malaria	Phase III *pediatric patients* (888) 825-5249
Mycamine® micafungin	Astellas Pharma US *Deerfield, IL*	candidiasis	Phase I completed *2 years – 16 years* (800) 695-4321
NAFT-600	Merz Pharmaceuticals *Greensboro, NC*	tinea pedis	Phase III *12 years and older* (888) 637-9872

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
Numax® motavizumab	MedImmune *Gaithersburg, MD*	respiratory syncytial virus	Phase II completed *up to 12 months* (301) 398-0000
peramivir intravenous	BioCryst Pharmaceuticals *Durham, NC*	influenza	Phase III *12 years and older* (919) 859-1302
Quadracel™ diphtheria, tetanus, pertussis polio vaccine	sanofi pasteur *Swiftwater, NJ*	diphtheria, tetanus, pertussis, polio	Phase III *4 years – 6 years* (800) 822-2463
Reyataz® atazanavir	Bristol-Myers Squibb *Princeton, NJ*	HIV-1 infection	in clinical trials *pediatric patients* (800) 332-2056
rotavirus tetravalent vaccine	sanofi pasteur *Swiftwater, NJ*	rotavirus	Phase I *6 weeks – 8 weeks* (800) 822-2463
Sustiva® efavirenz	Bristol-Myers Squibb *Princeton, NJ*	HIV infection	in clinical trials *pediatric patients* (800) 332-2056
talactoferrin alfa oral solution	Agennix *Princeton, NJ*	nosocomial infections	Phase I/II *preterm infants up to 24 hours* (609) 524-1000
Tamiflu® oseltamivir intravenous	Roche *Nutley, NJ*	influenza	Phase I *up to 1 year* (973) 235-5000
V503	Merck *Whitehouse Station, NJ*	human papillomavirus infections	Phase III *9 years and older* (800) 672-6372
Valcyte® valganciclovir	Genentech *South San Francisco, CA*	prevention of cytomegalovirus infections in heart transplant recipients	Phase I *less than 4 months* (800) 626-3553
Vfend® voriconazole	Pfizer *New York, NY*	invasive aspergillosis --- candidiasis	Phase III *2 years – 17 years* (860) 732-5156 --- Phase III *2 years – 17 years* (860) 732-5156
Viramune® XR™ nevirapine extended-release	Boehringer Ingelheim Pharmaceuticals *Ridgefield, CT*	HIV-1 infection	Phase I *3 years – 17 years* (800) 243-0127

Infectious Diseases

Product Name	Sponsor	Indication	Development Status
Viread® tenofovir	Gilead Sciences *Foster City, CA*	HIV infection --- hepatitis B	Phase III *2 years – 11 years* (800) 445-3235 --- Phase II/III *12 years – 17 years* (800) 445-3235

Neurologic Disorders

Product Name	Sponsor	Indication	Development Status
Abeladrug200	Abela Pharmaceuticals *Lake Forest, CA*	severe head trauma	Phase I/II *16 years and older* (949) 855-2885
BA-210 **(Orphan Drug)**	Alseres Pharmaceuticals *Hopkinton, MA*	spinal cord injuries	Phase II *16 years and older* www.alseres.com
Banzel® rufinamide **(Orphan Drug)**	Eisai *Woodcliff Lake, NJ*	Lennox-Gastaut syndrome	Phase III *1 year – 3 years* (888) 422-4743
brivaracetam	UCB *Smyrna, GA*	epilepsy --- epilepsy	Phase III *16 years and older* (770) 970-7500 --- Phase II *1 month – 16 years* (770) 970-7500
Butrans™ Transdermal System CIII buprenorphine transdermal system	Purdue Pharma *Stamford, CT*	pain	Phase III *7 years – 16 years* (800) 877-5666
Caldolor® intravenous ibuprofen	Cumberland Pharmaceuticals *Nashville, TN*	pain (see also other)	Phase III *6 years – 17 years* (877) 484-2700

Neurologic Disorders

Product Name	Sponsor	Indication	Development Status
darifenacin liquid oral suspension	Warner-Chilcott *Rockaway, NJ*	neurogenic detrusor overactivity	Phase II *2 years – 15 years* (800) 521-8813
Dysport® botulinum toxin A	Ipsen *Paris, France* Medicis Pharmaceutical *Scottsdale, AZ*	cerebral palsy muscle spasticity	Phase III *2 years – 17 years* (602) 808-8800
Epliga® oxcarbazepine extended-release	Supernus Pharmaceuticals *Rockville, MD*	refractory partial epilepsy	Phase III *4 years – 17 years* (301) 838-2500
ISIS-SMNRx **(Orphan Drug)**	Isis Pharmaceuticals *Carlsbad, CA*	spinal muscular atrophy	Phase I *2 years – 14 years* (800) 679-4747
Keppra® levetiracetam	UCB *Smyrna, GA*	epilepsy	Phase II completed *1 month – 4 years* (770) 970-7500
Keppra® XR levetiracetam extended-release	UCB *Smyrna, GA*	epilepsy	Phase II completed *12 years – 16 years* (770) 970-7500
Lyrica® pregabalin	Pfizer *New York, NY*	partial-onset seizures	Phase III *1 month – 16 years* (860) 732-5156
Maxalt® rizatriptan benzoate	Merck *Whitehouse Station, NJ*	acute migraine	Phase III *6 years – 17 years* (800) 672-6372
Neupro® rotigotine transdermal system	UCB *Smyrna, GA*	restless legs syndrome	Phase II *13 years – 17 years* (770) 970-7500
Nucynta™ tapentadol oral solution	Janssen Research & Development *Raritan, NJ*	post-operative pain	Phase II *6 years – 17 years* (800) 526-7736
Opana® IR oxymorphone immediate-release oral liquid	Endo Pharmaceuticals *Chadds Ford, PA*	post-operative pain	Phase III *up to 17 years* (800) 462-3636
OxyContin® oxycodone controlled-release	Purdue Pharma *Stamford, CT*	pain	Phase III *6 years – 16 years* (800) 877-5666

Neurologic Disorders

Product Name	Sponsor	Indication	Development Status
perampanel (E2007)	Eisai *Woodcliff Lake, NJ*	refractory partial seizures	Phase III *12 years – 18 years* (888) 422-4743
progesterone intravenous (BHR-100) **(Orphan Drug)**	BHR Pharma *Herndon, VA*	severe traumatic brain injury (Fast Track)	Phase III *16 years and older* (703) 964-3033
Rozerem® ramelteon	Takeda Pharmaceuticals North America *Deerfield, IL*	insomnia	Phase I completed *6 years and older* (877) 825-3327
Stedesa™ eslicarbazepine	Bial *Porto, Portugal* Sunovion Pharmaceuticals *Marlborough, MA*	refractory partial seizures	Phase III *16 years and older* (508) 481-6700
topimarate controlled-release (TPM-XR)	Supernus Pharmaceuticals *Rockville, MD*	epilepsy	Phase I/II *4 years – 17 years* (301) 838-2500
Treximet® sumatriptan/naproxen	GlaxoSmithKline *Rsch. Triangle Park, NC*	migraine	Phase III completed *12 years – 17 years* (888) 825-5249
USL261 (midazolam intranasal) **(Orphan Drug)**	Upsher-Smith Laboratories *Maple Grove, MN*	epilepsy with seizure clusters (Fast Track)	Phase III *14 years and older* (800) 654-2299
Vanquix® diazepam injection	Pfizer *New York, NY*	epilepsy	Phase III *2 years and older* (860) 732-5156
Vimpat® lacosamide	UCB *Smyrna, GA*	partial-onset seizures	Phase II *1 year – 17 years* (770) 970-7500
YKP3089	SK Biopharmaceuticals *Fair Lawn, NJ*	epilepsy	Phase II *16 years and older* (201) 421-3864
Zanaflex® tizanidine **(Orphan Drug)**	Acorda Therapeutics *Hawthorne, NY*	muscle spasticity due to cerebral palsy	Phase I *2 years – 16 years* (914) 347-4300

Psychiatric Disorders

Product Name	Sponsor	Indication	Development Status
Abilify® aripiprazole	Otsuka Pharmaceutical *Rockville, MD*	Tourette's syndrome	Phase III *7 years – 17 years* (301) 208-7113
arbaclofen (STX209)	Seaside Therapeutics *Cambridge, MA*	treatment of social withdrawal in patients with autism (see also genetic)	Phase II 5 years – 21 years (617) 374-9009
CM-AT (CM-4612)	CureMark *Rye, NY*	autism (Fast Track)	Phase III *3 years – 8 years* (914) 925-3450
Cymbalta® duloxetine	Eli Lilly *Indianapolis, IN*	generalized anxiety disorder, major depressive disorder (see also arthritis)	Phase III *7 years – 17 years* (800) 545-5979
Geodon® ziprasidone	Pfizer *New York, NY*	bipolar 1 disorder	Phase III completed *10 years – 17 years* (860) 732-5156
Intuniv™ guanfacine extended-release	Shire Pharmaceutical *Cambridge, MA*	generalized anxiety disorder, separation anxiety disorder, social phobia	Phase II *6 years – 17 years* www.shire.com
JNJ-31001074	Janssen Research & Development *Raritan, NJ*	attention-deficit/hyperactivity disorder (ADHD)	Phase I *6 years – 17 years* (800) 526-7736
Lamictal® lamotrigine	GlaxoSmithKline *Rsch. Triangle Park, NC*	bipolar 1 disorder	Phase III *10 years – 17 years* (888) 825-5249
LY2216684 (NERI)	Eli Lilly *Indianapolis, IN*	ADHD	Phase II/III *6 years – 17 years* (800) 545-5979
methylphenidate ER	Rhodes Pharmaceuticals *Coventry, RI*	ADHD	Phase III *6 years – 18 years* (401) 262-9400
molindone	Supernus Pharmaceuticals *Rockville, MD*	impulsive aggression with ADHD	Phase II *6 years – 12 years* (301) 838-2500
Namenda® memantine	Forest Laboratories *New York, NY*	autism	Phase II *6 years – 12 years* (800) 678-1605

Psychiatric Disorders

Product Name	Sponsor	Indication	Development Status
Pristiq® desvenlafaxine	Pfizer *New York, NY*	major depressive disorder	Phase III *7 years – 17 years* (860) 732-5156
Saphris® asenapine	Merck *Whitehouse Station, NJ*	bipolar disorder	Phase III *12 years – 17 years* (800) 672-6372
		schizophrenia	Phase III *12 years – 17 years* (800) 672-6372
		bipolar disorder, schizophrenia (sublingual)	Phase I *10 years – 17 years* (800) 672-6372

Respiratory Disorders

Product Name	Sponsor	Indication	Development Status
ACT-129968 (setipiprant)	Actelion Pharmaceuticals *South San Francisco, CA*	seasonal allergic rhinitis	Phase III *12 years and older* (650) 624-6900
Aerosurf® lucinactant for inhalation **(Orphan Drug)**	Discovery Laboratories *Warrington, PA*	neonatal respiratory distress syndrome	Phase II *neonates* (215) 488-9300
Alvesco® ciclesonide nasal aerosol	Sunovion Pharmaceuticals *Marlborough, MA*	perennial allergic rhinitis, seasonal allergic rhinitis	Phase III *6 years – 11 years* (508) 481-6700
Arcapta® Neohaler® indacaterol	Novartis Pharmaceuticals *East Hanover, NJ*	asthma	Phase III *12 years and older* (888) 669-6682
Astepro® azelastine nasal spray	Meda Pharmaceuticals *Somerset, NJ*	perennial allergic rhinitis	Phase III *6 years – 12 years* (732) 564-2200
beclomethasone nasal aerosol	Teva Pharmaceuticals USA *North Wales, PA*	seasonal allergic rhinitis	Phase III *12 years and older* (215) 591-3000

Respiratory Disorders

Product Name	Sponsor	Indication	Development Status
Bosatria™ mepolizumab	GlaxoSmithKline *Rsch. Triangle Park, NC*	asthma	Phase II *12 years and older* (888) 825-5249
CC10	Clarassance *Rockville, MD*	respiratory distress syndrome	Phase I/II *premature infants* (301) 452-2899
Dulera® mometasone furoate/ formoterol fumarate	Merck *Whitehouse Station, NJ*	asthma --- allergic asthma	Phase III *12 years and younger* (800) 672-6372 --- Phase II *12 years and older* (800) 672-6372
E004 (epinephrine inhalation aerosol)	Amphastar Pharmaceuticals *Rancho Cucamonga, CA*	asthma --- asthma	Phase III *4 years – 11 years* (800) 423-4136 --- Phase III *12 years and older* (800) 423-4136
fluticasone furoate/ fluticasone propionate	GlaxoSmithKline *Rsch. Triangle Park, NC*	asthma	Phase III *12 years and older* (888) 825-5249
fluticasone furoate/vilanterol inhalation powder	GlaxoSmithKline *Rsch. Triangle Park, NC* Theravance *South San Francisco, CA*	asthma --- asthma	Phase III *12 years and older* (888) 825-5249 (877) 275-8479 --- Phase II *5 years – 11 years* (888) 825-5249 (877) 275-8479
GSK2190915	GlaxoSmithKline *Rsch. Triangle Park, NC*	asthma	Phase II *12 years and older* (888) 825-5249
indacaterol/mometasone (QMF149 Twisthaler®)	Novartis Pharmaceuticals *East Hanover, NJ*	asthma	Phase II *12 years and older* (888) 669-6682

Respiratory Disorders

Product Name	Sponsor	Indication	Development Status
INOmax® inhaled nitric oxide	Ikaria *Hampton, NJ*	prevention of bronchopulmonary dysplasia in preterm infants	Phase III *up to 14 days* (877) 566-9466
Omnaris® ciclesonide HFA nasal spray	Sunovion Pharmaceuticals *Marlborough, MA*	perennial allergic rhinitis, seasonal allergic rhinitis	Phase III completed *12 years and older* (508) 481-6700
reslizumab	Cephalon *Frazer, PA*	eosinophilic asthma (see also gastrointestinal)	Phase III *12 years and older* (610) 344-0200
setipiprant (ACT-129968)	Actelion Pharmaceuticals US *South San Francisco, CA*	seasonal allergic rhinitis	Phase III *12 years and older* (650) 624-6900
Singulair® montelukast	Merck *Whitehouse Station, NJ*	exercise-induced asthma	Phase III completed *4 years – 14 years* (800) 672-6372
Spiriva® HandiHaler® tiotropium bromide	Boehringer Ingelheim Pharmaceuticals *Ridgefield, CT* Pfizer *New York, NY*	moderate persistent asthma (see also genetic)	Phase III *12 years – 17 years* (800) 243-0127 (860) 732-5156
Surfaxin® lucinactant **(Orphan Drug)**	Discovery Laboratories *Warrington, PA*	neonatal respiratory distress syndrome (prevention) --- acute hypoxic respiratory failure	application submitted *premature infants* (215) 488-9300 --- Phase II *children* (215) 488-9300
Surfaxin® LS lucinactant (lyophilized formulation) **(Orphan Drug)**	Discovery Laboratories *Warrington, PA*	neonatal respiratory distress syndrome (prevention)	Phase III *neonates* (215) 488-9300
Symbicort® formoterol/budesonide inhalation	AstraZeneca *Wilmington, DE*	asthma	application submitted *6 years – 11 years* (800) 236-9933
Veramyst® fluticasone furoate	GlaxoSmithKline *Rsch. Triangle Park, NC*	asthma --- asthma	Phase III *12 years and older* (888) 825-5249 --- Phase II completed *5 years – 11 years* (888) 825-5249

Respiratory Disorders

Product Name	Sponsor	Indication	Development Status
VR506	Vectura *Wiltshire, United Kingdom*	asthma	Phase II/III *12 years and older* www.vectura.com
Xopenex® levalbuterol	Sunovion Pharmaceuticals *Marlborough, MA*	asthma	Phase III *up to 48 months* (508) 481-6700

Skin Disorders

Product Name	Sponsor	Indication	Development Status
Amevive® alefacept	Astellas Pharma US *Deerfield, IL*	moderate to severe psoriasis	Phase II *12 years – 17 years* (800) 695-4321
ASC-J9	AndroScience *San Diego, CA* Orient Europharma *Taipei City, Taipei*	acne vulgaris	Phase II *12 years and older* (858) 638-7230
CIP-isotretinoin	Cipher Pharmaceuticals *Mississauga, Canada*	severe nodular acne	application submitted *12 years and older* (905) 602-5840
doxycycline/AUS-131	Nexgen Dermatologics *Deerfield Beach, FL*	acne vulgaris	Phase I/II *13 years and older*
Enbrel® etanercept	Pfizer *New York, NY*	plaque psoriasis	application submitted *pediatric patients* (860) 732-5156
IDP-107	Valeant Pharmaceuticals International *Mississauga, Canada*	acne vulgaris	Phase III *12 years and older* (905) 286-3000
JNJ 10229570-AAA	Janssen Research & Development *Raritan, NJ*	acne vulgaris	Phase II *12 years and older* (800) 817-5286
product 0405	Fougera Pharmaceuticals *Melville, NY*	atopic dermatitis	Phase II *3 months – 17 years* (631) 454-7677

Skin Disorders

Product Name	Sponsor	Indication	Development Status
Sorilux® calcipotriene foam	Stiefel, A GSK Company *Rsch. Triangle Park, NC*	plaque psoriasis	Phase III completed *12 years and older* (888) 825-5249
Taclonex® calcipotriene and betamethasone dipropionate ointment	LEO Pharma *Parsippany, NJ*	psoriasis vulgaris	Phase II completed *12 years – 17 years* (877) 494-4536
Taclonex® Scalp calcipotriol/betamethasone dipropionate topical suspension	LEO Pharma *Parsippany, NJ*	scalp psoriasis	Phase II *12 years – 17 years* (877) 494-4536
tazarotene foam	Stiefel, a GSK Company *Rsch. Triangle Park, NC*	acne vulgaris	application submitted *12 years and older* (888) 825-5249
Vectical® calcitriol ointment	Galderma Laboratories *Fort Worth, TX*	plaque psoriasis	Phase II completed *12 years – 17 years* (817) 961-5000
Visonac® methy aminolevulinate	PhotoCure *Princeton, NJ*	acne vulgaris	Phase II *12 years and older* (609) 759-6500
Xolair® omalizumab subcutaneous	Genentech *South San Francisco, CA*	chronic idiopathic urticaria	Phase III *12 years and older* (800) 626-3553

Other

Product Name	Sponsor	Indication	Development Status
Aloxi® palonosetron intravenous	Helsinn Therapeutics *Bridgewater, NJ*	post-operative nausea and vomiting, chemotherapy-induced nausea and vomiting	Phase III *up to 16 years* (908) 231-1435
Analatro™ black widow spider antivenom **(Orphan Drug)**	Instituto Bioclon *Toriella Guerra, Mexico*	black widow spider bite	Phase III *10 years and older* www.bioclon.com

Other

Product Name	Sponsor	Indication	Development Status
Anavip™ crotalinae (pit viper) equine immune F(ab)2 **(Orphan Drug)**	Instituto Bioclon *Toriella Guerra, Mexico*	snake bite	Phase III *2 years and older* www.bioclon.com
atacicept	EMD Serono *Rockland, MA* Zymogenetics *Seattle, WA*	systemic lupus erythematosus	Phase II/III *16 years and older* (800) 283-8088 (800) 775-6686
BioCart™**-II** autologous chrondocytes	ProChon Biotech *Woburn, MA*	knee injuries	Phase II *16 years and older* (781) 305-5035
Caldolor® intravenous ibuprofen	Cumberland Pharmaceuticals *Nashville, TN*	fever (see also neurologic)	Phase III *up to 16 years* (877) 484-2700
CellCept® mycophenolate mofetil	Roche *Nutley, NJ*	lupus nephritis (Fast Track)	Phase III *12 years and older* (973) 235-5000
Emend® aprepitant	Merck *Whitehouse Station, NJ*	chemotherapy-induced nausea and vomiting --- post-operative nausea and vomiting	Phase III *up to 17 years* (800) 672-6372 --- Phase I *6 months – 17 years* (800) 672-6372
FBS0701 **(Orphan Drug)**	FerroKin BioSciences *San Francisco, CA*	transfusional iron overload	Phase II *6 years – 17 years* www.ferrokin.com
Feraheme® ferumoxytol	AMAG Pharmaceuticals *Lexington, MA*	iron deficiency anemia in patients with chronic kidney disease	Phase III *6 months – 17 years* (617) 498-3300
food allergy immunotherapy (whole peanut extract)	DBV Technologies *Bagneux, France*	peanut allergy	Phase I *6 years and older* www.dbv-technologies.com
HPN-100 **(Orphan Drug)**	Hyperion Therapeutics *South San Francisco, CA*	urea cycle disorders	Phase II *up to 6 years* (888) 897-4276

Other

Product Name	Sponsor	Indication	Development Status
liver cell therapy (HHLivC) **(Orphan Drug)**	Cytonet *Weinheim, Germany*	urea cycle disorders	Phase II *up to 5 years* www.cytonet.de
novel human milk fortifier	Abbott Nutrition *Columbus, OH*	nutrition	Phase III *up to 21 days* (800) 551-5838
Nplate® romiplostim **(Orphan Drug)**	Amgen *Thousand Oaks, CA*	idiopathic thrombocytopenic purpura	Phase III *1 year – 18 years* (800) 772-6436
Nulojix® belatacept	Bristol-Myers Squibb *Princeton, NJ*	renal transplant rejection (prevention)	in clinical trials *2 years – 17 years* (800) 332-2056
ParaCel™ riboflavin ophthalmic solution	Avedro *Waltham, MA*	keratoconus	Phase III *12 years and older* (781) 768-3400
PGX-100 (ODSH)	ParinGenix *Tucson, AZ*	exacerbation of protein losing enteropathy	Phase I/II *6 years and older* (617) 480-5068
Precedex® dexmedetomidine	Hospira *Lake Forest, IL*	sedation	Phase II/III completed *28 weeks – 44 weeks* (224) 212-2000
Prochymal® remestemcel-L **(Orphan Drug)**	Osiris Therapeutics *Columbia, MD*	graft vs. host disease (see also diabetes)	Phase III completed *6 months and older* (443) 545-1800
Promacta® eltrombopag **(Orphan Drug)**	GlaxoSmithKline *Rsch. Triangle Park, NC*	idiopathic thrombocytopenic purpura	Phase II *1 year – 17 years* (888) 825-5349
SCH-697243 (grass pollen allergen extract)	Merck *Whitehouse Station, NJ*	allergic rhinitis	Phase III *5 years and older* (800) 672-6372
Sensipar® cinacalcet	Amgen *Thousand Oaks, CA*	treatment of secondary hyperparathyroidism (HPT) in patients with chronic kidney disease	Phase III *6 years – 17 years* (800) 772-6436
silibinin (intravenous milk thistle)	Rottapharm Madaus *Monza, Italy*	hepatic failure associated with mushroom poisoning	Phase II/III *2 years and older* www.rotta.com

Other

Product Name	Sponsor	Indication	Development Status
Soliris® eculizumab **(Orphan Drug)**	Alexion Pharmaceuticals *Cheshire, CT*	atypical hemolytic-uremic syndrome (aHUS) --- paroxysmal nocturnal hemoglobinuria	Phase II *1 month – 18 years* (203) 272-2596 --- Phase I/II *2 years – 17 years* (203) 272-2596
somatropin sustained-release	LG Life Sciences *Seoul, South Korea*	insufficient secretion of growth hormone	Phase III *3 years – 11 years*
Stanate® stannsoporfin	InfaCare Pharmaceuticals *Trevose, PA*	hyperbilirubinemia	Phase II *up to 48 hours* (267) 515-5850
Toviaz® fesoterodine	Pfizer *New York, NY*	overactive bladder	Phase II completed *11 years – 17 years* (860) 732-5156
Vascana™ nitroglycerin topical	MediQuest Therapeutics *Bothell, WA*	treatment and prevention of Raynaud's disease	Phase III *15 years and older* (425) 398-9580
Zemplar® paricalcitol	Abbott Laboratories *Abbott Park, IL*	secondary hyperparathyroidism in chronic kidney disease	Phase III *10 years – 16 years* (847) 937-6100
Zortress® everolimus	Novartis Pharmaceuticals *East Hanover, NJ*	*de novo* renal transplantation	Phase III *1 year – 17 years* (888) 669-6682

The content of this report has been obtained through public, government and industry sources, and the Adis "R&D Insight" database based on the latest information. ***Report current as of January 07, 2012.*** *The information in this report may not be comprehensive. For more specific information about a particular product, contact the individual company directly or go to www.clinicaltrials.gov. The entire series of* Medicines in Development *is available on PhRMA's web site.*

A publication of PhRMA's Communications & Public Affairs Department. (202) 835-3460

www.phrma.org | www.innovation.org | www.pparx.org | www.buysafedrugs.info

Provided as a Public Service by PhRMA. Founded in 1958 as the Pharmaceutical Manufacturers Association.

Copyright © 2012 by the Pharmaceutical Research and Manufacturers of America. Permission to reprint is awarded if proper credit is given.

Pharmaceutical Research and Manufacturers of America • 950 F Street, NW, Washington, DC 20004

acne vulgaris—The common form of acne seen most often in teenagers or young adults, which is the result of overactive oil glands that become plugged, red, and inflamed. Most outbreaks of acne can be treated by keeping the skin clear and avoiding irritating soaps, foods, drinks, and cosmetics. Severe acne and acne in those who are prone to scarring can be treated with topical creams and anti-inflammatory medications.

acute chest syndrome (ACS)—The second most common cause of hospitalization in sickle cell patients, accounting for more than 25 percent of premature deaths in sickle cell disease. ACS is unpredictable—it can come on quite suddenly and range from being very mild to fatal. Its main signs and symptoms include: fever, chest pain, cough, and trouble breathing.

angioedema—Swelling of the mucous membranes, tissues beneath the skin, or an internal organ due to an allergic reaction.

antithrombin (AT) deficiency—A genetic disorder leading to poorly functioning or diminished levels of antithrombin (an anticoagulant), a condition that can lead to excessive clotting. Historically called ATIII deficiency, AT deficiency is estimated to affect more than 200,000 people in Europe, Canada and the United States. It is one of a group of related conditions called thrombophilia. Individuals with AT deficiency are at risk for blood clots, organ damage or even death. Sometimes the clots can form spontaneously, putting an individual at sudden and unexpected risk. Patients are perhaps at greatest risk during events which are independently associated with a probability of thrombosis, such as surgery and delivery.

application submitted—An application for marketing has been submitted by the company to the Food and Drug Administration (FDA).

aspergillosis—Infection caused by *Aspergillus fumigatus*, a fungus sometimes found in old buildings or decaying plant matter.

atherosclerosis—A common disease in which deposits of plaque containing calcium and fatty substances, such as cholesterol, are formed within the inner layers of the arteries. It is a condition that progresses over decades, chiefly affecting the arteries of the heart, brain and extremities. Its complications include heart attacks and strokes.

atopic dermatitis—A chronic form of eczema characterized by an intensely itchy skin rash occurring in people who have an inherited tendency toward allergies, such as asthma or allergic rhinitis. It is common in babies, often appearing between the ages of 2 – 18 months.

attention deficit/hyperactivity disorder (ADHD)—ADHD is a complex neurological impairment that results in a constantly overactive behavior pattern and a difficulty concentrating. While it primarily affects children, a growing number of adults are being diagnosed with the disorder. Boys are afflicted some three times as often as girls. Children with ADHD are full of energy, fidgety, impulsive, reckless, irritable, emotionally immature and aggressive. Because their attention span is short, they do not conform to orderly routine. ADHD often leads to antisocial acts and difficulty learning, although IQ is normal. No definite cause has been established, but some researchers now believe heredity plays a role.

atypical hemolytic uremic syndrome (aHUS)—An extremely rare disease characterized by hemolytic anemia, low platelet count (thrombocytopenia), and acute renal failure. (It is a distinctly different illness from hemolytic uremic syndrome caused by particular strains of the bacterium *E.coli*.) There is substantial evidence that aHUS is a genetic disorder. Atypical hemolytic uremic syndrome may become a chronic condition, and patients with aHUS may experience repeated attacks. Children with aHUS are much more likely to develop chronic serious complications such as kidney failure and severe high blood pressure.

autism—One of five disorders that falls under the umbrella of pervasive developmental disorders (PDD), a category of neurological disorders characterized by "severe and pervasive impairment in several areas of development." The five disorders under PDD are: autistic disorder, Asperger's disorder, childhood disintegrative disorder (CDD), Rett's disorder, and PDD-not otherwise specified (PDD-NOS). Autism is a complex developmental disability that typically appears during the first three years of life and is the result of a neurological disorder that affects the normal functioning of the brain, impacting development in the areas of social interaction and communication skills. Both children and adults with autism typically show difficulties in verbal and non-verbal communication, social interactions, and leisure or play activities. As a spectrum disorder, it affects each individual differently and at varying degrees.

bacterial conjunctivitis—A microbial infection involving the mucous membrane of the surface of the eye.

Becker muscular dystrophy (BMD)—One of nine types of muscular dystrophy, a group of genetic, degenerative diseases primarily affecting voluntary muscles. It's caused by an insufficient production of dystrophin, a protein that helps keep muscle cells intact. Onset can occur during adolescence or adulthood. Symptoms include generalized weakness and wasting, which first affects the muscles of the hips, pelvic area, thighs and shoulders. BMD is similar to Duchenne MD but often much less severe. The disease progresses slowly and with variability but can affect all voluntary muscles. BMD primarily affects boys and men, who inherit the disease through their mothers. Most with BMD survive well into mid- to late-adulthood.

bipolar 1 disorder—Also known as bipolar 1 or bipolar type 1, considered the most severe form of this mental illness. It is characterized by one or more manic or mixed episodes, usually accompanied by major depressive episodes. In a major manic episode of bipolar 1 disorder, the patient may become delusional and even suffer from hallucinations, which are symptoms of psychosis. If that occurs, the condition is called bipolar 1 with psychotic features. Only

bipolar 1 disorder, by definition, can include such features. Bipolar 1 can seriously impair day-to-day functioning.

bronchopulmonary dysplasia—Abnormal growth of the lungs and air passages associated with exposure of immature lungs to high levels of oxygen.

candidiasis—A fungal infection, caused by *Candida albicans*, usually of the moist cutaneous areas of the body, including the skin, mouth, esophagus and respiratory tract.

conjunctivitis—Swelling (inflammation) or infection of the membrane lining the eyelids (conjunctiva).

Crohn's disease—A sub-acute chronic gastro intestinal disorder, involving the small intestine, characterized by patchy deep ulcers that may cause fistulas and a narrowing and thickening of the bowel.

cystinosis—Cystine, an amino acid, accumulated in internal organs, resulting in damage and cystinuria (presence of cystine in urine).

cytomegalovirus (CMV)—A virus that can cause infection without symptoms or with mild flu-like symptoms.

de novo—A latin phrase meaning anew; afresh; beginning again; from the start; new; not present previously; just beginning.

diabetes—A chronic disease due to abnormal insulin secretion from the pancreas, thereby causing problems in metabolizing sugar. Type 2, in most cases, can be controlled by a combination of dietary measures, weight loss, and oral medication. Type 1 is the more severe form, requiring insulin treatment.

diphtheria—A bacterial infection characterized by mucus coating the membranes of the nose and throat, causing breathing problems, a fever, sore throat, vomiting, stomach pains, and chills.

Duchenne muscular dystrophy—An inherited disorder that involves rapidly worsening muscle weakness. Other muscular dystrophies get worse much more slowly. Duchenne's is caused by a defective gene. Because of the way the disease is inherited, males are more likely to develop symptoms than are women.

enteropathy—Any disease of the intestine.

eosinophilic esophagitis—An inflammatory condition in which the wall of the esophagus becomes filled with large numbers of eosinophils, which are white blood cells (leukocytes) manufactured in the bone marrow and are particularly active in the type of inflammation caused by allergic reactions. The allergen(s) that causes eosinophilic esophagitis is not known. It is not even known whether the allergen is inhaled or ingested. The condition is more common among individuals with other allergic conditions such as asthma, hay fever, allergic rhinitis, and atopic dermatitis.

ependymoma—A tumor that comes from the cells lining the ventricular system of the brain or spinal cord, which contains cerebrospinal fluid. It is the third most common brain tumor in children. In rare cases, it is found in the spinal cord. Ependymomas have a cure rate of about 50 percent depending on the specific type.

epidermolysis bullosa—A rare, inherited condition in which blisters appear on the skin after minor damage. It mainly affects young children and has a wide range of severity.

epilepsy—Recurrent seizures—transient neurological abnormalities caused by abnormal electrical activity in the brain—or temporary alteration in one or more brain functions. Seizures are a symptom of brain dysfunction and can result from a wide variety of diseases or injury.

Fabry disease—A rare hereditary disorder that leads to an accumulation of glycolipid, a product of fat metabolism.

fibromyalgia—Fibromyalgia syndromes are a group of disorders of unknown cause characterized by achy pain and stiffness in soft tissues, including muscles, tendons and ligaments. Fibromyalgia (pain and stiffness) may occur throughout the body or may be restricted to certain locations. A common variation, the **primary fibromyalgia syndrome**, usually occurs in previously healthy young women who may be depressed, anxious, or stressed, often with interrupted and nonrestorative sleep.

fragile X syndrome—One of the most common causes of inherited mental retardation and neuropsychiatric disease in human beings, affecting as many as 1 in 2,000 males and 1 in 4,000 females. The syndrome is also known as FRAXA (the fragile X chromosome itself) and as the Martin-Bell syndrome. However, the preferred name is fragile X syndrome. The characteristic features of the fragile X syndrome in boys include prominent or long ears, a long face, delayed speech, large testes, hyperactivity, tactile defensiveness, gross motor delays, and autistic-like behaviors. Much less is known about girls with fragile X syndrome. Only about half of all females who carry the genetic mutation have symptoms themselves. Of those, half are of normal intelligence, and only one-fourth have an IQ under seventy. Few fragile X girls have autistic symptoms, although they tend to be shy and quiet.

FXIII deficiency (congenital)—A rare disease that affects 1 out of every 3-5 million people in the United States, or approximately 150 people. The condition is characterized by blood that clots normally, but the clots are unstable, so bleeding recurs. FXIII deficiency can cause umbilical cord bleeding in some newborns, soft tissue bruising, mucosal bleeding and potentially fatal intracranial hemorrhage (ICH). Studies have shown that up to 60 percent of people with FXIII deficiency experience at least one ICH during their lifetime.

Gaucher disease—A chronic, progressive, inherited genetic disorder. People with Gaucher disease lack sufficient levels of a particular enzyme. As a result of this enzyme deficiency, a fatty material, or lipid, accumulates in the body. Lipid accumulation in organs and bones can cause mild to severe symptoms that can

appear at any time throughout life, from infancy to adulthood.

glioma—A type of brain tumor arising from the supporting glial cells within the brain. Gliomas make up about 60 percent of all primary brain tumors.

graft vs. host disease—In bone marrow transplantation, normal bone marrow is used to replace malignant or defective marrow. In an **allogeneic** transplantation, healthy marrow is taken from a donor; in an **autologous** transplantation, the patient's own healthy marrow is used. In graft versus host disease, a complication of such transplants, immune system cells attack the transplant recipient's tissues.

Gram-positive bacteria—Gram's stain is a method of staining bacteria in order to identify them. Gram-positive bacteria stain violet.

***Haemophilus influenzae* b**—The bacteria causing the most serious bacterial infections in early childhood, including meningitis and pneumonia.

hemangioma—A birthmark that appears as a bright red patch or a nodule of extra blood vessels in the skin. It grows during the first year of life and then recedes over time. An hemangioma is usually benign and isn't associated with other medical conditions. Most often hemangioma doesn't require treatment. By age 10, a child who had an hemangioma in infancy usually has little visible trace left of the growth.

hemophilia—Hemophilia A, the "classic" hemophilia, is a genetic bleeding disorder due to deficiency of the coagulation factor VIII. Hemophilia B, or "Christmas" disease, is caused by deficiency of coagulation factor IX.

hepatitis—Inflammation of the liver with accompanying liver cell damage or death, caused most often by viral infection, e.g., hepatitis A, B, and C, but also by certain drugs, chemicals or poisons. Hepatitis may be either acute (of limited duration) or chronic (continuing). Hepatitis A spreads primarily from the stool of one person to the mouth of another, usually the result of poor hygiene. Both hepatitis B and C are transmitted through blood, unprotected sex, shared or reused needles, or from an infected mother to her newborn baby during delivery.

hereditary angioedema—A rare but serious problem with the immune system that is passed down through families. It is caused by low levels or improper functioning of a protein called C1 inhibitor, which affects the blood vessels. People with hereditary angioedema can develop rapid swelling of the hands, feet, limbs, face, intestinal tract, or airway (larynx or trachea).

Hunter syndrome—A rare, life-threatening genetic condition, also called mucopolysaccharides II (MPS II), that results from absence or insufficient levels of the lysosomal enzyme iduronate-2. Without this enzyme, cellular waste products accumulate in tissue and organs, which then begin to malfunction.

hyperbilirubinemia—Abnormally high amounts of bile pigment (bilirubin) in the blood causing jaundice. Most newborns have a rise in bilirubin in the first days following birth.

hypercholesterolemia (homozygous familial)—An inherited metabolic disorder resulting in an abnormal amount of cholesterol in the blood. It can lead to accelerated atherosclerosis and early heart attack. Dietary treatment seldom helps in these cases.

hyperoxaluria—An hereditary disorder that causes calcium oxalate stones to form in the kidney and the urine beginning in childhood. Also known as oxalosis.

hyperparathyroidism—An excess of parathyroid hormone in the bloodstream due to overactivity of one or more of the body's four parathyroid glands, which are located in the neck. The parathyroid hormone helps maintain an appropriate balance of calcium in the bloodstream and in tissues that depend on calcium for proper functioning. Two types of hyperparathyroidism exist. In primary hyperparathyroidism, an enlargement of one or more of the parathyroid glands causes overproduction of the hormone resulting in high levels of calcium in the blood (hypercalcemia), which can cause a variety of health problems. Secondary hyperparathyroidism is a result of another disease that causes low levels of calcium in the body. Surgery is the most common treatment for hyperparathyroidism.

hypophosphatasia—A rare, inherited disease that results in decreased activity of the enzyme alkaline phosphatase, which assists in the metabolism of phosphate that is present in many tissues, including bones and teeth. The illness may occur during infancy or as an adult. The infantile form of hypophosphatasia is fatal in 50 percent of cases. Symptoms of hypophosphatasia in infants include poor feeding, failure to gain weight, failure to thrive, delayed development, loss of teeth, and bone pain. Adults who develop hypophosphatasia have a normal life expectancy. Symptoms in adults include premature loss of teeth, fractures, and bone pain.

hypoxic—Refers to the lack of oxygen.

idiopathic—Of, relating to, or designating a disease having no known cause.

immune/idiopathic thrombocytopenia purpura—A condition that may follow a viral infection, which can trigger destruction of blood platelets by the immune system. The reduced number of platelets may result in abnormal bleeding into the skin and from other parts of the body (purpura).

inherited mitochondrial diseases—A group of systemic diseases caused by inherited or acquired damage to the mitochondria, which are small, energy-producing structures found in every cell in the body that serve as the cells' "power plants." When the mitochondria are not working properly, there is an energy shortage within those areas of the body that consume large amounts of energy such as the muscles, brain, and heart. The result is often muscle weakness, fatigue, and problems with the heart, eyes, and various other systems.

Japanese encephalitis (JE)—Caused by a virus that is closely related to the West Nile and Saint Louis encephalitis viruses and is transmitted to humans through the bite of an infected mosquito. It is the most common vaccine-preventable cause of encephalitis in Asia, occurring throughout most of Asia and parts of the western Pacific. In endemic countries, JE is primarily a disease of children; however, travel-associated JE can occur among people of any age. The risk for JE for most travelers to Asia is extremely low but varies based on destination, duration, season, and activities.

juvenile rheumatoid arthritis—Refers to arthritis or an arthritis-related condition (rheumatic disease) that occurs by age 15 or younger.

Kawasaki disease—A condition that causes inflammation in the walls of small- and medium-sized arteries throughout the body, including the coronary arteries, which supply blood to the heart muscle. Kawasaki disease is also called mucocutaneous lymph node syndrome because it also affects lymph nodes, skin, and the mucous membranes inside the mouth, nose and throat. Signs of Kawasaki disease, such as a high fever and peeling skin, can be frightening, but Kawasaki disease is usually treatable, and most children recover from the disease without serious problems.

keratoconus—Degeneration of the structure of the cornea, which is the clear tissue covering the front of the eye. The shape of the cornea slowly changes from the normal round shape to a cone shape. The cause is unknown, but the tendency to develop keratoconus is probably present from birth. Keratoconus is often discovered during adolescence. Most people who develop keratoconus start out nearsighted, which tends to become worse over time. Contact lenses are the main treatment for most patients with keratoconus, although severe cases may require corneal transplantation as a last resort.

Langerhans cell histiocytosis (LCH)—A rare disorder that occurs when a person has too many of a certain type of white blood cell, called a Langerhans cell (named for a German scientist). Those cells normally reside in the skin and help fight infections and destroy certain foreign substances in the body. In LCH, the cells accumulate on bones and other parts of the body, particularly the head and neck, causing a wide range of problems. LCH can also be found in the ribs, sternum, long bones of the arms and legs, vertebra of the spine and the pelvis. Although LCH can occur in people of all ages, a majority of cases occur in children who are under age 10.

Leber congenital amaurosis (LCA)—An inherited retinal degenerative disease characterized by severe loss of vision at birth. A variety of other eye-related abnormalities including roving eye movements, deep-set eyes, and sensitivity to bright light also occur with this disease. Some patients with LCA also experience central nervous system abnormalities.

Lesch-Nyhan syndrome (LNS)—A rare, inherited disorder caused by an enzyme (HPRT) deficiency. LNS is present at birth in baby boys. The lack of HPRT causes a build-up of uric acid in all body fluids, leading to symptoms such as severe gout, poor muscle control, and moderate retardation, which appear in the first year of life. A striking feature of LNS is self-mutilating behaviors–characterized by lip and finger biting–that begin in the second year of life. Abnormally high uric acid levels can cause sodium urate crystals to form in the joints, kidneys, central nervous system, and other tissues of the body, leading to gout-like swelling in the joints and severe kidney problems. Neurological symptoms include facial grimacing, involuntary writhing, and repetitive movements of the arms and legs similar to those seen in Huntington's disease.

Lennox-Gastaut syndrome—Characterized by seizures and mental retardation in infants and young children.

lupus nephritis—Damaging inflammation of the kidneys that can occur in people with lupus. If not controlled, it may lead to total kidney failure. Lupus nephritis affects approximately 3 out of every 10,000 people. In children with lupus, about half will have some form or degree of kidney involvement. More than half of patients have not had other symptoms of lupus when they are diagnosed with lupus nephritis.

lymphoma—Cancers in which the cells of lymphoid tissue, found mainly in the lymph nodes and spleen, multiply unchecked. Lymphomas fall into two categories: One is called **Hodgkin lymphoma**, characterized by a particular kind of abnormal cell. All others are called **non-Hodgkin lymphomas**, which vary in their malignancy according to the nature and activity of the abnormal cells.

major depressive disorder—A severely depressed mood and activity level that persists two weeks or more. The disorder is characterized by a combination of symptoms that interfere with a person's ability to work, sleep, study, eat, and enjoy once-pleasurable activities. Major depression is disabling and prevents a person from functioning normally. Some people may experience only a single episode within their lifetime, but more often a person may have multiple episodes.

McCune-Albright syndrome—A rare multisystem disorder characterized by the displacement of normal bone tissue with areas of abnormal fibrous growth. These fibrous bony areas may develop in many bones of the body, causing impaired mobility, pain, and in some cases, hearing and visual impairment. This syndrome is due to a genetic mutation that occurs randomly and for no apparent reason after fertilization; it is not inherited from the parents.

medulloblastoma—The most common primary central nervous system tumor which arises in childhood. Medulloblastomas arise in the fourth ventricle, between the brain stem and the cerebellum. Common symptoms are unsteadiness,

headaches, and vomiting due to hydrocephalus (from blockage of cerebrospinal fluid flow).

meningitis—An inflammation of the membranes that cover the brain and spinal cord (meninges).

meningococcal disease—Describes infections caused by the bacterium *Neisseria meningitidis* (also termed meningococcus). It carries a high mortality rate if untreated. While it is best known as a cause of meningitis, it also causes widespread blood infection (sepsis), which is more damaging and dangerous. Meningitis and meningococcal sepsis are major causes of illness, death, and disability in both developed and underdeveloped countries worldwide.

Morquio A syndrome (MPS IVA)—An inherited disease caused by a deficiency of a particular lysosomal enzyme (N-acetylgalactosamine-6 sulfatase, or GALNS). Deficiency of the enzyme results in excessive lysosomal storage of keratan sulfate in many tissues and organs, which causes systemic skeletal dysplasia, short stature, and joint abnormalities. Malformation of the thorax impairs respiratory function, and malformation of neck vertebrae and ligament weakness causes cervical spinal instability and, potentially, cord compression. Other symptoms may include hearing loss, corneal clouding, and heart valve disease. Morquio A syndrome is estimated to occur in 1 in 200,000 to 300,000 live births.

mucopolysaccharidoses II—See Hunter syndrome.

neuroblastoma—A tumor of the adrenal glands or sympathetic nervous system (the part of the nervous system responsible for certain automatic body functions, such as the control of heart rate). Neuroblastomas are the most common extra cranial (outside the skull) solid tumors of childhood.

neurofibromatosis—A group of three genetically distinct disorders that cause tumors to grow in the nervous system. Tumors begin in the supporting cells that make up the nerve and the myelin sheath (the thin membrane that envelops and protects the nerves), rather than the cells that actually transmit information. The type of tumor that develops depends on the type of supporting cells involved. Scientists have classified the disorders as neurofibromatosis type 1 (NF1, also called von Recklinghaus disease), neurofibromatosis type 2 (NF2), and a type that was once considered to be a variation of NF2 but is now called schwannomatosis. An estimated 100,000 Americans have a neurofibromatosis disorder, which occurs in both sexes and in all races and ethnic groups.

neurogenic detrusor overactivity—Urine voiding dysfunction secondary to neurologic injury or disease. The neurogenic detrusor overactivity syndrome, which may include urinary frequency, urgency, and incontinence, frequently contributes to a loss of independence or even institutionalization. It can occur in patients with primary diagnoses as diverse as Parkinson's disease, cerebral palsy, multiple sclerosis, spinal cord injury, and spina bifida.

nodular acne—A severe form of acne characterized by the presence of inflammation, nodular breakouts and cysts. It can be painful and often leaves scarring. A dermatologist is needed to treat this form of acne, often with both topical and systemic medications.

nosocomial infections—Infections that have been caught in a hospital.

parainfluenza virus 3—One in a group of four RNA viruses that rank second only to respiratory syncytial virus (RSV) as a common cause of lower respiratory tract disease in young children. Like RSV, human parainfluenza viruses (HPIVs) can cause repeated infections throughout life, which are usually manifested by an upper respiratory tract illness (such as a cold or sore throat). HPIVs can also cause serious lower respiratory tract disease with repeat infection (including pneumonia, bronchitis, and bronchiolitis), especially among the elderly and patients with compromised immune systems. There are four serotypes types of HPIV (1 through 4). Each of the four HPIVs has different clinical and epidemiologic features. HPIV-3 is more often associated with bronchiolitis and pneumonia.

paroxysmal nocturnal hemoglobinuria—A rare disorder (estimated to affect between one and five per 1 million people) that leads to the premature death and impaired production of blood cells. The disorder affects red blood cells (erythrocytes), which carry oxygen; white blood cells (leukocytes), which protect the body from infection; and platelets (thrombocytes), which are involved in blood clotting. Paroxysmal nocturnal hemoglobinuria affects both sexes equally, and can occur at any age, although it is most often diagnosed in young adulthood. People with paroxysmal nocturnal hemoglobinuria have sudden, recurring episodes during which red blood cells are prematurely destroyed (hemolysis). Affected individuals may pass dark-colored urine due to the presence of hemoglobin, the oxygen-carrying protein in blood, which is called hemoglobinuria. The premature destruction of red blood cells results in a deficiency of those cells in the blood (hemolytic anemia), which can cause signs and symptoms such as fatigue, weakness, abnormally pale skin, shortness of breath, and an increased heart rate. People with the disorder may also be prone to infections due to a deficiency of white blood cells. Abnormal platelets associated with paroxysmal nocturnal hemoglobinuria can cause problems in the blood clotting process. As a result, people with this disorder may experience abnormal blood clotting, especially in large abdominal veins; or, less often, episodes of severe bleeding (hemorrhage).

partial-onset seizures—Epileptic seizures caused by excessive electrical activity in just one hemisphere of the brain, resulting in a range of symptoms that may include sudden, jerky movements of one part of the body, distorted hearing, sense of smell or vision, numbness and a sudden sense of fear.

Glossary

pediculosis—Infestation with lice, which are ectoparasites that live on the body. *Pediculus humanus capitis* is the head louse, which is spread from person to person by close physical contact or combs, hats, and clothes.

Pelizaeus-Merzbacher disease (PMD)—A rare, progressive, degenerative central nervous system disorder in which coordination, motor abilities, and intellectual function deteriorate. The disease is one of a group of gene-linked disorders known as the leukodystrophies, which affect growth of the myelin sheath—the fatty covering that wraps around and protects nerve fibers in the brain.

Phase I—Human clinical trials, usually involving healthy volunteers, to determine safety dosage.

Phase II—Human clinical trials, involving a small number of volunteers with the condition the medicine is intended to treat, to evaluate the effectiveness of the medicine and look for side effects.

Phase III—Human clinical trials, involving thousands of people with the disease, to verify effectiveness of the medicine and monitor side effects from widespread, long-term use.

Phase IV—Additional post-marketing studies to evaluate long-term effects.

phenylketonuria (PKU)—PKU in its "classic" form is a rare, inherited metabolic disease that results in mental retardation and other neurological problems when treatment is not started within the first few weeks of life. When a very strict diet is begun early and well-maintained, affected children can expect normal development and a normal life span. The disease arises from the absence of a single enzyme (phenylalanine hydroxylase), which normally converts the essential amino acid, phenyla lanine, to another amino acid, tyrosine. Failure of the conversion to take place results in a buildup of phenylalanine, which is toxic to the central nervous system and causes the severe problems normally associated with PKU.

Pompe disease—A rare (estimated at 1 in every 40,000 births), inherited and often fatal disorder that disables the heart and muscles. It is caused by mutations in a gene that makes an enzyme called alpha-glucosidase (GAA). Normally, the body uses GAA to break down glycogen, a stored form of sugar used for energy. But in Pompe disease, mutations in the GAA gene reduce or completely eliminate this essential enzyme. Excessive amounts of glycogen accumulated everywhere in the body, but the cells of the heart and skeletal muscles are the most seriously affected. The symptoms of Pompe disease can vary widely in terms of age of onset and severity depending on the degree of enzyme deficiency.

primary immunodeficiency disorder (PID)—An inherited disorder that affects some 50,000 people in the United States. The disorder requires regular immunoglobulin replacement therapy to prevent potentially serious or life-threatening infections.

Pseudomonas aeruginosa—A Gram-negative bacterium common in soil and water. *Pseudomonas aeruginosais* an opportunistic pathogen, meaning that it exploits some break in the host defenses to initiate an infection. It causes urinary tract infections, respiratory system infections, dermatitis, soft tissue infections, bacteremia, bone and joint infections, gastrointestinal infections and a variety of systemic infections, particularly in patients with severe burns and in cancer and AIDS patients who are immunosuppressed. *Pseudomonas aeruginosa* infection is a serious problem in patients hospitalized with cancer, cystic fibrosis, and burns. The case fatality rate in these patients is 50 percent.

psoriasis—A common skin disease characterized by thickened patches of inflamed, red skin (plaques) often covered by silvery scales. About 80 percent of people who have psoriasis develop plaque psoriasis.

pulmonary arterial hypertension—High blood pressure in the arteries supplying the lungs due to increased resistance to blood flow through the lungs.

respiratory distress syndrome (RDS)—Lung disorder of premature infants characterized by respiratory distress and cyanosis (lack of oxygen in blood). RDS is caused by a deficiency of surfactant, a substance that coats the inner lining of the lungs and prevents them from collapsing during exhalation.

respiratory syncytial virus (RSV)—One of the most important causes of lower respiratory tract disease in children.

rhinitis—Inflammation of the nasal mucous membrane.

sarcoma—A malignant tumor that arises from deep body tissues, such as muscle, bone or fibrous tissue.

schizophrenia—The most common form of psychotic illness characterized by disturbances in thinking, emotional reaction and behavior. It is disabling and has a prolonged course that almost always results in chronic ill health and some degree of personality change.

sickle cell disease—An inherited, chronic and severe blood disease where the red blood cells are abnormal (sickle shaped), resulting in reduced oxygen-carrying capacity of the blood. It is caused by mutation of the gene that codes for hemoglobin. The disease affects primarily African Americans.

systemic lupus erythematosus (SLE)—The most serious form of lupus, a chronic autoimmune disorder causing inflammation and damage to multiple organs. SLE affects many systems of the body, including the joints, kidneys and brain.

thalassemia—Not just one disease but rather a complex series of genetic (inherited) disorders all of which involve underproduction of hemoglobin, the indispensable molecule in red blood cells that carries oxygen.

thromboembolism—The blocking of a blood vessel by a blood clot dislodged from its site of origin.

thrombosis—The formation of a blood clot within the heart or a blood vessel.

tinea curis—Also called "jock itch"—a fungal infection that affects the skin of the genitals, inner thighs and buttocks. Jock itch causes an itchy, red, often ring-shaped rash in those warm, moist areas of the body. Jock itch gets its name because it is common in people who sweat a lot, as do athletes, but anyone can get the condition.

tinea pedis—Also called "athlete's foot," a skin infection caused by a fungus.

Tourette syndrome (TS)—A neurological disorder characterized by repetitive, involuntary movements and vocalizations called tics. The early symptoms of TS are typically noticed first in childhood, with the average onset between the ages of 3 and 9. TS occurs in people from all ethnic groups; males are affected about three to four times more often than females. It is estimated that 200,000 Americans have the most severe form of TS, and as many as 1 in 100 exhibit milder and less complex symptoms such as chronic motor or vocal tics. Although TS can be a chronic condition with symptoms lasting a lifetime, most people with the condition experience their worst tic symptoms in their early teens, with improvement occurring in the late teens and continuing into adulthood.

ulcerative colitis—A chronic inflammation and ulceration of the lining of the colon and rectum. It causes bloody diarrhea and mainly involves the left colon.

urea cycle disorders—Inborn errors in metabolism that can lead to brain damage and death. They involve a deficiency in one of the enzymes required by the urea cycle that removes ammonia from the blood. Ammonia accumulates in toxic levels if the urea cycle does not convert nitrogen from protein metabolism into urea for excretion into the urine. A series of biochemical reactions are necessary to complete the urea cycle. When an enzyme is missing or deficient, the cycle is interrupted and nitrogen accumulates in the form of ammonia. It cannot be excreted from the body and enters the blood stream, damaging nervous tissues, including the brain. Seizures, poor muscle tone, respiratory distress, and coma follow if an affected infant is not treated.

urticaria—Also known as chronic hives, which are batches of raised, red or white itchy welts of various sizes that appear and disappear. While most cases of hives go away within a few weeks or less, for some people they are a long-term problem. Chronic hives are defined as those that last more than six weeks or hives that go away but recur frequently. In most cases of chronic hives, a cause is never clearly identified. In some cases, they may be related to an underlying autoimmune disorder, such as thyroid disease or lupus.

vitrectomy—A surgical procedure performed by a retinal specialist to remove the vitreous gel from the inside of the eye. Vitreous gel fills the inside cavity of the eye, taking up about two-thirds of the eye's volume. Normally, the vitreous is clear and allows light to easily pass to the back of the eye. A vitrectomy is sometimes needed if bleeding occurs in the vitreal cavity, blocking clear vision. A vitrectomy is sometimes used to repair a retinal detachment or to remove fibrous tissue that sometimes forms as a part of diabetic retinopathy. A silicone oil or gas is injected into the eye to fill the space that the vitreous once occupied.

Von Willebrand disease (VWD)—The most common inherited bleeding disorder, which affects the blood's ability to clot. If blood doesn't clot, heavy, hard-to-stop bleeding can result after an injury. The bleeding can damage internal organs, and in rare cases, the bleeding may even cause death. With VWD, either low levels of a certain protein—the von Willebrand factor—are circulating in the blood, or the protein doesn't work well. Von Willebrand factor also carries clotting factor VIII, another important protein that helps the blood clot. Factor VIII is the protein that's missing or doesn't work well in people who have hemophilia, another bleeding disorder. VWD is more common and usually milder than hemophilia. VWD occurs in about 1 out of every 100 to1,000 people, affecting both males and females, while hemophilia mainly affects males.

Wolman disease—A rare inherited condition involving the breakdown and use of fats and cholesterol in the body (lipid metabolism). Infants with Wolman disease are healthy and active at birth but soon develop signs and symptoms of the disorder. These may include an enlarged liver and spleen, poor weight gain, low muscle tone, jaundice, vomiting, diarrhea, developmental delay, anemia, and poor absorption of nutrients from food. Children affected by this condition develop severe malnutrition and generally do not survive past early childhood. Wolman disease is estimated to occur in 1 in 350,000 newborns.

Ten Leading Causes of Death in Children:

1 – 4 years (all causes 4,730)

1.	Accidents (unintentional injuries)	1,469
2.	Congenital malformations, deformations, and chromosomal abnormalities	521
3.	Assault (homicide)	421
4.	Cancer	394
5.	Diseases of heart	186
6.	Influenza and pneumonia	142
7.	Other diseases of respiratory system	100
8.	Septicemia	93
9.	Other and unspecified infections and parasitic diseases	66
10.	Cerebrovascular diseases	63

5 – 14 years (all causes 5,651)

1.	Accidents (unintentional injuries)	1,859
2.	Cancer	890
3.	Congenital malformations, deformations, and chromosomal abnormalities	331
4.	Assault (homicide)	320
5.	Diseases of heart	229
6.	Intentional self-harm (suicide)	222
7.	Chronic lower respiratory diseases	119
8.	Cerebrovascular diseases	97
9.	Influenza and pneumonia	89
10.	In situ neoplasms, benign neoplasms, and neoplasms of uncertain/unknown behavior	88

15 – 24 years (all causes 32,198)

1.	Accidents (unintentional injuries)	14,089
2.	Assault (homicide)	5,275
3.	Intentional self-harm (suicide)	4,298
4.	Cancer	1,663
5.	Diseases of heart	1,065
6.	Congenital malformations, deformations, and chromosomal abnormalities	467
7.	Influenza and pneumonia	206
8.	Diabetes mellitus	204
9.	Cerebrovascular diseases	189
10.	Pregnancy, childbirth	169

Source: Arialdi M. Minino, MPH; Sherry L. Murphy, B.S.; Jiaquan Xu, M.D.; and Kenneth D. Kochanek, M.A. *Deaths: Final Data for 2008.* National Vital Statistics Reports. Vol. 59, No. 10. National Center for Health Statistics. Dec. 7, 2011

Selected Facts about Children and Disease in the United States

Arthritis

- Some 294,000 children under the age of 18 are affected by **juvenile arthritis** (pediatric arthritis and rheumatologic conditions). Arthritis and related conditions, such as juvenile arthritis, cost the U.S. economy nearly $128 billion per year.[1]
- **Juvenile idiopathic arthritis (JIA)** is the most common type of juvenile arthritis. The **systemic** form accounts for 10 percent of all JIA cases.[1]
- Estimates of the prevalence of **juvenile primary fibromyalgia syndrome (JPFS)**, a musculoskeletal pain syndrome, are as high as 6 percent. JPFS accounts for 7.7 percent of new diagnoses made among children and adolescents by pediatric rheumatologists. Musculoskeletal pain syndromes, which include JPFS, account for approximately 25 percent of new referrals to pediatric rheumatologists. JPFS is the diagnosis in 25 percent to 40 percent of children with musculoskeletal pain syndromes. Patients with JPFS most frequently present with symptoms in adolescence (ages 13-15). The mean age of onset is age 12. FMS is diagnosed at least three to seven times more commonly in girls than in boys.[2]

Cancer[3]

- While **childhood cancers** are rare, representing less than 1 percent of all new cancer diagnoses, an estimated 11,210 new cases were expected to occur among children ages 0-14 in 2011. Some 1,320 deaths due to cancer were expected among that age group that year. Mortality rates for childhood cancer have declined by 53 percent since 1975, and the 5-year relative survival rate has increased to 82 percent today.
- **Leukemia** accounts for about one-third of all childhood cancers and cancer deaths.
- Other childhood cancers include: **brain** and other **nervous system** (27 percent); **neuroblastoma** (7 percent); **Wilms tumor** (5 percent); **non-Hodgkin lymphoma** (4 percent) and **Hodgkin lymphoma** (4 percent); **rhabdomyosarcoma** (3 percent); **retinoblastoma** (3 percent); **osteosarcoma** (3 percent); and **Ewing sarcoma** (1 percent).

Cardiovascular Disease

- The prevalence of **hypertension** among children reported by various studies ranges from 5.4 percent to 19.4 percent.[4] Researchers have reported an important link between an increase in blood pressure and the recent rise in childhood **obesity**. They estimate that for each 1-cm increase in waist circumference, the likelihood of high blood pressure increases by 10 percent and the likelihood of prehypertension increases by 5 percent.[5] The percentage of obese children and adolescents has more than doubled since the early 1970s.[4]

Diabetes[6]

- Some 215,000 people under age 20 have **diabetes**, representing 0.26 percent of all people in that age group. About one in every 400 children and adolescents has diabetes (type 1 or type 2). The total economic cost of diabetes in 2007 was an estimated $174 billion.

Eye Disorders

- **Acute conjunctivitis** is the most common eye disorder in young children.[7] One in eight schoolchildren has an episode of acute infective conjunctivitis every year.[8] Some 3 million school days are lost as a result of acute conjunctivitis. Approximately 2 percent of all primary care visits and 1 percent of all emergency room visits are related to conjunctivitis. Conjunctivitis affects people at any age but tends to occur most often between the ages of 1 – 25.[9]

Gastrointestinal Disorders

- An estimated 1.4 million Americans have inflammatory bowel disease, with that number evenly split between **Crohn's disease** and **ulcerative colitis**. Males and females appear to be affected equally. Crohn's disease may occur in people of all ages, but it is primarily a disease of adolescents and young adults, affecting mainly those between 15 and 35. However, Crohn's disease can also occur in people who are 70 or older and in young children as well. Ten percent of those affected--an estimated 140,000—are under the age of 18.[10]
- **Eosinophilic esophagitis** affects both children and adults. For unknown reasons, men are more commonly affected than women, and it is most commonly found among young boys and men.[11] In 2003, the incidence and prevalence of the disorder in children ages 0-19 was reported to be 1 and 4.3 per 10,000 children, respectively. Up to 50 percent of patients have concomitant atopic disorders including **asthma**, **eczema**, and/or allergic rhinitis.[12]
- Some researchers believe as many as 7 million U.S. children have **gastroesophageal reflux disease (GERD)**.[13] Most infants outgrow gastroesophageal reflux by their first birthday, but reflux that continues past age 1 may be GERD.[14] An estimated 33 percent of the U.S. population has acid reflux disease.That high prevalence makes acid reflux disease the most expensive chronic gastrointestinal disorder in the United States, with cumulative costs approaching $10 billion each year.[15]

Genetic Diseases

- **Acute chest syndrome (ACS)** is a common pulmonary complication in children with **sickle cell disease (SCD)**. The peak incidence for ACS is in children between the ages of 2 and 4. When ACS occurs during the first three years of life, the odds are significantly increased for more frequent episodes of ACS during childhood. For patients with SCD, ACS is the second most common cause of hospitalization and the most common cause of death, with one-fourth of SCD-related deaths due to ACS.[16]
- **Cystic fibrosis (CF)** affects approximately 30,000 children and adults (and 70,000 worldwide). About 1,000 new cases of CF are diagnosed each year. More than 70 percent of patients are diagnosed by age 2.[17]
- The median age of survival for a person with **CF** is in the late 30s. Today, more than 45 percent of the CF population is age 18 and older.[17]
- **Duchenne muscular dystrophy** is the most common fatal genetic disorder diagnosed in childhood, affecting approximately 1 in every 3,500 live male births (about 20,000 new cases each year). Cardiac problems eventually occur with Duchenne and may start early or during the teenage years. Typically, boys with Duchenne lose their ability to walk between the ages of 10 and 14. By their late teens, young men lose the strength in their upper bodies, including the ability to move their arms. Also during their teenage years, young men with Duchenne usually need help with breathing at night. Young men with Duchenne typically survive into their twenties or early thirties.[18]
- **Fragile X syndrome (FXS)** is the most common inherited form of mental retardation. FXS occurs in all ethnic groups, affecting an estimated 1 in 4,000 males and 1 in 6,000 females. Approximately 1 in 100 to 250 women in the general population is a Fragile X carrier.[19]
- **Friedreich ataxia**, an inherited disease that causes progressive damage to the nervous system, typically presents in children ages 8-15 and almost always presents before the age of 20. Friedreich ataxia is most prevalent in white populations. Most studies yield an incidence among Europeans and North Americans of European descent at approximately 1.5 per 100,000 per year. Loss of ambulation typically occurs 15 years after disease onset. More than 95 percent of patients are wheelchair bound by age 45.[2]
- **Hereditary angioedema (HAE)** is a very rare and potentially life-threatening genetic condition that occurs in about 1 in 10,000 to 1 in 50,000 people. HAE symptoms include episodes of edema (swelling) in various body parts including the hands, feet, face, and airway. Before therapy became available, the mortality rate from airway obstruction was reportedly as high as 30 percent. A child has a 50 percent chance of inheriting this disease if one of his or her parents has it. Because the disease is very rare, it is not uncommon for patients to remain undiagnosed for many years. The age of HAE onset varies considerably. In one study, half of the patients reported onset of their symptoms by age 7, and more than two-thirds became symptomatic by age 13. There also seems to be an increased frequency of attacks during puberty or adolescence.[20]

Genetic Diseases (continued)

- **Homozygous familial hypercholesterolemia**, a rare inherited disease of metabolism, occurs in fewer than one in 1 million people within the United States. Patients with the disease are typically children and young adults who develop heart disease early in life. Children younger than age 5 with this disease have suffered heart attacks and death.[21]
- **Mucopolysaccharidosis type II (MPS II)**, also called **Hunter syndrome**, is an inherited disorder. The syndrome is most often seen in males, although rare female cases have been reported. Hunter syndrome can occur in any ethnic group. It occurs in 1 in 100,000 to 1 in 150,000 males. Hunter syndrome is divided into two types. Type A is the severe form, which usually is diagnosed in children ages 18-36 months. It is considered the classic form. Symptoms in type A may include short stature, progressive and profound mental retardation, skin lesions, skeletal changes, deafness, and visual impairment. Children with type A may survive into the second and third decades of life. Type B Hunter syndrome is much milder than type A and may not be diagnosed until adulthood. Individuals with type B may live into their 70s.[22]
- **Sickle cell disease** affects millions of people throughout the world and is particularly common among those whose ancestors come from sub-Saharan Africa, Spanish-speaking regions in the Western Hemisphere, Saudi Arabia, India, and some Mediterranean countries. In the United States, 90,000 to 100,000 people have sickle cell disease, which occurs in 1 in every 500 African-American births. One in 12 African Americans has the sickle cell trait. From 1989 through 1993, sickle cell disease caused an average of 75,000 hospitalizations, costing the United States approximately $475 million.[23]

Infectious Diseases

- **Infectious diseases** are now the world's biggest killer of children and young adults, accounting for more than 13 million deaths a year and one in two deaths in developing countries. Over the next hour alone, 1,500 people will die from an infectious disease—more than half of them children under age 5. Just six deadly infectious diseases—**pneumonia, tuberculosis, diarrheal diseases, malaria, measles and more recently HIV/AIDS**—account for half of all premature deaths, killing mostly children and young adults. Every three seconds a young child dies—in most cases from an infectious disease. In some countries, one in five children dies before their fifth birthday. Every day, 3,000 people die from malaria—three out of four of them children.[24]
- More widespread use of low-cost **vaccines** could prevent 1.6 million deaths a year among children under the age of five. Yet today, one in five children is still not fully immunized against the six major killer diseases: **diphtheria, whooping cough, tetanus, polio, measles** and **tuberculosis**.[24]
- More than 164 million school days are missed annually in American public schools due to the spread of **infectious diseases**.[9]
- In 2009, the estimated number of diagnoses of **HIV infection** among adults and adolescents totaled 41,845 with 31,872 diagnoses in males and 9,973 diagnoses in females. Among children under the age of 13, an estimated 166 HIV infections were diagnosed; among those ages 13-14, 21 cases were diagnosed; and among those ages 15-19, 2,036 cases were diagnosed.[23]
- In 2009, young people (ages 13-29) accounted for 39 percent of all new **HIV infections** in the United States.[23]
- Among vaccine-preventable diseases, **pertussis** is one of the most commonly occurring ones in the United States. Reported cases of whooping cough vary from year to year and tend to peak every 3-5 years. In 2010, 27,550 cases of pertussis were reported in the United States—and many more cases go unreported. Twenty-seven deaths were reported—25 were in children younger than age 1. Since the 1980s, there's been an increase in the number of cases of pertussis, especially among teens (10–19 years of age) and babies younger than 6 months of age. While adolescents (ages 11–19) and adults (age 20 and older) accounted for approximately 44 percent of reported cases in 2010, children ages 7-10 have contributed a significant proportion of cases over the last several years (19 percent of cases in 2010, 23 percent of cases in 2009, 23.5 percent of cases in 2008, and 13 percent in 2007).[23]
- **Pertussis** is most severe for babies—more than half of infants younger than age 1 who get the disease must be hospitalized. About 1 in 5 infants with pertussis get pneumonia (lung infection), and about 1 in 100 will have convulsions.[23]

Infectious Diseases (continued)

- **Respiratory syncytial virus (RSV)**, a very contagious infection of the lungs and breathing passages, is the most common cause of bronchiolitis in children less than 1 year of age. Almost all children in the United States will become infected with RSV by their second birthday. **[Lungusa.org]** Although most RSV infections are usually mild to moderate in severity and can be treated on an outpatient basis, each year RSV is responsible for approximately 125,000 pediatric hospitalizations, with a mortality rate of about 2 percent. In infants with chronic lung or heart disease, the RSV mortality rate may be as high as 5 percent.[5]

Neurologic Disorders

- **Epilepsy** is often thought of as a condition of childhood, but it can develop at any time of life. Each year, 300,000 people have a first convulsion; 120,000 of them are under the age of 18, and up to 100,000 of them are children under the age of 5 who have experienced a fever-caused seizure. About 30 percent of the 200,000 new cases of epilepsy every year begin in childhood, particularly in early childhood and around the time of adolescence. Some 326,000 children through the age of 15 have epilepsy. By age 20, 1 percent of the population can be expected to have developed epilepsy. Epilepsy and seizures affect nearly 3 million Americans of all ages, at an estimated annual cost of $17.6 billion in direct and indirect costs.[25]

- **Lennox-Gastaut syndrome (LGS)** is a severe form of epilepsy that usually begins before the age of 4, with most cases beginning at about age 2. A cause cannot be determined in up to 35 percent of affected children.[26] LGS accounts for only 4 percent of all childhood epilepsy, yet is a significant contributor to childhood morbidity.[27] LGS is more common in males than females and has a mortality rate that ranges from 3 percent to 7 percent.[28]

- Studies suggest that **migraine headaches** occur in 5 percent to10 percent of school-aged children in the United States. The symptoms of migraines interrupt the normal activities in approximately 65 percent to 80 percent of children. In one study of 970,000 youngsters with self-reported migraines ages 6-18, 329,000 school days were lost per month. The age of onset of migraine headaches is earlier in boys than in girls. From infancy to age 7, boys are affected equally or slightly more than girls. The prevalence of migraines increases during the adolescent and young adult years, during which up to 30 percent of young women and up to 20 percent of young men experience migraines. Chronic migraine may affect up to 4 percent of teenage girls and 2 percent of teenage boys.[29]

Psychiatric Disorders

- Research shows that half of all lifetime cases of **mental illness** begin by age 14.[30] Studies indicate that 1 in 5 children and adolescents (20 percent) may have a diagnosable mental disorder. Estimates of the number of children who have mental disorders range from 7.7 million to 12.8 million. An estimated two-thirds of all young people with mental health problems are not getting the help they need.[31]

- **Attention-deficit/hyperactivity disorder (ADHD)** is one of the most common reasons children are referred for mental health services. It affects as many as one in every 20 children. Although boys are three to four times more likely than girls to experience ADHD, the disorder affects both genders. Although most children with ADHD have normal or above-normal intelligence, 40 percent to 60 percent have serious learning difficulties. Children and adolescents with ADHD are more likely than children without the disorder to suffer from other mental disorders. About one-half of all young people with ADHD have oppositional defiant disorder; about one-fourth have an **anxiety disorder**; as many as one-third have **depression**; and one-fifth have **bipolar disorder**. Nine out of 10 children respond to medication, and 50 percent of children who do not respond to an initial medication will respond to a second.[31]

- **Autism** is diagnosed in 1 out of 110 children today, making autism more prevalent than childhood cancers, multiple sclerosis, and cystic fibrosis combined.[32] Autism spectrum disorders (ASDs) occur in all racial, ethnic, and socioeconomic groups, but are four to five times more likely to occur in boys than in girls. The median age of earliest ASD diagnosis is between 4.5 and 5.5 years, but for 51 percent–91 percent of children with an ASD, developmental concerns had been recorded before the age of three. The median age of earliest ASD diagnosis is between 4.5 and 5.5 years, but for 51 percent – 91 percent of children with an ASD, developmental concerns had been recorded before the age of three. The estimated lifetime cost to care for an individual with an ASD is $3.2 million.[23]

Psychiatric Disorders (continued)

- Both dysthymic disorder and **major depressive disorder** together have affected approximately 11.2 percent of 13- to 18-year-olds in the United States at some point during their lives. Girls are more likely than boys to experience depressive disorders. Additionally, 3.3 percent of 13- to 18-year-olds have experienced a seriously debilitating depressive disorder.[30]
- **Schizophrenia** is rare in children under 12, but it occurs in about 3 out of every 1,000 adolescents.[31]

Respiratory Disorders[33]

- **Asthma**, one of the most common chronic disorders in childhood, currently affects an estimated 7.1 million children under the age of 18. Some 4.1 million of those children suffered from an asthma attack or episode in 2009.
- **Asthma**, one of the most common chronic disorders in childhood, currently affects an estimated 7.1 million children under the age of 18. Some 4.1 million of those children suffered from an asthma attack or episode in 2009.
- **Asthma** is the third leading cause of hospitalization among children under the age of 15. Approximately 32.7 percent of all asthma hospital discharges in 2006 were in those under 15, however only 20.1 percent of the U.S. population was less than 15 years old. In 2005, approximately 679,000 emergency room visits were due to asthma in those under 15.
- **Asthma** is one of the leading causes of school absenteeism; in 2008, asthma accounted for an estimated 14.4 million lost school days in children with an asthma attack in the previous year.
- In 2007, 3,447 deaths were attributed to **asthma**. However, deaths due to asthma are rare among children. The number of deaths increases with age. In 2007, 152 children under 15 died from asthma compared to 659 adults over 85.
- The annual direct health care cost of **asthma** is approximately $50.1 billion; indirect costs (e.g. lost productivity) add another $5.9 billion, for a total of $56 billion dollars.
- **Bronchopulmonary dysplasia (BPD)** is a lung disease that is seen most often in babies who were born severely premature—more than 10 weeks before their due date. Babies with BPD have inflammation and scarring in the lungs. About 5,000 to 10,000 babies born in the United States each year have BPD. More babies today have the disease than 30 years ago because more very premature babies survive.

Skin Disorders

- **Atopic dermatitis** is the most severe and chronic kind of **eczema**. It almost always begins in childhood, usually during infancy. An estimated 65 percent of eczema patients are diagnosed in the first year of life, and 90 percent of patients experience it before age 5. It is estimated that atopic dermatitis affects more than 30 million Americans.[34]
- **Psoriasis** affects as many as 7.5 million people in the United States, about 2.2 percent of the population. It occurs nearly equally in men and women across all socioeconomic groups, and it occurs in all races, though Caucasians are slightly more affected. Every year, some 20,000 children under age 10 are diagnosed with psoriasis. People usually have their first outbreak between the ages of 15 and 25, but it can appear at any age.[35]

Sources:

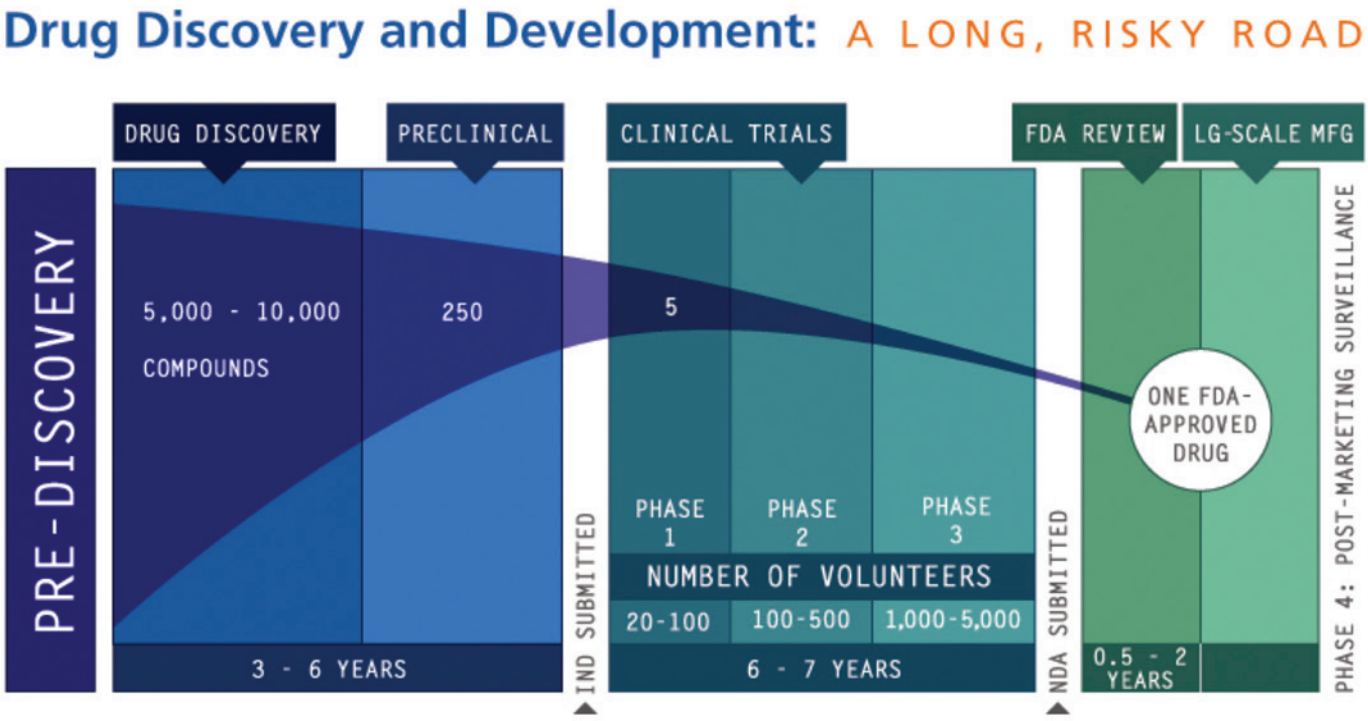
1. Arthritis Foundation, *www.arthritis.org*
2. Medscape Reference, WebMD LLC, *www.emedicine.medscape.com*

Sources: (continued)

3. American Cancer Society, *www.cancer.org*
4. BioMed Central Ltd., *www.biomedcentral.com*
5. Medscape, WebMD LLC, *www.medscape.com*
6. American Diabetes Association, *www.diabetes.org*
7. Review of Optometry, Jobson Medical Information LLC, *www.revoptom.com*
8. National Center for Biotechnology Information, U.S. National Library of Medicine, National Institutes of Health, *www.ncbi.nlm.nih.gov*
9. Conjunctivitis Blog, *www.conjunctivitis.blogspot.com*
10. Crohn's & Colitis Foundation of America, *www.ccfa.org*
11. MedicineNet, Inc., *www.medicinenet.com*
12. Bentham Science Publishers, *www.benthamscience.com*
13. PAGER, *www.reflux.org*
14. National Digestive Diseases Information Clearinghouse, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, *www.digestive.niddk.nih.gov*
15. LIVESTRONG, *www.livestrong.com*
16. UpToDate, Inc., *www.uptodate.com*
17. Cystic Fibrosis Foundation, *www.cff.org*
18. Parent Project Muscular Dystrophy, *www.parentprojectmd.org*
19. Genetic Disease Foundation, *www.geneticdiseasefoundation.org*
20. U.S. Hereditary Angioedema Association, *www.haea.org*
21. National Institutes of Health Clinical Center, *clinicalstudies.info.nih.gov*
22. About.com: Rare Diseases, *www.rarediseases.about.com*
23. U.S. Centers for Disease Control and Prevention, *www.cdc.gov*
24. World Health Organization, *www.who.int*
25. Epilepsy Foundation, *www.epilepsyfoundation.org*
26. Medical Home Portal Project, Department of Pediatrics, University of Utah, *www.medicalhomeportal.org*
27. Wiley Online Library, John Wiley & Sons, Inc., *www.onlinelibrary.wiley.com*
28. Head & Face Medicine, BioMed Central, Ltd., *www.head-face-med.com*
29. eMedicine Health, WebMD, LLC, *www.emedicinehealth.com*
30. National Institute of Mental Health, National Institutes of Health, *www.nimh.nih.gov*
31. Mental Health America, *www.mentalhealthamerica.net*
32. The Autism Education Network, *www.autismeducation.net*
33. American Lung Association, *www.lungusa.org*
34. National Eczema Association, *www.nationaleczema.org*
35. National Psoriasis Foundation, *www.psoriasis.org*

The Drug Discovery, Development and Approval Process

Developing a new medicine takes an average of 10-15 years;
For every 5,000-10,000 compounds in the pipeline, only 1 is approved.



The Drug Development and Approval Process

The U.S. system of new drug approvals is perhaps the most rigorous in the world.

It takes 10-15 years, on average, for an experimental drug to travel from lab to U.S. patients, according to the Tufts Center for the Study of Drug Development. Only five in 5,000 compounds that enter preclinical testing make it to human testing. And only one of those five is approved for sale.

On average, it costs a company $1.2 billion, including the cost of failures, to get one new medicine from the laboratory to U.S. patients, according to a 2007 study by the Tufts Center for the Study of Drug Development.

Once a new compound has been identified in the laboratory, medicines are usually developed as follows:

Preclinical Testing. A pharmaceutical company conducts laboratory and animal studies to show biological activity of the compound against the targeted disease, and the compound is evaluated for safety.

Investigational New Drug Application (IND). After completing preclinical testing, a company files an IND with the U.S. Food and Drug Administration (FDA) to begin to test the drug in people. The IND shows results of previous experiments; how, where and by whom the new studies will be conducted; the chemical structure of the compound; how it is thought to work in the body; any toxic effects found in the animal studies; and how the compound is manufactured. All clinical trials must be reviewed and approved by the Institutional Review Board (IRB) where the trials will be conducted. Progress reports on clinical trials must be submitted at least annually to FDA and the IRB.

Clinical Trials, Phase I. These tests usually involve about 20 to 100 healthy volunteers. The tests study a drug's safety profile, including the safe dosage range. The studies also determine how a drug is absorbed, distributed, metabolized, and excreted as well as the duration of its action.

Clinical Trials, Phase II. In this phase, controlled trials of approximately 100 to 500 volunteer patients (people with the disease) assess a drug's effectiveness and determine the early side effect profile.

Clinical Trials, Phase III. This phase usually involves 1,000 to 5,000 patients in clinics and hospitals. Physicians monitor patients closely to confirm efficacy and identify adverse events.

New Drug Application (NDA)/Biologic License Application (BLA). Following the completion of all three phases of clinical trials, a company analyzes all of the data and files an NDA or BLA with FDA if the data successfully demonstrate both safety and effectiveness. The applications contain all of the scientific information that the company has gathered. Applications typically run 100,000 pages or more.

Approval. Once FDA approves an NDA or BLA, the new medicine becomes available for physicians to prescribe. A company must continue to submit periodic reports to FDA, including any cases of adverse reactions and appropriate quality-control records. For some medicines, FDA requires additional trials (Phase IV) to evaluate long-term effects.

Discovering and developing safe and effective new medicines is a long, difficult, and expensive process. Biopharmaceutical companies invested an estimated $67.4 billion in research and development in 2010.