



# FACTS about CENTRAL NERVOUS SYSTEM DISORDERS

## Biotechnology is the Foundation for Historic Breakthroughs in the Treatment of Central Nervous System Disorders

**The Central Nervous System** is the command center of the entire body. It consists of the brain, spinal cord and optic nerves. Without it, we would be unable to breathe, see, smell, move, think, feel or use any of our most basic senses.

- **An estimated 50 million Americans** are affected by diseases or disorders of the spinal cord and brain. Central nervous system conditions include: Alzheimer's disease, multiple sclerosis, epilepsy, Parkinson's disease, mental illness, ADHD, ALS, brain injuries, dementia, Huntington's disease, memory loss and migraine, among others. Disorders can result from damage, dysfunction or death of nerve cells. Disorders can be genetic or acquired due to toxic, metabolic, traumatic, infectious or inflammatory conditions.
- **More than 90 percent** of the American population has experienced or will experience the effects of a brain-related disorder or injury at some point in their lives. Diseases like Alzheimer's, Parkinson's, epilepsy, multiple sclerosis and mental illness affect millions of Californians each year. According to the National Alliance on Mental Illness in California, people with brain disorders occupy more hospital beds than individuals with cancer, heart disease and lung disease combined.

## California Biotechnology Provides New Therapies to Restore and Heal the Central Nervous System

**Just a decade ago**, neuroscience textbooks taught that nerve cells in the adult human brain and spinal cord could not regenerate. Once dead, it was thought, central nervous system cells were gone for good. Because rebuilding nervous tissue seemed out of the question, research and treatment focused almost entirely on therapeutic approaches to relieve symptoms and limit further damage.

Today, research into the regeneration mechanisms of the central nervous system has raised hopes that researchers can find ways to actually repair central nervous system damage. Thanks to the biotechnology industry, several major discoveries over the past 15 years have revolutionized how we understand the nervous system and its disorders. For example, new insights into the development of the nervous system, brain plasticity, molecular pathology and the role of non-neuronal cells are already changing how we understand and treat these disorders.

Researchers are on the verge of discovering methods to treat and eventually prevent incurable disorders such as Alzheimer's and Parkinson's through therapies that promote growth, regeneration and protection of nervous tissues. Biotechnology treatments that restore nerve damage will someday allow spinal cord injury patients the ability to move and walk, and those in chronic pain the chance to live normal lives again. Those living with the debilitating symptoms from multiple sclerosis will soon find treatments that stimulate healthy cell growth in their bodies.

California biotechnology has 116 therapies in the product pipeline for central nervous system-related conditions. These progressive therapies will treat diseases once thought untreatable.

## Lucie Keene Healdsburg, California

*Lucie Keene experienced symptoms of Parkinson's disease years before the diagnosis came. As a chair-side dental assistant, Lucie relied on her dexterity to handle sensitive dental instruments. When she started to notice symptoms of stiffness and pain in her left hand, Lucie's physician informed her that she most likely had arthritis. After Lucie retired in 2001, the pain and rigidity became more severe and tremors entered the picture. Her physician was still unsure of Lucie's diagnosis but had a hunch. Lucie's physician prescribed a metabolic treatment made specifically for Parkinson's patients. The tremor symptoms started to subside and a diagnosis was finally made. Lucie indeed had Parkinson's disease.*



*Current evidence indicates that symptoms of Parkinson's disease are related to depletion of dopamine. Administration of dopamine is ineffective in the treatment of Parkinson's disease because it does not cross the blood-brain barrier. However, the metabolic treatment Lucie's doctor prescribed is a precursor of dopamine and has the ability to cross the blood-brain barrier, and is converted to dopamine in the brain. This novel treatment relieves symptoms of Parkinson's disease.*

*The biologic therapy addressed Lucie's tremors, but pain and flexibility were still an issue. Lucie's doctor sent her to a movement specialist who adjusted her treatment dosage and added a second drug therapy which allows her to maintain all of the activities she loves. Today, Lucie enjoys gardening, skydiving, volunteering on the set of her community theater group and spending time with her five children and seven grandchildren which she affectionately calls "The Magnificent Seven."*





	, Monrovia, San Diego	<b>Myozyme</b> <sup>®</sup> for the treatment of Pompe disease, a rare neuromuscular disease; <b>Aldurazyme</b> <sup>®</sup> for the treatment of enzyme deficiency, which can be life-threatening; symptoms including mental retardation and spinal cord compression
<b>Neurobiological Technologies</b>	Emeryville	<b>NAMENDA</b> <sup>®</sup> for the treatment of Alzheimer's disease; <b>Questcor H.P. Acthar</b> <sup>®</sup> gel for the treatment of multiple sclerosis
<b>Questcor</b>	Union City	<b>Acthar</b> <sup>®</sup> Gel for the treatment of multiple sclerosis
<b>Acadia Pharmaceuticals</b>	San Diego	<b>Pimavanserin</b> to treat Parkinson's disease psychosis, schizophrenia, sleep maintenance, neuropathic pain and ACP-104 to treat Parkinson's disease
<b>Cypress Bioscience</b>	San Diego	<b>Milnaoipran</b> for the treatment of fibromyalgia syndrome
<b>Boston Scientific</b>	Mountain View	<b>Precision</b> <sup>®</sup> Spinal Cord Stimulation system to treat refractory migraines
<b>Elan</b> (Biogen Idec)	San Diego, South San Francisco	Synthetically engineered antibodies to treat Alzheimer's and Parkinson's disease
<b>Genentech/ Biogen Idec</b>	South San Francisco/ San Diego	<b>Rituxan</b> <sup>®</sup> for the treatment of primary progressive multiple sclerosis
<b>Geron Corporation</b>	Menlo Park	Stem Cell Programs (GRNOPC1) to treat spinal cord injury; also studying Parkinson's disease, nerve regeneration
<b>Neurocrine Biosciences</b>	San Diego	<b>Indiplon</b> to treat insomnia, CRF receptor antagonist to treat depression and anxiety-related disorders
<b>Orchestra Therapeutics</b>	Carlsbad	<b>NeuroVax</b> <sup>®</sup> for the treatment of multiple sclerosis
<b>PDL BioPharma</b>	Freemont	<b>Daldaclizumab</b> for the treatment of multiple sclerosis
<b>Plexxikon</b> (Wyeth strategic alliance)	Berkeley	PPAR agonists to treat Alzheimer's disease and multiple sclerosis
<b>Roche Palo Alto</b>	Palo Alto	Developing therapies for Alzheimer's disease, anxiety, depression, schizophrenia
<b>StemCells, Inc.</b>	Palo Alto	In Phase I, to evaluate HuCNS-SC for the treatment of Batten disease, a rare and fatal neurodegenerative disease; also looking at spinal cord injuries and other myelin disorders; potentially for Alzheimer's disease, epilepsy and ALS
<b>Titan Pharmaceuticals</b>	South San Francisco	<b>Iloperidone</b> to treat schizophrenia and psychosis; <b>Spheramine</b> <sup>®</sup> to treat Parkinson's disease
<b>TransOral Pharmaceuticals</b>	Pt. Richmond	<b>Intermezzo</b> <sup>™</sup> for the treatment of insomnia
<b>Chiron</b> (Novartis)	Emeryville	Immunoassay for the treatment of Creutzfeld-Jacob disease, a rare degenerative fatal brain disorder
<b>Medtronic</b>	LA, Palo Alto, Goleta, Santa Ana, additional California locations	<b>Activa</b> <sup>®</sup> Parkinson's Control Therapy; <b>Activa</b> <sup>®</sup> Tremor Control Therapy