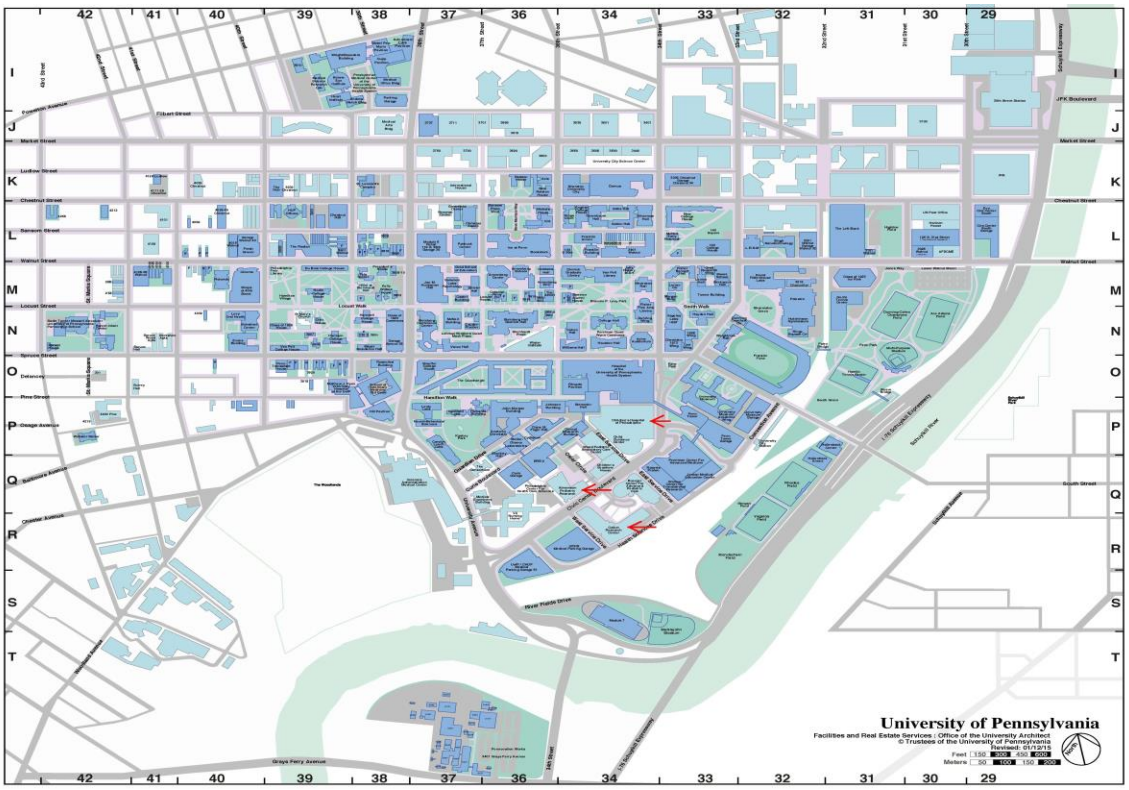
GENERAL INFORMATION

The **Children's Hospital of Philadelphia (CHOP)** is the oldest institution in the country dedicated to the care of children, and the University of Pennsylvania is the first University in the United States. CHOP provides tertiary care for a catchment area that includes 12,000,000 people. Annually, CHOP receives approximately 28,200 inpatient admissions, 86,100 emergency room visits, and over 1 million outpatient visits. A search of the electronic health records at CHOP yields 181,446 unique patients with intellectual or developmental disabilities (IDDS) (Identified using ICD-9 codes for autism spectrum disorder, attention-deficit hyperactivity disorder, intellectual disability, language delay, etc).

The Division of Neurology has about 17,000 outpatient visits per year in 7 locations, about 2000 inpatient admission and an equal number of inpatient consultations. The Division of Metabolism hosts about 3,000 outpatient visits annually. The Regional Autism Center follows over 3,000 children with autism spectrum disorders. Approximately 7,800 children with attention deficit disorder annually visit CHOP outpatient facilities. The CHOP Care Network currently has 60 locations, including 31 Primary Care sites, 15 Specialty Care & Surgery Centers, 3 Urgent Care Centers and 11 Newborn & Pediatric Inpatient Care sites (pediatric inpatient units at affiliated community hospitals). Patient care activities have experienced rapid growth over the past 5 years. The hospital currently has 527 beds to provide a range of inpatient, emergency and outpatient care. CHOP admitted more than 31,000 children in 2014. Its emergency department treatment recorded almost 90,000 visits. Also, the Buerger Center for Advanced Pediatric Care, opening in July 2015, will be the nation's most state-of-the-art facility for outpatient medicine.

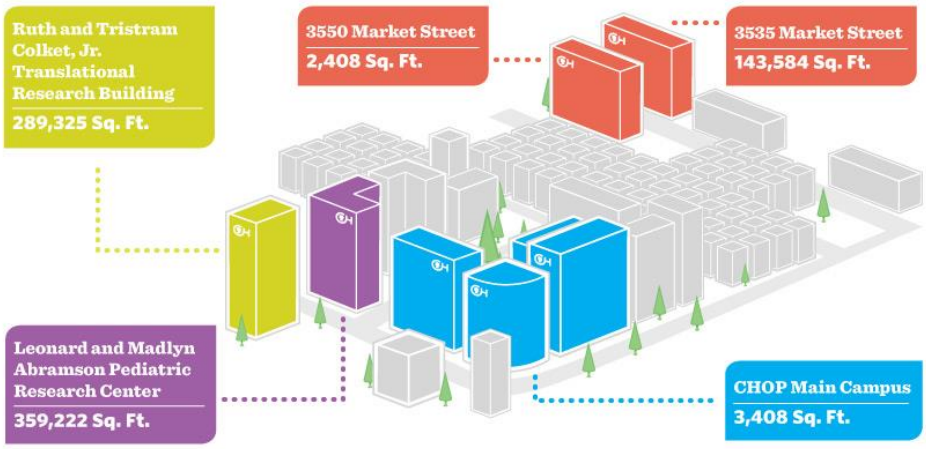
CHOP is consistently recognized as a national leader for advancement of healthcare for children and proudly shares the No. 1 ranking on *U.S. News & World Report's* 2014-15 Honor Roll of the nation's Best Children's Hospitals. Recent surveys by *U.S. News & World Report* rated several subspecialty areas and CHOP has ranked in the top four in all ten specialties. For example, in the last survey reported in 2014, two programs were rated #1 (Neonatology and Pulmonology) and three were rated #2 (Cancer, Diabetes & Endocrinology and Neurology & Neurosurgery). Thus, by both fact-based and reputation-based surveys conducted in the past ~5 years, both CHOP and its individual subspecialty programs have consistently been rated the best in the nation. Also, *Parents* magazine named CHOP No. 1 on its 2013 list of Top 10 Best Children's Hospitals. CHOP was also awarded Magnet status by the American Nurses Credentialing Center (ANCC)—an achievement met by only 6 percent of hospitals in the United States.

The **University of Pennsylvania Perelman School of Medicine**, established in 1765, was the first medical school in the 13 American colonies. Several of the Clinical Practices at the University of Pennsylvania Health System consistently makes *the National Honor Roll* (*U.S. News and World Report*), currently ranked #7 overall. The Medical School employs over 2,000 full-time faculty, has twenty-eight departments with numerous divisions and more than 24 Institutes and Research Centers. At this time, the Medical Center campus includes approximately 900,000 sq. ft. of research space. These two institutions provide the home for this Intellectual and developmental Disabilities Research Center. Unlike most other University/Children's Hospitals, these two institutions reside on contiguous city blocks just west of downtown Philadelphia.



This is a map of the University of Pennsylvania with the Children's Hospital of Philadelphia's buildings colored in pale blue. Part of the space in CHOP (1st red arrow), the Abramson Research Center (2nd red arrow), and the Colket Translational Research Building (3rd red arrow) house most of the cores for this IDDRC.

Currently, the Children's Hospital of Philadelphia has nearly 800,000 gross square feet of research space (84,500 square feet of animal facilities). It manages over 200 million dollars in total research support with 121 million coming from the NIH.



The newly named Raymond G. Perelman Campus includes CHOP's most state-of-the-art research and clinical facilities: the Ruth and Tristram Colket Jr. Translational Research Building and the Buerger Center for Advanced Pediatric Care. The Colket Translational Research Building opened in 2009 and includes 773,000 square feet of space—289,000 of which is devoted to research—and currently stands at 11 stories. This building is designed to expand vertically to 23 stories to account for future growth. This facility is home to 45 NIH-funded faculty members and 500 CHOP employees who will occupy wet-bench space on 4 floors. In 2008 a vivarium of ~ 250,000 square feet opened on 4 below-grade floors. The vivarium includes CHOP's new barrier facility for pathogen-free rodent breeding colonies and immunocompromised rodent strains. The vivarium also includes 17,500 square feet to house non-human primates primary being used with the goal of developing an vaccine directed to HIV. The building is designed to expand to 23 stories in order to accommodate future needs for research growth.

Currently, the University of Pennsylvania has over 2 million square feet of research space. Built on its strong tradition in academic medicine and its recent emphasis on fundamental investigation and translational research, the University of Pennsylvania is currently an extremely exciting research environment. Penn Medicine is consistently among the top recipients of funding from the National Institutes of Health.

In 2010, the 10-story Smilow Center for Translational Research was completed and includes 531,000 gross square feet of space to support biomedical and translational research.

These resources and the commitment to further growth would seemingly make this an ideal location for one of the 15 nationally supported IDDRCs.

Research: CHOP has a long and distinguished tradition of basic, translational and clinical research. CHOP has the third largest pediatric research program in the country and was the first children's hospital to initiate a pediatric research department, now known as the Children's Hospital of Philadelphia Research Institute (formerly the Joseph Stokes Jr. Research Institute). In 1995, CHOP centralized laboratory research from across all CHOP divisions and departments in the Leonard and Madlyn Abramson Pediatric Research Center (ARC). The ARC is a state-of-the-art research facility with over 500,000 gsf, the largest freestanding pediatric research center in the country. The next phase of CHOP'S growth in laboratory research was the construction of a new, freestanding research building across the street from the ARC that has an expanded laboratory animal facility that accommodate non-human primates, principally for AIDS vaccine research, as well as an additional 200,000 gsf of additional laboratory research modules, offices, cores and support services. This building named the Ruth and Tristram Colket Jr. Translational Research Building has the capability of expanding upward to expand our research space by an additional 23 stories.

To support the "bench to bedside" philosophy, CHOP has an active and growing research program with many funded programs and clinical centers for children with specialty health needs. More than 300 investigators conduct research through more than 1,200 human (IRB approved) and animal (IACUC approved) research protocols. The research is broadly based and includes studies to understand the basic mechanisms of biological functions and human diseases, as well as testing new drugs, devices, vaccines and other biological agents for safety and efficacy. Larger programmatic areas of investigation include AIDS, cardiac diseases, childhood cancer, cystic fibrosis, diabetes, hemophilia, hypercholesterolemia, hyperinsulinism, mental retardation, neonatal seizures, nutritional disorders, sickle cell diseases, and a number of other major disorders and diseases that affect children. All research activities at CHOP are organized administratively under the JSRI. Dr. Bryan A. Wolf is the Chief Scientific Officer, Dr. Tom Curran is Deputy Scientific Director, Dr. Dennis Durban is Director of Clinical and Translational Research, and Mary Tomlinson is Senior Vice President of Research Administration. An Executive Committee is made up of the Six Department Chairs and Five Research Directors or at-large members. This committee together with the Board of Trustees provides a structure of governance and accountability.

CHOP Research Institute Research Core Facilities

High-throughput Sequencing Core: The High-Throughput Sequencing (HTS) Core at CHOP and the Beijing Genomics Institute have formed a collaborative genome center called BGI@CHOP. Together, these elements for the HTS Core offer increased capacity, expertise and analytical resources for conducting next-generation sequencing studies. The HTS Core provides automated library construction and high-quality, high-throughput sequencing services for whole genome, whole exome, RNA-SEQ, and ChIP-SEQ. BGI@CHOP Exome workflow passed CAP inspection in April 2014.

Biorepository Core**:** The Biorepository Core collects and organizes biospecimens from investigators across the Research Institute. With a capacity for approximately 7 million samples, the facility is designed to house all of the biospecimens available at CHOP, avoiding specimen duplication, preserving precious biomaterials, and providing broad access to data and materials. Initial sample collection focuses on DNA samples, but the facility can also safely store fluids, RNA, tissue samples, and a number of other biospecimens.

Biostatistics and Data Management Core (BDMC): The BDMC supports the biostatistical and data management needs from virtually all subspecialties of pediatric medicine and supports studies ranging from narrowly defined basic science projects to large, multi-site clinical trials. The BDMC supports more than 25 funded studies and collaborates with investigators on numerous grant applications each year. It is staffed by a full-time Scientific Director, a Deputy Director, biostatistics and data management/information technology managers, and 15 additional staff members representing the disciplines of biostatistics, data management,

and information technology. The BDMC's Biostatistics subcore provides consultative and analytic support services to investigators interested in basic, pre-clinical, clinical, and epidemiological pediatric studies. The Data Management/Information Technology (DM/IT) subcore provides a selection of services ranging from consultation through full-service data management.

Clinical Research Support Office (CRSO): The CRSO assists in the start-up, execution, and completion of clinical research projects, in compliance with local and federal requirements. The office maintains a staff of well-trained study coordinators and project managers who can be assigned to support any type of clinical research study at CHOP. The CRSO Navigator is available to assist/guide investigators with any questions that arise during the design, start up, and execution of their clinical studies. The CRSO is also available to assist investigators with budget preparation, IRB submissions, and IND and IDE applications to the Food and Drug Administration. The CRSO maintains a highly trained staff with expertise on good clinical practices of clinical research, which ensures that study teams comply with all relevant regulatory requirements.

Flow Cytometry Core: This core provides access to flow cytometry equipment and analysis software for trained personnel from individual research labs on a fee-for-service basis. The core assists users in the design of experimental protocols that require various flow cytometric methods. The laboratory is capable of both sample preparation and analyses in support of individual research efforts and offers specialized services such as training and mutiparametric cell sorting.

Nucleic Acid PCR Core (NAPCore): The NAPCore provides a centralized source for specialized services, technical expertise, and reagents to support the needs of molecular biology investigators. These services include Sanger DNA sequencing, small-scale next-generation sequencing and library assistance, fluorescent fragment analysis (MLPA and microsatellite analysis), microarrays, real-time PCR, oligonucleotide ordering, and sample quality control assessment. While production-level NGS is performed by BGI@CHOP, the NAPCore has additional resources for smaller-scale projects and Sanger sequence validation. The facility has MiSeq and Ion Torrent PGM sequencers, and two electrophoresis units along with support equipment for library preparation, emulsion PCR and bead enrichment.

Pathology Core: The Pathology Core provides basic histopathology, immunohistochemistry, tissue microarray, and laser capture microdissection services to researchers at CHOP and within the surrounding academic community. The core offers a full range of histopathology services, including tissue processing, embedding, and cutting for both paraffin and frozen tissue. The core also performs most standard stains as well as immunohistochemistry, antibody workup, fluorescence *in situ* hybridization, and TUNEL. Tissue microarrays can be constructed, and sophisticated imaging instrumentation is available for virtual microscopy and image analysis. Specialized software is available for image analysis, and to manage and store array data.

Protein and Proteomics Core: The Protein and Proteomics Core Facility addresses the growing need for the technological resources to identify, produce, and characterize new proteins. It provides a variety of services for investigators at CHOP, Penn, and outside institutions. These services include producing and characterizing proteins, investigating protein-protein interactions, and characterizing whole proteomes. Some services are provided on a user-operated, sign-up basis, whereas others are performed as full-service by the dedicated facility personnel. The core has a full range of equipment needed for protein production and biochemical and cell biological experiments, specialized instrumentation and computational capabilities necessary for state-of-the-art proteomics experiments, its own computing infrastructure and a variety of software.

Laboratory Animal Facility (LAF): The CHOP Research Institute has two laboratory animal facilities (LAFs), one located in the ARC and the other in the CTRB. The LAFs provide care, housing, husbandry, and veterinary care for CHOP's animal colonies. Accredited by the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC), the LAFs ensure humane care and use of animals, including training, compliance oversight, administration and operations, clinical veterinary services, and animal husbandry. The LAFs work closely with the Institutional Animal Care and Use Committee (IACUC) to ensure that CHOP's animal care and use program supports research, while simultaneously adhering to the regulations that govern the use of animals and the principles that underlie the ethical use of animals in research.

Small Animal Imaging Facility: The Small Animal Imaging Facility is a state-of-the-art lab that satisfies investigators' imaging needs in a "clean" environment necessary for longitudinal studies. The facility is open to all CHOP and Penn investigators whose animals are housed in the facility. Services include MRI, PET-CT, SPECT-CT, Optical Imaging, Ultrasound, and NMR/Microimaging. NMR/Microimaging Services at CHOP

feature a 400 MHz (9.4Tesla) high-resolution wide-bore spectrometer equipped with a HP computer. The system can perform most of the traditional high-resolution NMR experiments as well as microimaging of specimens and small models. The services are available not only to CHOP investigators but also to investigators affiliated with large center program or private research institutions.

Transgenic Mouse Core: The Transgenic Mouse Core enables investigators to generate transgenic and chimeric mouse lines in-house without quarantine delays. An *in vitro* fertilization service is available to overcome any breeding problems that can impact valuable mouse lines. Providing a single male mouse enables the core to fertilize embryos *in vitro*, and the resulting fertilized embryos can then be transferred into surrogate mother mice or cryopreserved. Other services include production of transgenic mice by microinjection of DNA directly into embryonic stem cell nuclei; generation of knockout mice by microinjection of modified ES cells into blastocysts; mouse line rederivation; and embryo and sperm cryopreservation.

Bioanalytical Core: The Bioanalytical Core specializes in developing and validating robust liquid chromatography/tandem mass spectrometry methods for the analysis of natural products, drugs, and metabolites in various biological samples (blood, dried blood spots, plasma, urine, and tissue). With extensive experience in method development and validation, the core performs method validations, partial validations, cross-matrix validations, or combinations required to meet project needs. Validation studies are performed in accordance with the US Food and Drug Administration Guidance for Industry, Bioanalytical Method Validation. The core has developed assays for investigational and marketed drugs used for pain, oncology, cardiology, and infectious diseases. These assays are typically used to support pediatric drug discovery and development.

Metabolomics Core: The Metabolomic Core provides investigators with a resource that facilitates the analysis of major metabolic pathways in humans, animals, and *in vitro* systems. The analytical repertoire includes the measurement – both *in vivo* and *in vitro* – of flux through major pathways of intermediary metabolism, including glycolysis, the tricarboxylic acid cycle, the oxidation of fatty acids and amino acids, the urea cycle and protein synthesis and degradation; determination of *in vivo* metabolic rate in freely moving organisms; and determination of selected drugs and/or drug metabolites with triple-stage quadruple mass spectrometry.

Stem Cell Core: The Stem Cell Core provides expertise and quality-control reagents for the culture and differentiation of human embryonic stem cells (ESCs) and human induced pluripotent stem cells (iPSCs) for the CHOP and Penn communities. The facility maintains five of the new NIH-approved human ESC lines and several human iPSC lines.

Healthcare Analytics Unit (HAU) Core: A service unit of two centers at CHOP (CPCE and PolicyLab), the HAU serves as a resource for investigators who want to use administrative or other existing data to answer research questions; offers programmer/analysts services to pull, clean, manage, model, and analyze data; and provides the expertise of the center's faculty members with their advanced training in clinical epidemiology and public health. The unit supports and provides access to several databases.

Research IS Web Services Core: The Research IS Web Services Core designs and supports web sites for investigators, labs, studies, core facilities, outreach programs, Research Affinity Groups, and Centers of Emphasis, as well as providing web development for Research Administration. The team develops a variety of client-side and database-driven web applications, including search and data gathering functionality, custom login and access restriction, and more. Web Services posts new content and site updates daily as part of their service to internal clients. In addition, the team provides development support to, and day-to-day administration of, Institute-wide web presences, including the Research Institute public website, the Research Institute intranet, and the Share (Wiki) collaborative environment.

Viral Vector Cores: As part of the Center for Cellular and Molecular Therapeutics, the Research Vector Core has expanded its capacity to provide infrastructure support for investigators interested in using viral vectors in their research model systems. The Clinical Vector Core uses a patented vector production technology and a highly efficient purification process that utilizes combined column and gradient centrifugation-based process steps. This system has manufactured clinical grade AAV vectors that have demonstrated excellent safety in several clinical studies.

CHOP-Research Institute Centers of Emphasis

The following centers are directly related to the activities of the IDDRC. Several of these centers have been developed during the past five years and dramatically expand the research opportunities available to our scientific community.

Center for Applied Genomics (CAG): The CAG develops new and better ways to diagnose and treat children affected by complex medical disorders by translating basic research findings into medical innovations. CAG aims to discover the genetic causes of both common and rare childhood diseases, including autism, epilepsy, schizophrenia, diabetes, and pediatric cancer. Ultimately, CAG's objective is to discover genetic markers to accurately diagnose patient subsets with genetic abnormalities that guide physicians to the most appropriate therapies. CAG is one of the world's largest genetics research programs, and the only center at a pediatric hospital to have large-scale access to state-of-the-art high-throughput genotyping and sequencing technology. It operates one of the world's largest whole exome and whole genome sequencing laboratories, which has led to numerous discoveries to elucidate the causes of pediatric disease.

Center for Autism Research (CAR): The CAR coordinates and supports research into the causes of the autism spectrum disorders (ASDs). The CAR research programs are predicated on the theory that effective treatments will follow from a better understanding of causal mechanisms. CAR establishes a broad-based research program aimed at fundamental discoveries into causes of ASDs. CAR establishes programs of research focused on developmental, neurobiological, and genetic mechanisms of the ASDs, with a particular emphasis on understanding the individual differences across the spectrum. CAR faculty also engage in research to evaluate the current standard of care for patients with an ASD and to test the effectiveness of promising new treatments.

Department of Biomedical and Health Informatics (DBHi): The Department of Biomedical and Health Informatics (DBHi) is the home for the development of innovative solutions to healthcare's immediate and long-term informatics needs. DBHi provides the expertise and infrastructure needed to maximize the value of information relevant to all biomedical research activities occurring at CHOP. This endeavor blends the disciplines of bioinformatics and clinical informatics, which themselves require excellence in and integration of various knowledge domains, including biology, medicine, statistics, mathematics, linguistics, and computer science. The aim of CMBI is to empower investigators, clinical staff, patients, and families to most effectively use the ever-expanding totality of pediatric health information. In turn, these processes are expected to result in more effective pediatric healthcare interventions. Particular foci of interest include genomic and functional genomic discovery, genome-enabled medicine, biomedical data integration and dissemination, eHealth, and clinical decision support.

Center for Cellular and Molecular Therapeutics (CCMT): The CCMT facilitates rapid translation of pre-clinical discoveries into clinical application. One of few such programs based at a pediatric institution, CCMT collaborates with other major programs to pursue new therapies for inherited and acquired disorders. CCMT also serves as an educational resource for investigators, clinicians, students, patient families, and the general public. CCMT has dedicated resources and personnel to help facilitate rapid translation. In addition, given the complicated nature and the government's stringent regulations of cell and gene therapy, the center guides and assists investigators through the regulatory approval process.

Center for Childhood Cancer Research (CCCR): The CCCR represents a highly integrated basic, translational, and clinical research environment dedicated to more targeted, more effective, and less toxic therapy for cancer in children. This goal is realized by uniting the diverse talents of investigators in CHOP's renowned multidisciplinary program in pediatric cancer research, patient care, and molecular profiling. Recruitment of leading talent in areas that can facilitate this progress, spanning the laboratory and clinical research spectrum, enable CCCR's mission. CCCR's organization supports an environment where the latest scientific findings from cutting-edge basic research can be translated into innovative clinical trials, designed to dramatically improve the cure rates for pediatric cancers while simultaneously reducing long-term side effects.

The Center for Injury Research and Prevention (CIRP): CIRP advances the safety and health of children, adolescents, and young adults through comprehensive research resulting in practical tools to reduce injury and promote recovery. The CIRP turns research into action, advancing the science and creating a tangible impact on injury research and prevention. The center addresses injuries comprehensively from prevention to after-the-injury healing; translates rigorous scientific research to usable, age-appropriate tools and practical steps for families, professionals, and policymakers; asks and answers important questions from an interdisciplinary perspective; and engages with a broad range of organizations including, universities,

government entities, nonprofits, foundations, and corporations, to ensure research results extend to the real world.

Center of Mitochondrial and Epigenomic Medicine (CMEM): The CMEM is poised to advance the understanding of, and potential treatments for, a multitude of disorders and diseases that involve mitochondria. Scientists and physicians need to understand normal energy flow, the disturbance of energy flow during disease, and communication between the mitochondria and nuclear DNA. This crosstalk is mediated by the epigenomic, inherited modifications in gene expression. CMEM is investigating mitochondrial and epigenomic dysfunction and treatment for a wide range of clinical problems such as autism, epilepsy, heart disease, diabetes and obesity, forms of blindness, Alzheimer and Parkinson disease, cancer, and aging. In addition to examining the essential roles of mitochondria, the CMEM team is exploring how mitochondrial genes influence adaptation to extremes in our environment such as arctic cold, tropical heat or high altitude.

Center for Pediatric Clinical Effectiveness (CPCE): The mission of the CPCE is to discover and disseminate knowledge about best practices in the management of pediatric disease. CPCE provides infrastructure for training in and performance of clinical effectiveness research aimed at understanding the best ways to prevent, diagnose, and treat diseases in children. It builds on the existing research expertise and infrastructure at CHOP to create an environment and opportunities for the exchange of ideas among clinical effectiveness researchers, facilitate the performance of clinical effectiveness research through a pilot grant program and assistance with projects that use existing national and local databases, and educate the next generation of clinical effectiveness investigators in the methods of clinical epidemiology.

PolicyLab: PolicyLab aims to achieve optimal child health and well being by informing program and policy changes through interdisciplinary research. It develops evidence-based solutions for the most challenging health-related issues affecting children. PolicyLab's experience caring for children and families drives its "evidence to action" approach to improving children's health. This approach requires that PolicyLab projects involve practitioners, policymakers, and families throughout the research process, from design to dissemination. By partnering with stakeholders, PolicyLab engages in research that is both responsive to community needs and relevant to policy priorities and work to identify the programs, practices, and policies that support the best outcomes for children and their families.

UNIVERSITY OF PENNSYLVANIA SCHOOL OF MEDICINE

The David Mahoney Institute of Neurological Sciences has the distinction of being the first research organization to receive NIH funding for training in the neurosciences. Established in 1953 as an interdisciplinary institute designed to continue the outstanding early work at Penn on the biophysics of the nervous system, the Institute has approximately 150 faculty from six schools within the university, and 32 different departments. The collective research interests encompass almost every aspect of the nervous system and include computational, developmental, systems, behavioral/cognitive and cellular/molecular neuroscience, as well as the neurobiology of disease.

The Department of Neuroscience at the U of P was founded in 1992 to recognize the growing importance of neuroscience as a scientific discipline. Department laboratories pursue a wide variety of research interests reflecting the entire range of modern neuroscience. The Department lies at the heart of the campus-wide Institute of Neurological Sciences, the first research organization in the country to receive NIH funding for training in the neurosciences. The mission of the Department is to study the function and dysfunction of the nervous system, and to train medical, graduate and undergraduate students so they can become leaders of a new generation of neuroscientists. The Department of Neurology at the U of P currently stands first among all US Neurology Departments in NIH extramural grant support. It accepts 7 new residents/year, selected from the very top candidates entering the field. The majority of these residents elect to pursue a career in academic neuroscience.

Penn Centers and Institutes: The University of Pennsylvania School of Medicine has a number of freestanding, interdisciplinary centers and institutes, which are listed below.

Penn Medicine Neuroscience Center: The Penn Medicine Neuroscience Center (PMNC) at the University of Pennsylvania Perelman School of Medicine and Health System was created in 2006 to integrate and strengthen Penn's interdisciplinary, world-class neuroscience programs in patient care, education, and research. The PMNC promotes collaborations among clinical specialists, basic science and clinical researchers, and the educators who train the future generations of neuroscience physicians and scientists.

The PMNC supports the practice of translational medicine in which groundbreaking research is moved from the laboratory into clinical trials and, ultimately, into clinical practice to benefit patients. In short, the PMNC represents a model for integrated clinical care, research, and education. It encourages interdisciplinary thinking and unites a diverse group of clinicians, researchers, and educators through a unifying vision, strategic thinking, program development, and shared resources.

The Center of Neurobiology and Behavior (CNB) is an interdisciplinary research program with core faculty, space and administration within the Department of Psychiatry. The primary scientific objective of the CNB is to foster interdisciplinary research and training in the basic neural and molecular mechanisms underlying complex behavior, including but not limited to psychopathologic behavior. The placement of the CNB within the Department of Psychiatry fosters a bi-directional translation of research between clinical and basic research programs. The CNB was established in 1996 in order to consolidate and to give a specific identity to existing basic science programs within Psychiatry.

The Leonard Davis Institute of Health Economics (LDI) was established at the University of Pennsylvania in 1967, two years after Congress enacted Medicare. It was created in response to growing national concern over the lack of good research and education to inform policies critical to the financing and management of the nation's increasingly costly and complex health care system. Today, LDI is considered one of the world's leading university-based programs in health services and health economics research. LDI and its Senior Fellows are among the pioneers in interdisciplinary health services research that has helped guide health policies at all levels of government and the private sector. Over 200 LDI Senior Fellows work to improve the health of the public through studies on the medical, economic, and social issues that influence how health care is organized, financed, managed, and delivered in the United States and worldwide.

The Centers for Sleep and Respiratory Neurobiology are interacting, complementary clinical and research programs. Together, these programs operate the clinical and research sleep laboratories of the Hospital of the University of Pennsylvania, and together, they are developing clinical methods and guidelines for the evaluation and treatment of sleep disorders within the Penn Health System. Studies are evaluating the neural/ventilatory mechanisms that underlie sleep apnea syndromes, and the mutifactorial causes of both hypersomnia and insomnia in the elderly. Ongoing studies are also examining the neurophysiology of arousal and fatigue in humans, and performance deficits associated with fatigue/sleep deprivation.

Cell and Developmental Biology Cell biology and developmental biology are highly interdependent fields of biomedical research, with advances in one field pushing the boundaries of the other in the pursuit to understand of the complex biological processes that underlie cellular function and embryonic development. The genome revolution, in combination with equally revolutionary developments in cellular imaging and microscopy, now provide cell and developmental biologists with extraordinary experimental tools to investigate the complexity of gene regulatory pathways that propel embryonic development and the functional activities of cellular structures and organelles that mediate cellular functions, as well as a unique opportunity to apply this knowledge to understand of the cellular basis of specific human diseases and birth defects and to develop genetic and cell therapies to treat these disease conditions. Cell and developmental biology clearly have an exciting future for discovery in the biological and medical sciences.

The Department has 21 faculty with cutting edge research programs in cellular and developmental biology. Our developmental biologists pursue questions of how developmental signals and transcription regulatory networks transform apparently uniform, newly fertilized eggs into organisms with a complexity of specialized cells, tissues and organs, organized within a functional body plan. These studies utilize a diversity of model organisms, Drosophila, Zebrafish, Xenopus, Chick and Mouse, utilizing current genetic, molecular, biochemical and microscopy approaches. Our cell biologists utilize similar approaches to pursue questions of how individual cells control and execute complex cellular functions, including cell division, intracellular trafficking of ions and molecules, cell motility and muscle contraction.

The Center for Excellence for Diversity in Health Education and Research, now in its 20th year of operation, is a unit in the Perelman School of Medicine whose purpose is to establish, facilitate, conduct and evaluate programs and projects that will enhance the health of underrepresented minorities, particularly African American and Hispanic Americans. The Center operates as an integral part of UPENN and the UPHS. In this capacity, it collaborates extensively with all units of the University that share its mission and goals. One of the Center's principal efforts is preparing minority physicians for positions of leadership in medicine with an emphasis on faculty development. The Center's activities and programs will ultimately improve the health of

minorities through promoting the growth of leaders in the biomedical sciences who are concerned and focused on these issues. The Center emphasized diversity, multiculturalism and interdisciplinary collaboration in education and research. Programs within the center include recruitment, mentoring and career development, tutoring and related activities at all levels of preparation in medicine.

The Department of Medical Ethics and Health Policy is based in the Perelman School of Medicine at the University of Pennsylvania. Under the direction of the department chair, Ezekiel Emanuel, MD, PhD, the Department stands as one of the premier institutions of research and education in medical ethics in the world. The Department's distinguished faculty produce and disseminate scholarship and conduct one of the leading bioethics master's programs in the world. In addition to their own projects, faculty members supervise research being carried out by undergraduates, graduate students, medical students, doctoral students and post-doctoral fellows. The Department serves as the hub for interdisciplinary research and collaboration on topics across four research areas in biomedical ethics: neuro- and mental healthcare ethics, health policy, behavioral economics, research ethics, global bioethics, and the ethics of healthcare allocation. Our health policy research follows three tracks: reducing low-value services; economic and health impacts of policies, such as smoking cessation and workplace wellness; and implementation sciences, with specific effort towards replicating effective programs in the healthcare delivery system.

The Orphan Disease Center was formed in 2011, and was led by H. Lee Sweeney, PhD, William Maul Measey Professor of the Department of Physiology, from 2012-2014. Since January 2015, James M. Wilson, MD, PhD, Professor of Pathology and Laboratory Medicine, serves as the current Director of the Center. The mission is to improve the quality of life for those afflicted with rare diseases with a transformative approach to the development of highly effective, innovative therapies. It emphasizes platform technologies that can be deployed with a high probability of success across a range of diseases for which there is substantial unmet need without consideration of disease prevalence. The Center will strive to assure access of these novel therapies to all affected populations.

March of Dimes Prematurity Research Center at The University of Pennsylvania In November of 2014, the March of Dimes joined with the University of Pennsylvania and other leading hospitals to launch the fourth transdisciplinary research center aimed exclusively at finding what causes preterm birth. The University of Pennsylvania research team includes over 40 faculty-level investigators, trainees, and staff and is led by its principal investigator Deborah Driscoll, M.D., and project leaders Rebecca Simmons, M.D., Michal Elovitz, M.D., and Dr. Samuel Parry, M.D. Three key research themes are being pursued via transdisciplinary interactions that will generate new research hypotheses and strategies to prevent preterm birth.

The basic premise of the March of Dimes Prematurity Research Center at the University of Pennsylvania is that the causes of preterm birth involve highly interactive biologic and environmental factors that will not be uncovered by singular studies from isolated disciplines. Rather, the guiding premise is based on a commitment to craft investigational collaborations, integrated datasets, and innovative analytic tools that will generate new insights into the complex causes of preterm birth. Our virtual transdisciplinary and transinstitutional center assembles scientists from diverse fields to share knowledge and integrate data systems to transform one another's perspectives and craft a rich analytic framework to understand what has until now remained a mystery.