

FACILITIES AND OTHER RESOURCES – THE OHIO STATE UNIVERSITY CTSI

Clinical and Translational Science Institute (CTSI)

The CTSI is a collaboration between Ohio State, The Ohio State University Wexner Medical Center and Nationwide Children's Hospital (NCH) dedicated to turning the scientific discoveries of today into life-changing disease prevention strategies and the health diagnostics and treatments of tomorrow. Funded by a multi-year Clinical and Translational Science Award (CTSA) from the National Institutes of Health, the CTSI leverages expertise from every college across the University, including scientists and clinicians from the seven Health Science Colleges, the College of Engineering, Wexner Medical Center, NCH, community health and education agencies, business partnerships, and regional institutional network partnerships. The CTSI provides financial, organizational, and educational support to biomedical researchers, as well as opportunities for community members to participate in credible and valuable research. The services described below are of special importance to Ohio. Dr. Julie Johnson, Director of the CTSI.

The Ohio State University offers a rich scientific and educational environment for this training program. The Ohio State University and Research Institute at Nationwide Children's Hospital both provide state-of-the-art resources that are accessible to all investigators. Further, each individual training faculty mentor's laboratory is fully equipped to support each K12 scholar's research.

The Ohio State University

Ohio State was founded in 1870 as the major land grant institution in the state of Ohio. During the past 152 years, the University has grown to be among the country's leading research universities. Its mission is the attainment of international distinction in education, scholarship and public service. Ohio State is the third largest university in the United States, with 3,800 regular faculty, 66,000 undergraduate and graduate students and 15 different colleges. Ohio State consistently ranks among the top 20 national public universities according to U.S. News & World Report. Designated as an RU/VH (Research 1) institution by the Carnegie Classification of Institutions of Higher Education, Ohio State's research portfolio



has shown consistent growth over the last decade. FY2021 research expenditures totaled \$1.236 billion, of which \$581 million was from federal grants. Faculty and staff participating in this proposal hold research and teaching positions from colleges across the university, including:

- College of Arts and Sciences
- College of Education and Human Ecology
- College of Engineering
- College of Food, Agricultural & Environmental Sciences
- College of Medicine
- College of Nursing
- John Glenn College of Public Affairs
- College of Public Health
- College of Pharmacy

Wexner Medical Center

The Ohio State University Wexner Medical Center is one of the largest and most diverse academic medical centers in the country, is ranked Central Ohio's "Best Hospital" by U.S. News & World Report Magazine and boasts 10 specialties ranked as among the best in the country. The University Health System Consortium has also ranked it in the top ten academic medical centers nationally in quality and accountability measurements. Wexner Medical Center is recognized for its leadership and innovation in information technology including the development of a system-wide computerized recordkeeping system that allows the paperless and confidential exchange of clinical information for which it received the 2001 Nicholas Davies Award. Wexner Medical Center expert physicians and researchers are leaders in personalized health care, giving people access to unique disease prevention and treatment options based on their own genetic makeup and lifestyle. Wexner Medical Center includes the College of Medicine, seven hospitals, a Comprehensive Cancer Center, more than 20 research centers and institutes, numerous outpatient clinics, and multiple other services, 25 core laboratories and more than 2,000 active clinical trials in virtually every medical specialty. One of the nation's top ranked top-ranked College of Medicine consists of 19 departments. The seven hospitals are University Hospital; Ross Heart Hospital; James Cancer Hospital; Harding Hospital; Brain and Spine Hospital; Dodd Rehabilitation Hospital (all on one campus); and Ohio State University Hospital East (5 miles away). Our Comprehensive Cancer Center is one of only 49 National Cancer Institute (NCI)-designated comprehensive cancer centers in the country. The research centers and institutes include Brain and Spine Tumor Center; Center for Physical Medicine and Rehabilitation; Center for Psychiatry and Behavioral Health; and the Comprehensive Spine Center. Wexner Medical Center also includes a unified physician practice, representing more than 800 pre-eminent physicians and a network of community-based primary and subspecialty care facilities that manage more than 900,000 patient visits each year.

Since the late 1980s, Wexner Medical Center has been a leader among large academic medical centers in the implementation and use of electronic health records (EHRs). Ohio State adheres to the standard Epic build, allowing for generalizability of research across a diverse set of practice environments, and offers Ohio State MyChart (a patient portal to the EHR system) and MyChart Bedside (a patient portal customized to the inpatient environment). The University Hospital System is a network of 1,720-bed hospitals with state-of-the-art clinical facilities including a 15-bed clinical research unit and tumor procurement service. The Richard Ross Heart Hospital, immediately adjacent to training facilities at the Davis Heart and Lung Research Institute, is a 290,000 sq. foot 150-bed hospital for patients with cardiovascular disease. A new 21-story hospital building dedicated to Cancer, Critical Care and Emergency Medicine opened in December of 2014. This new hospital provides expanded opportunities for clinical research.



CTSI-Specific Resources

CTSI Appalachian Translational Research Network (ATRN)

An innovative outcome of the Ohio State CTSI community engagement efforts has been the establishment of the Appalachian Translation Research Network (ATRN). The primary goal of the ATRN is to improve the health of rural Appalachia through community-engaged research. Health disparities are pronounced in Appalachia, and therapeutic delivery is often compromised by a combination of regional characteristics, e.g., largely rural population, high levels of economic distress and cautiousness by residents when relating to people or institutions from outside the region. The ATRN is a network of several university partners and more than 80 community partners in Appalachian regions of Ohio, West Virginia, Kentucky and Tennessee focused on developing community-based participatory clinical research efforts to identify and address health disparities and inequities. The network hosts a yearly conference that draws many participants, both researchers and community organizations, to discuss pressing issues that tie this region together.

CTSI Biostatistics, Epidemiology and Research Design (BERD) Core

BERD provides a centralized resource of expertise in the biostatistical, epidemiology and design aspects of clinical/translational, basic and population-based research. BERD supports translational investigators at both Ohio State and Nationwide Children's Hospital (NCH) in response to the growing need for analytical support, education, and methodological development. Such collaboration has been effective in correcting common design flaws which can invalidate conclusions, decrease efficiency and increase patient risk. Dr. Guy Brock is the Director for BERD.

CTSI Community Engagement Program

Community Engagement supports the development of researcher/participant and researcher/community partnerships. Such partnerships require familiarity with research participant perspectives, outreach and engagement best practices and available resources. Services available through the Community Engagement Program with a particular emphasis on developing trusting partnerships in Appalachia-Ohio include assistance in project planning for community-based or community-engaged projects; assistance with recruitment, data collection or other study-related activities in Appalachian-based projects; collaborative opportunities with Appalachian Translational Research Network community partners; collaborative opportunities with Appalachian Translational Research Network institutional/regional partners; and collaborative opportunities with Ohio State researchers to conduct studies in the Appalachian region. Dr. Pamela Salsberry is Director of the Community Engagement Program.

CTSI Patient Clinical Interactions (PCI)

The CTSI PCI Program is responsible for providing facilities and resources to investigators conducting human subjects' research at Ohio State and NCH. PCI connects investigators to local established clinical and translational research entities, leveraging collective resources and expertise (Ohio State College of Medicine Clinical Trials Management Organization, Ohio State Comprehensive Cancer Center Clinical Trials Office, Ohio State CTSI Clinical Research Center and NCH Clinical Research Services).

CTSI Recruitment and Retention Services (RRS)

The RRS provides consultation to research team members to help facilitate the process of recruiting and retaining study participants by sharing the best tools and tactics available in study participant recruitment and retention. Since the most successful approach to recruitment is a combination of multiple tools and strategies, RRS can help guide recruiters through the process and has a toolbox of options such as ResearchMatch, Clinical Trial Alerts, MyResearch Chart, StudySearch, HERO line and assistance for creating recruitment brochures, fliers, social media campaigns and advertisements.

CTSI REDCap Services

REDCap is a secure, web-based application for building and managing online surveys and data collection forms. REDCap's easy design environment allows investigators to create data capture forms with features like a built-in audit log and configurable user rights. It was specifically designed for research data collection, which sets it apart from other commercial survey building tools like Qualtrics or SurveyMonkey. The CTSI and BMI co-host the installation of REDCap at Ohio State and provide consultation, training and account management services.

CTSI Regulatory Knowledge and Support (RKS)

RKS provides services for drafting and review of IRB protocols, consents, and data and safety monitoring plans (DSMP), as well as a data and safety monitoring board. Specific services include:

- Consultation for developing data and safety monitoring plans, and drafting protocols, consent forms and amendments for IRB and/or grant submissions
- Safety monitoring committee development and operations
- Posting of Ohio State research studies on StudySearch
- IHIS training, access and modification requests
- Research subject advocate for clinical trials

In addition, the CTSI, in collaboration with the Ohio State Office of Responsible Research Practices (ORRP) and the eight institutions that compose the three CTSA sites in Ohio, has executed an agreement to improve efficiencies in conducting multi-center clinical research studies. In multi-center trials, IRB review will be conducted at one site and a single review will serve as the IRB approval for all participating sites. The participating institutions include Ohio State, NCH, University of Cincinnati, Cincinnati Children's Hospital Medical Center, Case Western Reserve University, University Hospital-Cleveland, MetroHealth and the Cleveland Clinic Foundation.

CTSI Trial Innovation Unit/Trial Innovation Network

The NIH-funded TIN is a national collaborative initiative aimed at improving investigator-initiated multicenter trial operations for Clinical and Translational Science Award (CTSA) consortium members across the US - including all investigators at Ohio State and NCH. The TIN provides services for all aspects of proposal development and execution, including Efficacy to Effectiveness (E2E) consultations on clinical trial design, development of robust recruitment plans and materials, serving as a Central IRB and serving as a clinical and/or data coordinating center.

Other CTSI Services

Tracking and Evaluation, Comparative Effectiveness Research, Clinical Research Center, Clinical Research Services, Research Education, Training and Career Development (including programming for K12 and T32 scholars and clinical research professionals), Translational Technologies and Core Resources, Pilot Translational and Clinical Studies, Research Voucher Program, Research Concierge and others detailed in the UM1 proposal modules.

Ohio State Resources

Ohio State Information Technology, Biostatistics and Informatics Resources

Chief Research Information Officer (CRIO) and Research Information Technology (RIT) Research Information Technology in Ohio State's College of Medicine and Wexner Medical Center, under the direction of CRIO Dr. Tim Huerta, develops and serves the informatics and information infrastructure to support research. Dr. Huerta holds appointments in Family Medicine and Bioinformatics and is a senior faculty member in CATALYST – the Center for the Advancement of Team Science, Analytics, and Systems Thinking in Health Services and Implementation Science Research. RIT is currently developing DataCore, a shared resource for

researchers across the college that will make large-scale clinical datasets available in a standardized format on an analytics platform.

DataCore

In collaboration with the CTSI, the Data Core provides investigators, trainees, and research staff at Ohio State and Nationwide Children's Hospital with access to state-of-the-art biomedical informatics expertise, technologies and data management platforms. Research IT provides leadership and counseling for researchers on projects and proposals requiring expertise in EHR data access, data use (i.e. data sharing agreements and intellectual property agreements) and data governance (i.e. HIPAA compliance, security and safety and IRB).

Office of the Chief Information Officer (OCIO)

Organized under the University's Vice President and CIO are three central groups that provide a broad portfolio of technology tools and services to faculty, staff and students: OCIO, Office of Distance Education and eLearnin and Enterprise Security. Commonly used central tools and services for research include high volume and secure data storage, cloud computing, high-bandwidth networking, and guidance on how to navigate research data contracts, policies, and compliance requirements. Ohio State formalized its relationship with Amazon Web Services (AWS) in February 2018 to offer a portfolio of scalable, on-demand computing, database, storage, and application services for the Ohio State community.

Ohio Supercomputer Center (OSC)

OSC provides a powerful high-performance computing, research and educational cyberinfrastructure for a diverse statewide/regional constituency. OSC is a member of the Ohio Department of Higher Education's Ohio Technology Consortium and has in-house research staff specializing in the fields of supercomputing, computational science, data management, biomedical applications and a host of emerging disciplines.

SCARLET

The Ohio State University CTSI, in concert with programmers in the Department of Biomedical Informatics, developed a research registry platform named the Scalable Analytics Registry for Rapid Learning and Translational Science (SCARLET). A research registry platform is a secure, web-based application that leverages REDCap and Integrated Health Information Systems (IHIS) for data capture. Research data sourced from REDCap is merged with clinical data sourced from IHIS. The registry pipeline software takes specific data points from the REDCap database and extracts IHIS data from the Information Warehouse; it then integrates this data into a standard Observational Medical Outcomes Partnership (OMOP), or in other words, the registry. The front end of that data conduit involves a query portal that could be used and further developed to provide database search queries. Research IT will extend SCARLET to "SCARLET for All" by bringing this technology to all eligible research studies by June 2020 at no cost to the researcher. Studies are eligible if their IRB and consent documents allow for full access to the medical record. Starting in July, we will begin working with the IRB to identify active studies, reach out to the Principal Investigators and engage them to determine whether access is appropriate. This will reduce efforts related to securing research data for studies and facilitate statistical analysis.

Biomedical Informatics Department (BMI)

BMI is located in a purpose-built facility comprising over 40,000 sq. ft. on the second and third floors of Lincoln Tower. Of note, BMI is located near the Wexner Medical Center, the Colleges of Pharmacy, Public Health and Engineering, as well as campus wide scholarly resources, thereby creating networking opportunities and facilitating meetings and collaborations. BMI incorporates a suite of consultative services, including EHR content development for research purposes, research data warehousing and registries, electronic data capture/management, bioinformatics, biostatistics and software engineering. Importantly, BMI strongly supports training in the responsible conduct of research and facilitates/encourages access to the online CITI training modules, attendance to the department's seminar courses and faculty-led research-in-

progress sessions, and research ethics support through the Ohio State CTSI Design, Biostatistics and Research Ethics Support and Training Core and the Ohio State Center for Ethics and Human Values. Computing resources are described under Equipment. Dr. Lang Li is Chair and Dr. Soledad Fernandez is Vice Chair of the Department.

Translational Data Analytics Institute (TDAI)

TDAI is a foundational component of Ohio State's Discovery Themes Initiative. Membership in TDAI provides an exceptional environment for cross-college interdisciplinary and external collaboration. Our Affiliated Faculty are part of an active community of scientists representing 14 colleges and more than 40 disciplines who work on developing programs, resources and collaborative projects that span the traditional academic disciplines. Within this infrastructure, interdisciplinary teams of faculty work collaboratively, for example, to 1) conduct research with translational value, 2) identify and pursue funding and publishing opportunities that advance the community's research agenda and 3) forge partnerships with industry and community organizations working in relevant spaces. Dr. Tanya Berger-Wolf is Faculty Director of TDAI.

Through TDAI, affiliated faculty are connected to a vast network of existing and developing shared resources including datasets and databases, and robust opportunities to test new technologies and platforms through external partnerships. Examples include data from SmartColumbus, computational and educational support from the Ohio Supercomputer Center, Wi-Fi data from Aruba Networks and more. TDAI supports a virtual Data Commons connecting users for sharing data sets, knowledge and software; shared services to accelerate tech transfer, health- and business-related analyses and development of a secure interoperable analytical pipeline; and maximization of a cloud-based environment to integrate, develop and incorporate workflow specifications compliant with the FAIR process. In addition, TDAI has worked with nearly a dozen partners across campus to map, coordinate, and make accessible special events, workshops and seminars related to data literacy and data analytics; these include data analytics for beginners, data visualization tools, working with big data in Amazon Web Services and more.

Center for Biostatistics

The Center for Biostatistics at The Ohio State University was instituted in 2001 with the mission to provide a single, readily identifiable, and responsive source of expertise with whom biomedical investigators both within and outside Ohio State can collaborate in all aspects of study design, data management, and statistical analysis of clinical, epidemiological, public health, and laboratory research data. The Center provides statistical support to biomedical investigators at The Ohio State University Wexner Medical Center, the Comprehensive Cancer Center, the Clinical and Translational Science Institute, the health sciences colleges and other investigators throughout and outside the university. It is comprised of a diverse group of biostatisticians and programmers, as well as affiliated bioinformaticians and support staff from the Department of Biomedical informatics. The Center is currently led by Dr. Soledad Fernandez, Director, and Dr. Guy Brock, Associate Director. Both have over 15 years of continual NIH funding and experience collaborating with investigators in the biomedical sciences and have taken leadership roles in biostatistics oversight of multiple large program project and center awards. This includes leading the Biostatistics, Epidemiology, and Research Design Core of the CTSI (led by Dr. Guy Brock) and Comprehensive Cancer Center Biostatistics Shared Resource (BSR) (led by Dr. Soledad Fernandez). The Center also runs the Biostatistics Resources at Nationwide Children's Hospital (BRANCH), with Dr. Guy Brock as the Director.

Secondary Data Core

The SDC is a shared resource for Ohio State researchers that stores and synthesizes large-scale clinical datasets on an easy-to-use analytic platform to facilitate outcomes research. The SDC aims to reduce the costs associated with data licensing, the time and effort associated with data acquisition, and both the effort and risk of error involved in processing and preparing data for analysis. The SDC streamlines research on

secondary datasets to allow researchers to focus on discovery. The SDC houses large-scale clinical datasets including but not limited to:

- Truven MarketScan
- The Healthcare Cost and Utilization Project (HCUP)
- The Centers for Medicare and Medicaid Services (CMS) Claims

The SDC's principal contribution is its shared data model. Using ontology matching, the SDC uses common data elements across datasets to facilitate cross-dataset discovery. This allows researchers to ask their analytic question of many datasets via a single operation rather than having to obtain and prepare each dataset they wish to analyze. The SDC also streamlines reassessing and extending prior findings as new data become available, not only to advance science but providing useful information on trends to health behavior and promotion efforts, public policy and health services organizations.

Ohio State Team Science and Commercialization Resources

Center for the Advancement of Team Science, Analytics and Systems Thinking in Health Services and Implementation Science Research (CATALYST)

CATALYST is a center within The Ohio State University College of Medicine focused on advancing research and discovery at Ohio State in the delivery of health services across the continuum of care using a team science approach. As an innovative and independent center within the College of Medicine, CATALYST is a well-recognized hub for health services and implementation science research efforts within the college. CATALYST supports transformational research in the areas of patient portals, patient engagement, data integration and analysis, infant and maternal mortality, patient safety and quality improvement, and management practices in health care. Dr. Ann McAlearney directs CATALYST and Dr. Timothy Huerta is a core faculty.

Ohio State Enterprise for Research, Innovation and Knowledge (ERIK)

The Enterprise for Research, Innovation and Knowledge positions Ohio State to expand curiosity-driven research and creative expression activities, further develop our research community, including students, faculty and staff to be leaders both today and in the future and grow the innovation ecosystem to address societal challenges. It is comprised of the Office of Research, the Office of Innovation and Economic Development, and the Office of Knowledge Enterprise. The office supports team science workshops, leads efforts such as the Growing Research Opportunities (GRO) program to support team development and early research and provides support to enable grant submissions. The Office of Research is responsible for human subjects, animal research, compliance and other regulatory components for the University. ERIK supports commercialization opportunities and partnerships and houses the Technology Commercialization Office.

Technology Commercialization Office (TCO)

The Technology Commercialization Office (TCO) at Ohio State University is dedicated to supporting academic and clinical researchers, inventors, colleges and centers by advancing their discoveries and innovations to market and dissemination to the community. The TCO at Ohio State provides a great platform to manage and foster the dissemination of innovative solutions and technologies. TCO has strong relations with the corporate sector, venture capitalists, industries under different focus areas, other funding agencies to connect investigators to them. TCO also grants accelerator awards to advance and further develop promising technologies, bringing them closer to the market. TCO has helped create more than 45 startups, 59 portfolio companies and raised more than 65 million to support new innovations. They have a streamlined process known as commercialization pathways under the Cycle of Innovation, which provides a platform for filing and publication of inventions. The TCO team has experts in different IP management areas including Licensing Analyst, Licensing Compliance Officer, Corporate Relations, Contracts Manager, Contracts Associate, Commercialization Strategy Officer and Director of Licensing - Life Sciences.

Keenan Center for Entrepreneurship

The Tim and Kathleen Keenan Center for Entrepreneurship works to grow and foster a culture of entrepreneurship for the Ohio State community through the creation and support of new ventures and the education and encouragement of their founders. The Keenan Center provides a campus-wide hub for collaboration and engagement with early-stage capital, startup talent and robust programming resources to maximize opportunities for social and economic impact.

Ohio State Clinical Trials Programs and Research Support

Two clinical trials organizations at Ohio State are closely aligned with the CTSI: 1) the Center for Clinical Research Management, comprised of the Clinical Trials Management Office (CTMO), the Clinical Research Center (CRC) and laboratory and nutrition analytical services; and the Clinical Trials Office of the Ohio State Comprehensive Cancer Center (OSUCCC – James).

Clinical Trials Management Office (CTMO)

The CTMO provides a central resource for comprehensive management of clinical trials, including protocol implementation and coordination, data and regulatory management, negotiation of clinical trial agreements, development of clinical trial budgets, internal auditing and clinical trial education. In addition to working directly with investigators with the goal of conducting methodologically sound clinical trials, the CTMO also aims to conduct cost-effective and expedient trials. The CTMO is led by Drs Brad Rovin and Deanna Golden-Kreutz. A summary of the resources provided by the CTMO include:

- protocol development;
- regulatory administration and management;
- trial activation and coordination;
- financial and contract management;
- data management; and
- protocol tracking and monitoring.

Clinical Trials Office (CTO)

The Clinical Trials Office (CTO) provides a centralized resource to facilitate the development, implementation, and management of clinical trials at The Ohio State University Comprehensive Cancer Center. Under the direction of Dr. William Carson, the CTO staff works closely with the principal investigator of each clinical trial to ensure compliance to protocol-specific procedures. The CTO provides the following services:

- Complete protocol management, including screening, monitoring treatment administration, assessing toxicities and managing and reporting adverse reactions for patients on oncology clinical trials
- Data management
- Initial and ongoing preparation of regulatory documents for submission to the Institutional Review Board (IRB) and other appropriate agencies
- Clinical trial budget preparation and contract negotiations
- Clinical Trials Management Software

Grants Management Office (GMO)

The Grants Management Office (GMO) at The Ohio State University Wexner Medical Center consists of the College of Medicine GMO and Ohio State Comprehensive Cancer Center GMO.

- College of Medicine GMO
 - a. The College of Medicine GMO works to support all non-OSUCCC - James areas in the College of Medicine and College of Pharmacy and assists with all non-OSUCCC - James new faculty grant transfers and post award financial assistance.
- OSUCCC - James GMO
 - a. The OSUCCC GMO manages grant activities focused on cancer. Their role is to assist a faculty member with submitting a grant (budget development, document creation, etc.). Upon award

of a grant the OSUCCC - James GMO will assist with personnel appointment, budget management, and creating progress reports. Furthermore, assistance for project close-out is offered upon completion of the grant.

Office of Responsible Research Practices (ORRP) and Institutional Review Board (IRB)

The primary responsibility of ORRP is to protect the rights and welfare of human research subjects in accordance with federal regulations. Three internal IRBs review, approve, and conduct periodic reviews of research involving human subjects (including data and biological materials obtained from human subjects). Ohio State has full AAHRPP accreditation from the Association for the Accreditation of Human Research Protection Programs. The Office of Research Risks and Protections (described below) helps Ohio State faculty, staff and student researchers navigate research requirements through education and quality improvement initiatives designed to facilitate research, improve efficiencies and ensure regulatory compliance. The Ohio State Institutional Review Board (IRB) will serve as the IRB of record for participating clinical sites. The Ohio State IRB has served as a Central IRB for a number of Ohio State investigator-initiated multi-centered trials and will leverage its experience in the facilitation of quality and efficient regulatory oversight. As a member of the SMART IRB, we will secure IRB authorization agreements with all sites using the SMART IRB platform. As the IRB of record, Ohio State IRB will be responsible for conducting the review of the study protocol in accordance to 21 CFR Parts 50, 56, 312 and 812, 45 CFR 46 and applicable international and local regulations and laws with respect to the initial review, continuing reviews and any potential modifications to the protocol. Ohio State IRB will review reported adverse events, unanticipated problems involving risks to subjects, and any incident of serious noncompliance in accordance to the IRB's defined policies and procedures. All research –related documents will require Ohio State IRB review and approval prior to use. The Ohio State IRB will operate in a transparent manner, readily providing IRB meeting minutes to sites per requests and investigators and sites will be notified in writing of all IRB decisions.

Office of Sponsored Programs (OSP)

OSP provides the highest quality research administration at all stages of sponsored projects, by promoting electronic research administration, responsible stewardship of funds and sound management practices. In accomplishing its mission OSP:

- Streamlines administrative processes and minimizes the administrative burden for investigators conducting sponsored programs, by providing easily accessible and intuitive administrative information systems.
- Creates and consistently implements well-documented procedures that facilitate the conduct of sponsored activities, while ensuring compliance with sponsor and university requirements.
- Ensures seamless research administration from proposal development through timely award closeout.
- Provides effective stewardship of sponsor funds and promotes positive sponsor interactions.
- Partners with other university entities to develop a shared agreement on practices and procedures.
- Creates valid metrics that measure performance and progress toward goals.

Research Commons

The Research Commons at Ohio State Libraries leverages campus partnerships to provide support services at each stage of the research lifecycle. It enhances the libraries' mission by providing a hub for collaborative, interdisciplinary research that is both expertise- and technology-enabled. The Research Commons provides a suite of services and a space through which researchers can explore collaborative, interdisciplinary and emerging research methods and connect with experts for support at any stage of the research process. Focus areas of support for researchers are listed below.

- **Data Management Assistance from the Research Commons Staff:** Writing data management plans for grant proposals; best practices in data organization; data sharing and preservation guidance; evaluating data for re-use; and ethics, policies and federal requirements.

- **Data Visualization:** Charts, graphs, timelines, tables and box-and-whisker-plots are just some of the more recognizable ways to visualize data. Through the Research Commons, students, faculty and staff can obtain assistance with determining the best format to present data based on research question, data type, audience and medium; creating static, dynamic and interactive visualizations and infographics; identifying appropriate data visualization software; training for a variety of data visualization tools including free and open source options, Ohio State-licensed resources, and other specialized software, such as Adobe Illustrator, Adobe Photoshop, Adobe InDesign, Tableau, Gephi and Cytoscape.
- **Geographic Information Systems (GIS):** The Research Commons aids with finding and creating geospatial data sets; cleaning, organizing and managing geospatial data; designing and carrying out spatial analyses; mapping and geo-visualization; identifying appropriate GIS methods, tools and software; training for a variety of GIS tools and web-based mapping platforms.
- **Digital humanities (DH):** With expertise in a variety of methods and tools, the Research Commons team assists DH researchers with refining project scope; accessing digital content; writing grant proposals; finding collaborators; project management; content and data management; determining the best methods and platforms/tools for a project; and exploring options for hosting, data sharing and curation.

Selected Ohio State Clinical and Translational Science / Clinical and Translational Research-Related Centers, and Institutes and Cores

Center for HOPES

Center for Health Outcomes and Policy Evaluation (Center for HOPES), established in 1994, conducts applied research and evaluation to improve health and health care. Our clients include health care organizations, government agencies, community groups and private-sector entities. Located at Ohio State's College of Public Health, the Center strives to use the academic capabilities and experience of our faculty and research staff to conduct applied research and evaluation studies that will be of value to decision-makers. Studies are in the areas of health services research, outcomes measurement, health economics, survey research, healthcare improvement, program evaluation, comparative effectiveness research and health policy analysis. All our studies are performed in close collaboration with our clients, which include government agencies, health care systems, foundations, private sector industries, community health organizations, along with other public and private entities.

Center for Human Resource Research (CHRR)

CHRR was founded in 1965 to manage the National Longitudinal Surveys of Labor Market Experience (NLS) for the U.S. Department of Labor, a project that continues to this day. CHRR is a multidisciplinary research organization affiliated with the Division of Social and Behavioral Sciences in the College of Arts and Sciences at Ohio State. CHRR is responsible for designing survey instruments, overseeing fieldwork and generating and disseminating fully documented data sets to researchers in government, private research organizations and universities around the world. These interests range from the production of substantive analyses of economic, social and psychological aspects of individual labor market behavior to examining the impact of government programs and policies. CHRR's strengths are in the areas of survey design, analysis and data documentation and dissemination. The CHRR system has the best record for the timely production and distribution of public use files from computer-assisted personal interviewing (CAPI) surveys. In addition to conducting a diverse number of surveys, CHRR staff members continue to contribute innovative applications of ideas and technology to the field of survey methodology.

Center for Public Health Practice (CPHP)

CPHP, directed by Dr. Andrew Wapner, integrates the work of practitioners and academicians to improve the health of people and the well-being of communities. Programs and services are designed to increase the skills of public health practitioners and to build the capacity of organizations across Ohio. Included among its areas

of expertise are workforce and organizational development, adult learning, group facilitation and process design, project management, and practice-based research. The work of the CPHP is funded through grants and fee-for-service initiatives, including the federally funded Ohio Public Health Training Center, one of 37 public health training centers located across the U.S. funded through the Health Resources and Services Administration.

Center for Urban Regional Analysis (CURA)

Founded in 2001, CURA serves as a bridge across academia, industry and the policy sector by providing spatial analysis of economic, social, environmental, and health issues in urban and regional settings in Ohio and beyond. As a hub for data-driven urban science on campus, CURA is an interdisciplinary group of scholars in social, natural and environmental sciences; applied economics; agriculture; engineering; health and medical professions; and the humanities. CURA offers a wide range of support services for research that applies to urban and metropolitan areas, rural areas, and broader regional issues. Services include mapping, data hosting, research data design, geocoding of locations, web app creation, GIS data processing, spatial analysis and cartographic services.

Comparative and Translational Medicine Program (CTMP)

The CTMP provides an integrated platform for preclinical and translational research and training for studies involving animals with natural disease. It is comprised of three major components:

- Blue Buffalo Veterinary Clinical Trials Office
 - The Blue Buffalo Veterinary Clinical Trials Office (BBVCTO) provides assistance in the design, execution and evaluation of veterinary clinical trials of client-owned animals. The BBVCTO facilitates the conduct of such studies through input into clinical trial design, networking with regional veterinarians to ensure timely enrollment, assistance in collection and coordination of data and establishment of standard operating procedures.
- Veterinary Biospecimen Repository
 - The Veterinary Biospecimen Repository (VBR) collects and stores tissue specimens from diseased animals and data warehouse on disease diagnosis, pathology, treatments and other clinical outcomes. The VBR represents a remarkable resource that continues to assist investigators as they strive to develop new prevention and treatment strategies for both animals and humans.
- Comparative Pathology and Mouse Phenotyping
 - The Comparative Pathology and Mouse Phenotyping Shared Resource and the Histology and Immunohistochemistry service have merged into a single unit within the Department of Veterinary Biosciences (VBS). While intrinsically involved with the teaching and education missions of VBS, the combined service now offers anatomic pathology (necropsy, phenotyping, biopsy and slide evaluation), clinical pathology and histology (including immunohistochemistry and tissue microarrays) support to researchers both within the College of Veterinary Medicine as well as throughout The Ohio State University, including Nationwide Children's Hospital

Dorothy M. Davis Heart and Lung Research Institute (DHLRI)

The Dorothy M. Davis Heart and Lung Research Institute (DHLRI) was born from the multidisciplinary, problematic study of heart and lung disease at The Ohio State University in the late 1990s. In 2000, DHLRI opened its new home in one of the most advanced interdisciplinary facilities on the Ohio State campus. Today, the seven floor, 100,000 sq. ft. Institute offers research space for up to 50 principal investigators and their teams. Numerous Core Laboratories within the DHLRI offer state-of-the-art as well as innovative developing technologies to support all aspects of basic and clinical research. The clinical care provided nearby at the University Hospital, The Ross Heart Hospital, The James Cancer Hospital and other offices, clinics and hospitals of the Wexner Medical Center offers first-hand perspectives on how research affects the prevention,

detection, and treatment of heart and lung disease. Their mission is to develop, through research, strategies to cure patients affected with heart and lung disease and to prevent these diseases from developing in individuals at risk. The DHLRI also inspires to: bring together the world's best scientific minds in an open environment that fosters and enhances innovative, creative inquiry; encourage the intermingling of basic and clinical scientists from diverse specialties; create research projects that look at heart and lung health issues not just from one or two sides, but from all viewpoints; focus on outcomes that advance patient care, knowledge and the ability to create new knowledge. Core facilities include the following:

- Small Animal Imaging
- Comprehensive Lab Animal Monitoring System (CLAMS) enabling integrated metabolic studies
- Interventional Cardiology and Catheterization for large animal studies

Foods for Health (FFH)

The goal of the Foods for Health initiative is to advance interdisciplinary research that defines the relationship among foods, disease prevention and health promotion. The future of food is one where nutritional recommendations are precise and eating healthy is easier. Solutions that help us achieve this goal will come from all disciplines, and Ohio State continues to be optimally positioned for innovative research. Our community is empowered by an expansive campus that uniquely co-locates Colleges of Food, Agricultural and Environmental Sciences, Education and Human Ecology, Arts and Sciences, seven Health Sciences colleges, a top-ranked academic Medical Center and a Comprehensive Cancer Center. FFH researchers work collaboratively to discover new ways in which foods can enhance health.

Institute for Behavioral Medicine Research

Established in 1996, the Institute for Behavioral Medicine Research (IBMR) is the cornerstone of a broad research program at The Ohio State University in the field of psychoneuroimmunology (PNI) – the study of how the brain interacts with the body's immune system. This field has evolved from a novel area of curiosity to an important scientific field, one that has meaningful implications for public health and great promise for enhancing medical treatments.

Institute for Materials Research

IMR was established in 2006 with a central goal: to guide Ohio State's materials-allied research enterprise to be among the very best in the nation, impacting the forefront of materials research, winning the most competitive and prestigious research programs and centers and enabling the attraction of top talent in areas that exploit the multi-college breadth of the university. IMR brings together a large, diverse, interdisciplinary community consisting of more than 265 faculty members from 40 departments and 10 colleges who are actively engaged in research and innovation across the materials continuum. It has supported efforts for receiving large awards from NSF and other Federal sources and has led research and educational partnerships with industry partners. This includes biomedical research applications.

Institute for Population Research (IPR)

IPR was established in 2000 as a multi-disciplinary research center that nurtures population and health research at Ohio State. IPR supports research in all facets of population and health. IPR faculty and graduate student affiliates span six colleges and sixteen departments, and IPR serves as a bridge between behavioral and biomedical scientists at Ohio State. Through its Geographic Core, IPR offers advice on incorporating geographic analysis in population and health research projects. Working groups are an opportunity for a small set of IPR affiliates to explore research areas that are of great significance and/or newly emerging. Recent working groups have been organized for health disparities, geographic analysis of health and complex systems analysis. IPR occupies a 6000 sq ft suite of offices in Ohio State's Townshend Hall, comprising several faculty affiliate offices, a dedicated seminar room, graduate student suite and space for hosting research projects including those requiring special consideration for restricted or sensitive data. Dr. Pamela Salsberry is Associate Director of IPR.

Kirwan Institute for the Study of Race and Ethnicity

The Kirwan Institute for the Study of Race and Ethnicity is an interdisciplinary engaged research institute established in May 2003 that supports racially equitable policy and capacity building through its Opportunity Communities Model. This research model brings an intersectional analysis to focus areas such as housing, education, jobs, transportation, health and criminal justice. The Institute's framework for engagement and capacity building around these sources of inequity include Policy, Law and Civil Rights Research; Opportunity Mapping; and Communications, Field Building and Engagement.

Ohio State Animal Resources

Ohio State's animal use program is accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care (AAALAC) International and is registered as a research facility under the Animal Welfare Act (AWA) USDA. Also, there is an assurance on file with the NIH Office of Laboratory Animal Welfare (OLAW). The Ohio State University's large, consolidated animal care program supports an extensive and comprehensive research program including the Colleges of Medicine, Public Health, Veterinary Medicine, Dentistry, Pharmacy, Biological Sciences and Social and Behavioral Sciences. The university's centralized animal vivarium consist of over 14 buildings located primarily within the Health Sciences complex. Approximately 70,000 sq ft of animal housing space consists primarily of rodent barrier housing utilizing individually ventilated caging systems. In addition, facilities for accommodating large animals, rabbits and nonhuman primates are available. Support facilities include an experimental surgery suite, small animal imaging core, and biohazard housing at the ABSL2 and ABSL3 levels. These facilities will be expanded in 2023 with the opening of the Interdisciplinary Research Facility (IRF) on the animal vivarium West Campus Innovation District. Facilities include mouse procedure rooms, necropsy facilities, and facilities for immunocompromised animals for a variety of studies across the translational research continuum.

Ohio State Biochemistry and Molecular Biology Core

The Biochemistry and Molecular Biology Core provides and maintains selected instrumentation and provides sufficient training to facilitate end-user operation. Major pieces of supported equipment include real-time PCR: Roche Lightcycler 480 and Lightcycler 1.2 (Roche light cyclers), Surface plasmon resonance biosensor (Biacore 3000), Phosphorimager (Molecular Dynamics/Amersham), PTC-225 PCR Tetrad (MJ Research), Alphamager (Alpha Innotech), Typhoon Imaging (General Electric) and Wallac MicroBeta TriLux.

Ohio State Bioinformatics Center

The Biomedical Informatics Shared Resource (BISR) supports advanced biological and biomedical research conducted by Ohio State researchers by facilitating high-throughput, novel experiments that link multidimensional phenotypic and biomolecular data sets. BISR utilizes and coordinates data-intensive computational methods for all high throughput data analysis, as well as pathway and network analysis. BISR also assists researchers with accessing publicly available data to generate new hypotheses and draw new conclusions via integrative analysis of both public and private data sources. BISR fosters collaborations with Ohio State researchers; customizes analysis workflows to meet the unique needs of their projects, interprets and presents results, works on manuscript preparation and design and planning of grant applications. Specific applications include the following:

- Analysis of next generation sequencing data including whole exome-sequencing, RNA-sequencing, smRNA-sequencing, ChIP-sequencing, ATAC-sequencing and whole genome re-sequencing.
- Analysis of long read sequencing (such as PacBio and Oxford Nanopore Sequencing) including QC and error correction of long reads, gene/gene isoform expression, novel gene discovery and full-length isoform identification, de novo fusion gene detection and corresponding fusion isoform expression profiles, allele-specific expression and haplotyping, de novo genome assembly, de

novo transcriptome assembly, methylation calling, nucleosome positioning and chromatin accessibility.

- Single-cell RNA-seq data analysis services:
 - Basic scRNA-seq data analyses, including quality control, alignment, trimming, assembly, differentiation expression and clustering, using developed pipelines
 - Advanced scRNA-seq data analyses, including but not limited to cell trajectory discovery, cell type prediction, co-regulated gene module identification
 - Selective scRNA-seq analyses in aim to solving specific issues such as drop-out issue, immense expression data (i.e., 10X scRNA-seq data)
 - Result interpretation and interpretation
 - An all-in-one user-friendly web server for scRNA-seq analysis
 - Integrative analysis of single-cell multi-omics data to enhance the effectiveness and efficiency
- Metagenomic data analysis services:
 - Metagenomic data analysis including species/strain composition profiling, taxonomic analysis, abundance analysis, phylogenetic analysis, whole-genome shotgun analysis
 - Metatranscriptomic data analysis including functional profiling, expression activity analysis, 16S ribosomal RNA analysis, whole-transcriptome shotgun analysis
 - Advanced joint metagenomic and metatranscriptomics data analysis for more accurate gene-level, species-level, and strain-level analysis
 - Network studies in microbiome and host-microbiota interactions based on high-throughput multi-omics data
 - Causality study between human microbiota and diseases
 - Existing tools/pipelines recommendation, analyst training and guidance
- Analysis of microarray datasets, including mRNA (Affymetrix), SNP and micro-RNA.
- Analysis of nCounter NanoString data.
- Proteomics data analysis:
 - Protein/peptide identification and quantification from label-free and label-based tandem mass spectrometry data
 - Post-translational modification analysis (PTM), such as phosphorylation
 - Downstream bioinformatics analysis, such as: differential expression analysis, pathway analysis and functional enrichment, analysis, network analysis, involving finding pivotal proteins in the networks
- Metabolomics data analysis:
 - LC-MS data preprocessing (including quality control assessment of raw chromatograms, peak calling, retention time alignment and preliminary identification using MS2 data if available)
 - Interpretation of liquid-chromatography untargeted metabolomics datasets, which include relative abundances of a broad spectrum of polar and non-polar small molecules (< 1500 Daltons)
 - Statistical analysis to identify biologically-relevant metabolites
 - Pathway enrichment analysis of relevant metabolites
- Integrative analysis of publicly available datasets (dbGaP, GEO, TCGA) using search parameters defined by the OSUCCC - James researchers.
- Pathway analysis of results from sequencing and microarray data.
- Custom bio-molecular data management, application development, deployment and support.
- CRISPR Screening:
 - Experimental Design
 - Cancer-specific essential genes
 - Synthetic lethal partners

- Drug resistance mechanism
- Precision cancer medicine services:
 - Integrating gene expression profiles, mutations and phenotype features to predict target, drug and biomarker in precision cancer medicine
 - Identification of potential druggable targets
 - Assessment of efficacy drugs and associated biomarkers

Ohio State Campus Microscopy and Imaging Facility (CMIF)

The Campus Microscopy and Imaging Facility (CMIF) in the Biomedical Research Tower serves University faculty, staff and students as well as researchers outside Ohio State. It offers a full range of microscopes, and support instrumentation allows cell and tissue preparation with immunocytochemistry, in situ hybridization, freeze-fracture, cryo-ultramicrotomy, scanning and transmission electron microscopy. This includes technology and microscopes for common biological applications including Live Cell Confocal imaging, Multiphoton Imaging, Confocal Microscopy, Light Microscopy, Super-resolution microscopy, Electron Microscopy including scanning and Transmission Electron Microscopy (SEM and TEM); as well as cryostat services for sample preparation located in the Biomedical Research Tower.

Ohio State Campus Chemistry Instrumentation Core (CCIC)

The Campus Chemical Instrument Center (CCIC) was founded in 1981 as a unit of the Office of Research. The mission of the CCIC is to provide state-of-the-art research facilities for the entire campus in three areas: Nuclear Magnetic Resonance (NMR), Mass Spectrometry (MS) and Proteomics. Since the NMR, MS and Proteomics Facilities are central hubs for the Ohio NMR and Ohio MS Consortiums, respectively, all researchers in the colleges and universities of the State of Ohio have access to all facilities of the CCIC with the same user fees. The Ohio State Office of Research provides personnel support of the CCIC. Equipment funding has been provided by Ohio Board of Regents, National Institutes of Health, National Science Foundation and Office of Research.

- National Gateway Ultrahigh Field NMR Center
 - A cutting-edge ultrahigh field 1.2 GHz nuclear magnetic resonance (NMR) spectrometer has been funded by the National Science Foundation (NSF), which will be the centerpiece of the new National Gateway Ultrahigh Field NMR Center. Once commissioned, this next generation NMR instrument will be open to U.S. NMR researchers in the fields of biomolecular NMR of proteins and nucleic acids in solution and in the solid state, materials science, and metabolomics.
- Ohio State Proteomics Shared Resource
 - The Proteomics Shared Resource (PSR) provides researchers access to advanced mass spectrometry instrumentation and analysis for protein identification, characterization and quantification. Using a variety of analytical platforms, researchers are able to discover novel differentially expressed proteins in serum, urine, BAL fluid, saliva, frozen tissues, formalin-fixed tissues and cell lysates. The PSR is part of the Campus Chemical Instrument Center managed by the Ohio State Office of Research. PSR is an interdisciplinary unit that provides researchers with technical expertise and state-of-the-art instrumentation needed to identify proteins, protein modifications, protein interactions and protein biomarkers as well as protein quantitation studies. The PSR can identify proteins from solution, 1D and 2D gels using electrophoresis and imaging equipment, robotic sample handlers and (tandem) mass spectrometers. PSR provides: a high-quality, affordable service for identifying proteins, protein modifications, protein interactions and protein biomarkers as well as protein quantitation studies; consultative services and technical assistance in experimental design and implementation in protein sample preparation, separation and purification, as well as in image analysis, mass

spectrometry and data mining; education and training for basic and clinical investigators in proteomics analysis applications and capabilities; advanced methods of sample pre-fractionation prior to mass spectrometric analysis and protein identification; analysis of complex mixtures of proteins by 2D-HPLC and tandem mass spectrometry, especially for evaluating protein and chemical biomarkers for cancer and therapeutic regimen

Ohio State Center for Design and Manufacturing Excellence (CDME) and the Medical Modeling, Materials and Manufacturing (M4) Lab

The M4 Lab brings together an interdisciplinary team of experts under one roof in a user facility on The Ohio State University's West Campus. The group includes representatives from the College of Medicine's Department of Otolaryngology, the College of Engineering's Center for Design and Manufacturing Excellence (CDME), and the Institute for Materials Research (IMR).

Ohio State Center for Ethics and Human Values

The Center for Ethics and Human Values is Ohio State's hub for respectful discussion and interdisciplinary engagement on the ethical challenges that shape the University and the broader community—an essential part of "Education for Citizenship." A faculty-led, University-level center, we have collaborated with more than forty academic departments and programs in a dozen Ohio State colleges, covering a wide range of scientific and humanistic disciplines. We have also worked closely with university efforts including the Shared Values Initiative, the Provost's Civil Discourse Project, the Office of Diversity and Inclusion and the Office of Research.

Ohio State Center for Healthy Aging, Self-Management and Complex Care

The Center for Healthy Aging, Self-Management and Complex Care in the College of Nursing brings together a community of internationally renowned nurse scientists, scholars, clinicians and educators dedicated to advancing our knowledge and response to the issues of complex care, self-management and health promotion among vulnerable and aging populations. The team comes together to cultivate innovations that effect care delivery spanning all settings and adult ages.

Ohio State Center for Knowledge Management

Ohio State's Center for Knowledge Management (CKM), housed in the John A. Prior Health Sciences Library, is one of the nation's most comprehensive repositories of global biomedical knowledge and intellectual capital. The CKM provides cost-effective access to biomedical knowledge, identifies and makes available knowledge and key research findings, expedites packaging of information content as reusable and sharable resources, facilitates understanding and helps incorporate information resources into work processes. The Center for Knowledge Management supports The Ohio State University Medical Center in its three-part mission of research, education and patient care through advances in the acquisition, organization, storage and distribution of biomedical and other health science-related information.

Ohio State Center for Microbial Interface Biology

This Board of Trustees-approved, campus-wide Center for Microbial Interface Biology continues to grow, stature and impact because of the significant contributions of its members. It is housed in the Office of Health Sciences and its hub is on the 10th floor of the Biomedical Research Tower (BRT). The Center for Microbial Interface Biology continues to address the growing crisis in the US and worldwide related to death and suffering from a variety of infections and their complications.

Ohio State Center of Microbiome Science (CoMS)

CoMS is a highly interdisciplinary network of investigators at Ohio State University and Nationwide Children's Hospital representing over 84 faculty from nine different colleges. The three focus areas of CoMS are: Community, Compute and Curriculum. This includes building community within and between investigators in microbiome science, enabling investigators to perform microbiome studies by building out molecular and

bioinformatic tools on campus, and providing trainee education and opportunities to gain high-tech digital skills in computational microbiology and bioinformatics.

Ohio State Center for RNA Biology

RNA research is an interdisciplinary endeavor that spans biology, medicine, agriculture, mathematics, physics, and chemistry. Ohio State's Center for RNA Biology houses the single largest group of RNA experts in the country – more than 200 faculty, staff, students and postdocs. The center's mission is to advance life sciences research and education at the university by building on existing strengths in RNA biology, developing synergies through interdisciplinary initiatives and outreach, attracting and retaining outstanding faculty, and bringing the best graduate and postdoctoral researchers to the university. To encourage new ideas and collaborations between members, the Center for RNA Biology supports the development of new research teams through the cooperative Center for RNA Biology Seed Grant Program. The Center for RNA Biology is focused on developing the next generation of scientists through Education and Outreach. To do this the Center for RNA Biology facilitates a monthly seminar series in which it hosts world-renowned speakers from around the country to talk about their scope of work in the RNA field.

The Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC – James)

OSUCCC – James is the only cancer program in the United States that features a National Cancer Institute (NCI)-designated comprehensive cancer center aligned with a nationally ranked academic medical center and a freestanding cancer hospital on the campus of one of the nation's largest public universities and is one of only 51 NCI-designated comprehensive cancer centers in the nation, a designation that has been maintained through competitive renewal since 1976. At the most recent renewal, OSUCCC – James earned the NCI's highest ranking, "exceptional," for its third consecutive review, and received a five-year, \$23 million NCI support grant. The NCI survey team stated that the OSUCCC – James "should serve as the model for other matrix university-based centers." At Ohio State, more than 300 cancer researchers and their teams from 11 of our 15 colleges work collaboratively, across multiple disciplines, to improve the effectiveness of cancer prevention, diagnosis and treatment. In addition to its five scientific programs and 20 shared resources ranging from gene editing and genomics to target validation and clinical trials support, the OSUCCC – James support tissue-based translational research through a biomarker development resource, the Drug Development Institute, and clinical trial support. The OSUCCC – James supports community-engaged research and clinical care through its Center for Cancer Health Equity (CCHE) and has specific emphasis with internal cross-cutting themes including immune-oncology with the Pelotonia Institute of Immuno-Oncology (PIIO), Center for Tobacco Research, the Center for Cancer Engineering (CCE-CURES), in addition to growth in translational genomics and cancer metabolism. Detailed information regarding the OSUCCC – James's research services are available at the OSUCCC – James Research Website. Several specific Shared Resources with high continuous utilization by CTSI-supported researchers include:

- Bioinformatics Shared Resource (BISR) Computational Biology Services (CBS) and Data Sharing Infrastructure (DSI)
 - The Biomedical Informatics Shared Resource (BISR) described above analyzes high-throughput, high-dimensional biological data and other biomedical data and information using state-of-the-art informatics tools and high-quality informatics analysis for OSUCCC – James investigators.
- Biospecimen Services Shared Resource (BSSR)
 - Including tissue procurement through our IRB-approved Total Cancer Care Protocol, a repository, linkage to deidentified clinical data, and facilitated collaborations
- Clinical and Translational Science Shared Resource (CTSSR)
 - Supports customizable biomarker assays and other correlative science applications for clinical trials
- Clinical Treatment Unit and Clinical Trials Processing Laboratory

- Comparative Pathology and Digital Imaging Shared Resource (CPDISR)
- Genomics Shared Resource (GSR) (collaborative with Nationwide Children's Hospital) The GSR offers instrumentation and expertise for DNA and RNA analysis using sequencing, genotyping, real-time PCR, Affymetrix GeneChips, nCounter Analysis, next-generation sequencing library generation, single cell genomics, next-generation sequencing (through Nationwide Children's Hospital Biomedical Genomics Core), nucleic acid extraction and QC for RNA/DNA/proteins.
- Genetically Engineered Mouse Models
- Leukemia Tissue Bank to support leukemia research studies
- Medicinal Chemistry Shared Resource and The Medicinal Chemistry Shared Resource (MCSR) provides medicinal chemistry support to investigators. It integrates the expertise of multiple disciplines, including synthetic and process chemistry, instrumental analysis and molecular pharmacology utilizing automated high throughput screening methods.
- Microscopy Shared Resource (collaborative with the Campus-wide Imaging Facility-see above) A range of state-of-the-art instruments are available through the Microscopy Shared Resource (MSR).
- Nutrient and Phytochemical Analytics for nutrient and food quantitation for clinical trials
- Target Validation Shared Resource to support drug development including high-throughput screens and pre-clinical model confirmation
- Recruitment, Intervention, and Survey (RISSR) to support cancer behavioral, epidemiological and non-therapeutic clinical cancer research.
- Pharmacanalytical Shared Resource (PhASR) PhASR supports pre-clinical and clinical drug development at Ohio State by providing high quality and cost-effective bioanalytical method development, quantitative sample analysis and pharmacokinetic/pharmacodynamic experimental design, data analysis and modeling.
- PIIO Immune Modulatory and Discovery Platform (IMDP): For tumor: immune interface studies, the core offers single cell genomics and proteomics, mass cytometry, flow cytometry, multispectral cytometry, multispectral imaging, antibody development core, cellular therapy core and immune informatics.

Ohio State Diabetes and Metabolism Research Center

Ohio State University Wexner Medical Center's Diabetes and Metabolism Research Center (DMRC) is a university-wide effort committed to conducting clinical trials and basic research that translate to managing, preventing and curing diabetes. Currently the DMRC includes over 50 Principal Investigators and their laboratories that are located within the Colleges of Medicine; Food, Agricultural and Environmental Sciences; Nursing; Public Health; Engineering; Dentistry; Veterinary Medicine; Department of Human Nutrition in the College of Education and Human Sciences; and Department of Chemistry and Biochemistry in the College of Arts and Sciences.

Ohio State Drug Development Institute (DDI)

The Drug Development Institute is a component of the OSUCCC – James that was founded to address the translational development gap that exists between discoveries made in the research lab and the conversion of those discoveries to innovative drug therapies and devices for patients. The DDI leverages world-class research and drug development resources at The Ohio State University to advance projects from early drug discovery through preclinical and clinical development. We coordinate and manage all the necessary early-stage drug development activities to ensure a seamless integration of project teams and timely progression of projects. When appropriate, we partner with external contract research organizations to obtain critical data. The team includes scientists and leaders with experience working in the pharmaceutical industry and partners with the Technology Commercialization Office (TCO) to facilitate patenting and establish commercialization plans and partnerships to facilitate the drug and device pipeline to the clinic.

Ohio State Electron Paramagnetic Resonance (EPR) Core Lab

The EPR Core is a resource of Ohio State's Davis Heart and Lung Research Institute (DHLRI). The core offers magnetic resonance technology for detection, quantification and visualization of free radicals in biological systems. The method is routinely used to measure free radicals such as superoxide, hydroxyl and nitric oxide in chemical/biochemical biological systems. EPR also enables measurement and imaging of physiologically pertinent tissue parameters such as tissue perfusion, oxygenation, metabolism, redox state, viability and pH using appropriate spin probes.

Ohio State Flow Cytometry and Cell Sorting Analysis Core

The Flow Cytometry and Cell Sorting Analysis Core is a joint venture between the Comprehensive Cancer Center and the Davis Heart and Lung Research Institute. It offers experimental design, protocol development, assistance in running samples, and analytical assistance. Instrumentation includes the FACS Aria, FACS Calibur, and FACS Vantage and i-Cyt Reflection (Veterinary Biosciences). Flow Cytometry capabilities include but are not limited to DNA analysis, phenotypic analysis, apoptotic studies, cell cycle and functional studies. Cell Sorting allows for the separation from a complex mixture of cells into a defined single cell fraction that can then be analyzed. Optics, lasers and electronic processors, automate the task of identifying and quantitatively analyzing individual cells. By measuring the physical and chemical properties of cells, such as fluorescence, then by physically separating cells while still alive, the cell sorter has become an important tool for biomedical research and clinical medicine.

Ohio State Food Innovation Center

A population of nine billion people in year 2050 will demand a staggering 70% increase in the world's food supply. Simply increasing production will not eradicate hunger nor improve human health. One third of food produced is now lost or wasted due to flaws in process, economics, energy, behavior and policy. Food discovery at Ohio State is innovation that works across disciplines; it is the best ideas from academic, government and industry professionals that solve local, national and global food needs. The Ohio State Food Innovation Center has the tools and talent to improve access to abundant, safe, health-promoting food.

Ohio State Gene Therapy Institute

Founded in April, 2022, Ohio State's Gene Therapy Institute will coordinate existing strengths to accelerate the expansion of gene therapies. Related research is being conducted by over 50 faculty across the colleges of Medicine, Arts and Sciences, Law, Business, Veterinary Medicine, Engineering and Pharmacy. The university holds one of the largest first-in-human clinical trial portfolios: 10 active trials; grant support of \$14.6 million for a first-in-human nervous system gene therapy trial and \$4.8 million for translational Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)-gene therapy research from the National Institutes of Health; and research collaborations with industry partners that include Battelle, Medtronic, Biogen and Bayer.

Ohio State Infectious Disease Institute

The Infectious Diseases Institute will generate solutions to the detrimental effects of microbes on the health of humans, animals, plants, and the environment for the benefit of society. Programmatic areas include: Antimicrobial Resistance; Ecology, Epidemiology, and Population Health; Host Defense and Microbial Biology; Microbial Communities; and Viruses and Emerging Pathogens.

The Ohio State Martha Pritzler Center for Women, Children and Youth

The Martha S. Pitzer Center for Women, Children and Youth at The Ohio State University College of Nursing is internationally renowned for the discovery of new knowledge and its translation into real world settings to optimize health and wellness outcomes in infants, children, adolescents and women through health promotion and risk reduction.

Ohio State Molecular Cytogenetics Shared Resource

The Molecular Cytogenetics Shared Resource provides molecular cytogenetic technology and classical banded metaphase cytogenetics. Services include metaphase karyotyping of human and mouse tissue, fluorescence in situ hybridization (FISH) using many different types of probes and tissues and multicolor spectral karyotyping (SKY).

Ohio State Neuroscience Core Facilities

The Department of Neuroscience cores for preclinical neurological studies include the following:

- The Rodent Behavior Core provides expertise and services for comprehensive phenotyping of mouse models using a battery of standard behavioral paradigms. The Core centralizes behavioral assessment facilities and expertise for neuroscience investigators, ensuring that behavioral testing is performed expertly and adheres to best practices in the field. Assessments provided range from sensorimotor, learning and memory, to motivated behavioral measures.
- Electrophysiology Core for preclinical neural model systems
- Neuroimaging Core
 - Fluorescence confocal microscopy of cells, tissues and zebrafish embryos in the living and fixed state as well as wide-field, point-scanning and spinning disk confocal microscopes

Ohio State Primary Care Research Institute

The Ohio State Primary Care Research Institute has as its mission to foster, facilitate and report collaborative, interdisciplinary research directed toward optimizing people's health. Its vision is to be recognized internationally as a center of excellence for the quality, quantity and impact of its research on the professional literature, development of public policy and health outcomes.

Ohio State Small Animal Imaging Core

This facility which is part of the Davis Heart and Lung Research Institute (DHLRI) includes high resolution imaging equipment (MRI, ultrasound, microCT and optical), X-ray irradiator, body composition analyzer and personnel trained in the operation of each imaging modality and small animal handling procedures, as well as analytical software support for quantitative image analysis. In addition to providing interim animal housing for serial imaging studies, the SAIC also offers on-site suites for surgical procedures, and animal care provided by University Laboratory Animal Resources. Image reconstruction, multi-modality fusion, quantitative image analysis, high resolution graphics and networking to the facility's server are also available.

Ohio State Spine Research Institute

At the Spine Research Institute, we are dedicated to developing a better understanding of the causal pathways that lead to spine and other musculoskeletal disorders through research, education and the development of platform technologies. We maintain that if we can understand how these disorders develop, we can provide better solutions for preventing, evaluating and treating them.

Ohio State Veterinary Tissue Bank

The Tissue Bank (biospecimen repository) collects samples of tumors and normal tissue from companion animals and stores these tissues under controlled conditions for future use by multiple investigators. The Tissue Bank at Ohio State was selected by the Canine Comparative Oncology Genomics Consortium (CCOGC) as one of three veterinary institutions nationwide to participate in populating the Pfizer-CCOGC multi-institutional Tissue Bank. This National Cancer Institute-sponsored endeavor emphasizes the importance of comparative oncology research. Ohio State's Tissue Bank follows the guidelines established by the CCOGC for several specific types of tumors and similar established protocols for other tumors. Tissues are collected and archived only after receiving consent from the owners. This sample bank will serve as a tremendous resource with the ultimate goal of developing new prevention and treatment strategies for dogs with a variety of illnesses.

Ohio State Zebrafish Core

The Zebrafish Core allows investigators to take advantage of the zebrafish facility on campus and provides a Genome Manipulation Facility for Bacterial Artificial Chromosome (BAC) recombination and the design of Zn-finger nucleases, which can be used in zebrafish as well as other animal and cellular systems. The Core offers two types of service. 1) It will provide users the opportunity to exploit the unique experimental advantages of zebrafish for their research. 2) This Core will also contain a Genome Manipulation Facility with a focus on ZFN and bacterial artificial chromosome (BAC) recombineering. The modular assembly of a zinc finger DNA binding domain to the cleavage domain of a DNA endonuclease have been used to perform genome editing in a range of organisms, including zebrafish and human cell lines. This Facility provides BAC recombineering services to produce DNA for transgenic zebrafish and mouse lines.

Ohio State Extension Program

The nation's land-grant universities have a mission to disseminate and teach new knowledge to the citizens living throughout the state. This mission is accomplished through outreach education and the Cooperative Extension System that was established by the Smith-Lever Act of 1914 as a federal-state-local partnership between the USDA, the land-grant university system, and local county governments. As part of Ohio State's land grant mission, Ohio State Extension has an office located in each of Ohio's 88 counties. The Ohio State Extension Program focuses on four major program areas:

1. Agriculture and Natural Resources
2. 4-H Youth Development
3. Family and Consumer Sciences
4. Community Development

The system was developed to transfer and apply the latest scientific research to address local needs that are constantly changing. Dr. Kenneth Martin is Associate Director and Department Chair for Ohio State Extension.

CORE FACILITIES AND OTHER RESOURCES - NATIONWIDE CHILDREN'S HOSPITAL (NCH)

Nationwide Children's Hospital (NCH) is among America's largest not-for-profit free-standing pediatric healthcare systems and is ranked number eight in U.S. News & World Report's 2021-22 "America's Best Children's Hospitals Honor Roll" list. NCH provides unique expertise in pediatric population health, behavioral health, genomics and health equity, as the next frontiers in pediatric medicine, leading to best outcomes for the health of the whole child. Integrated clinical and research programs, as well as prioritizing quality and safety, are part of what allows Nationwide Children's to advance its unique model of care. NCH is the only

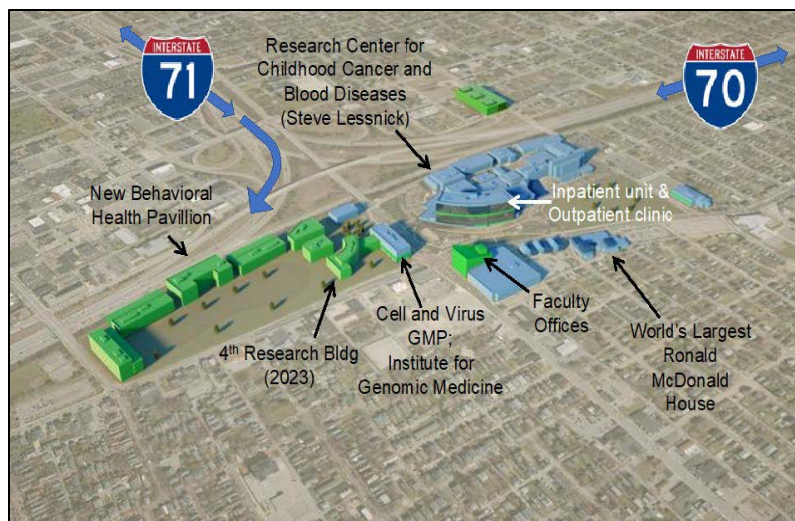
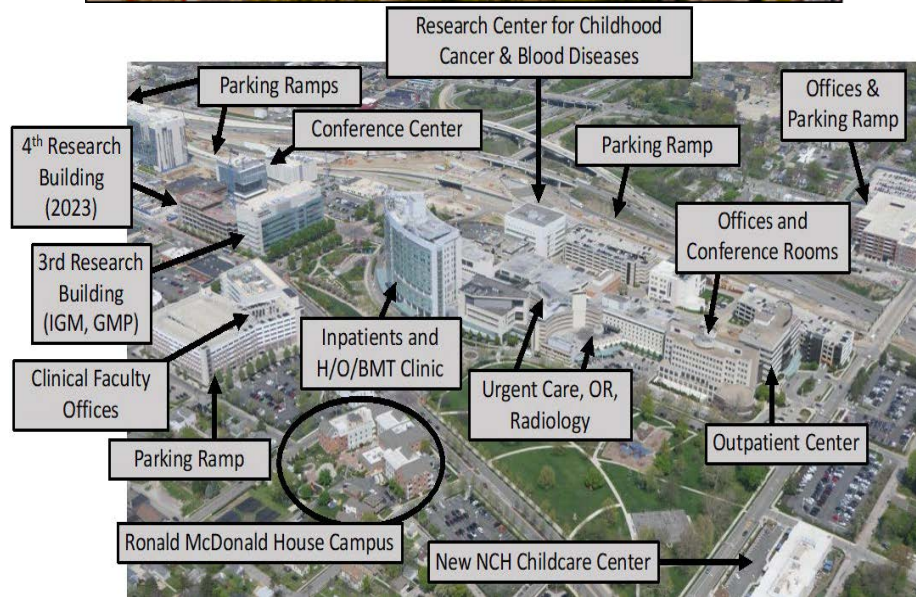


tertiary care facility with pediatric subspecialty services in central Ohio. With over 1.6 million patient visits per year, it captures more than 80% of the market share. The 12-story main hospital is central to over 2 million square feet of inpatient and outpatient facilities on campus, with 549 licensed beds and 130 leased beds. A staff of more than 13,000 provides state-of-the-art wellness, preventive and rehabilitative care, and diagnostic treatment. As home to the Department of Pediatrics of The Ohio State University College of Medicine, Nationwide Children's physicians train the next generation of pediatricians and pediatric specialists.

THE ABIGAIL WEXNER RESEARCH INSTITUTE AT NATIONWIDE CHILDREN'S HOSPITAL

The Abigail Wexner Research Institute at NCH is ranked number six based on NIH funding among freestanding children's hospitals and is one of the fastest growing pediatric research institutes in the nation; over \$136 million in external grants and contracts were obtained in 2021. As a 501(c)(3) subsidiary of NCH, Inc., the Abigail Wexner Research Institute is organized into 13 multidisciplinary Centers of Emphasis that allow traditional academic boundaries to be crossed and merged. Scientific and clinical interests intersect in this model which encourages collaboration and the free flow of ideas. More than 195 faculty scientists focus on discoveries to improve child health, ranging from basic molecular biology to applied, patient-oriented and population health research.

The Abigail Wexner Research Institute, as part of The Ohio State University College of Medicine Department of Pediatrics, is based on the NCH campus near downtown Columbus, Ohio, approximately five miles from the Ohio State campus. The NCH campus is conveniently located at the intersection of US Interstates 70 and 71, with easy access ramps from the highways. The current research laboratories are located in the Wexner Institute for Pediatric Research, the Wexner Annex (WA, Research Building II), and Research Building III, structures that are adjacent to clinical and educational facilities. Together, these state-of-the-art buildings have over 525,000 square feet (sq ft) of lab and office space dedicated to research. All the buildings are contiguously located on the sprawling campus, with convenient access to childcare services, surgical suites, inpatient and outpatient units and conference rooms/auditoriums (see aerial photo taken from the southeast of campus). The lower levels are occupied by



the animal facilities. These buildings house research laboratories, investigator offices and ample space for support personnel and functions, including grants administration, accounting, operations, information technology, purchasing, compliance, safety and research training. Additional clinical research space can be found in the Near East Office Building and Faculty Office Building, housing non-laboratory-based clinical, epidemiological, and biobehavioral research groups, as well as the J West Building, a 160,000 sq. ft. structure contiguous with the

Wexner Institute. A fourth research building, opening in 2023, will total 155,000 sq. ft., with additional space available to support future research.

FACILITY OVERVIEW

Laboratory Facilities

The standard laboratory for principal investigators (PIs) is modular and averages ~1200 sq ft. These labs contain both fixed and movable benches, fume hoods with chemical storage cabinet, 208 V outlets for large equipment, 18 megohm Type I reagent grade deionized/reverse osmosis water and high-speed computer access to facilitate data capture and transfer. In addition, each laboratory floor contains adjacent hallway common equipment space that includes procedure rooms, tissue culture rooms with biological safety cabinets and centrally plumbed carbon dioxide in each, autoclaves, walk-in cold rooms, icemakers, darkrooms and microscopy suites. In addition, each floor has dedicated space for eating and conference rooms. Trainee and staff desk space is located directly adjacent to the laboratory space and next to exterior windows, which provide an additional source of natural light. Clinical research space is in the J West Building on the main hospital campus. The fourth Floor offers approximately 13,500 square feet of laboratory space. This space includes a Research Kitchen, Height/Weight room, Urine/Blood Draw room, three -80 freezers for storage of biological samples, a file room for storage of hard copy data and test materials, a shared workspace with nine cubicles for staff, and six observation rooms dedicated to conducting interviews with research subjects totaling approximately 750 square feet. Observation rooms have one-way mirrors and video monitoring equipment for conducting assessments. The new Near East Office Building, which opened in March 2019, provides an additional 12,000 sq. ft. of offices and conference rooms for clinical research on the 3rd floor. Office space for each PI is generally found on the same floor as his/her laboratory and averages 120 sq ft. Each office is provided with a desk, filing cabinets, shelves, computers and a printer. Administrative assistants are located outside of PIs' offices. Researchers are also supported by a collective of shared resources (scientific core facilities) that offer leading-edge analyses, processes and systems that offer an array of options for basic, clinical, and translational investigation (for details see below).

Major Equipment

All research laboratories and common equipment areas are equipped with standard items necessary for modern molecular biological research, including equipment for electrophoresis, cell culture, centrifugation (ultra, high speed, tabletop, and micro centrifuges), thermal cyclers, speedvacs, microplate readers, pH meters, balances, shakers, ovens (microwave, high-temp, vacuum), refrigerators, freezers and a high-quality house water purification system.

The Steve and Cindy Rasmussen Institute for Genomic Medicine (SCRIGM; Dr. Richard K. Wilson and Dr. Elaine R. Mardis)

The Steve and Cindy Rasmussen Institute for Genomic Medicine (SCRIGM) at Nationwide Children's Hospital (NCH) was created in 2016 as one of the first ventures into pediatric personalized genomic medicine for children's hospitals. Recognizing that the root cause of many childhood diseases can be traced directly to the genome, SCRIGM's vision is to integrate molecular genomics into the mainstream of pediatric patient diagnosis and treatment. The SCRIGM combines robust research and clinical laboratories with genome scientists, computational biologists, and clinical geneticists to optimize discovery and patient care. Collaboration among basic science investigators, physician-scientists and clinicians is emphasized to quickly transition novel research results into advanced diagnostics using state-of-the-art technology.

The Steve and Cindy Rasmussen Institute for Genomic Medicine (IGM), Computational Genomics Group (Dr. Peter White)

The Computational Genomics Group comprises a dynamic team of bioinformatics scientists, computational biologists, data scientists, software developers and software engineers with the substantial technical and bioinformatics expertise required to oversee the multiple platforms that acquire, store and analyze large and complex data sets generated by the IGM. Integrating this group within the IGM is critical to its success,

ensuring that team members learn new methodologies and develop novel analysis approaches at pace with the technological growth that has become a primary driving force for biological discovery. Leveraging the flexibility of the Cloud, the group continues to develop highly optimized solutions to address the substantial processing, networking, and big data challenges arising from genomic science. Presently the group is comprised of four highly integrated teams

1. Translational Bioinformatics Team

- a. The Translational Bioinformatics Team develops and applies challenging and complex software solutions for the next-generation sequencing (NGS) data produced by the Institute and collaborators. The team supports the needs of all aspects of NGS analysis, including data generation, analysis, and interpretation, preparing novel methods and technologies for research and clinical production. Members possess diverse computational and biological expertise, working closely with investigators within IGM, transcribing biological questions to code, and with the Clinical Informatics team, translating research pipelines to clinical applications.

2. Cloud Solutions Team

- a. The Cloud Solutions Team implements, operates, and maintains the computing infrastructure that is tailor-designed to address the substantial processing, networking, and data moving challenges arising from genomic science. Utilizing the elasticity of the Cloud and innovative Big Data technologies, the team collaborates with IGM faculty and R&D teams to develop highly optimized state-of-the-art bioinformatics solutions.

3. Clinical Informatics Team

- a. The Clinical Informatics team supports the production informatics needs of IGM's Clinical and Service laboratories. Members work closely with IGM faculty and R&D teams to design and build efficient instrument-to-interpretation pipelines for next-generation sequencing workflows, optimizing outcomes for our genomic medicine initiatives. They also manage validated pipelines and any vendor-provided solutions in compliance with the College of American Pathologists (CAP) / Clinical Laboratory Improvement Amendments of 1988 (CLIA) and HIPAA.

4. Data Management Team

- a. The Data Management team manages sequencing and laboratory processing data for the IGM Clinical and Service Laboratories. The team is responsible for supporting, customizing, and further developing the Laboratory Information Management System (LIMS) to facilitate the flow of information to and from other equipment and systems used in the labs, improving lab efficiency, ensuring sample integrity, and promoting easy reporting. Members work closely with the IGM Production Informatics and Cloud Infrastructure teams to track analysis locations and support production systems for analysis. The group provides bioinformatics services on a collaborative basis at subsidized hourly rates. It serves as an interface between the research investigator and the multiple domains required to handle the size and complexity of genomic data. IGM has built a dedicated cloud-based computational resource through Amazon Web Services (AWS), allowing large and varied configurations to be provisioned on-demand (see Computing). AWS has granted us extensions to our account limits enabling us to launch thousands of simultaneous instances to support the analysis of both large- and small-scale sequencing projects. Our usage has been so successful that internal AWS development teams often meet with us to help define the requirements and features of their future product offerings. We are uniquely positioned to adapt and develop new computational tools in a manner driven by the demands of our research community as it utilizes new technologies.

Developing analytical pipelines for human exome and genome sequencing analysis, big data research, and identifying disease-causing genetic variants, are key focus areas for the Computational Genomics Group. The group also evaluates and supports multiple software products for genomics applications to make data analysis tools accessible to biologists.

Training and education in genomics and bioinformatics are essential components of our mission. IGM provides internship opportunities in genomics and bioinformatics to undergraduate and graduate students. We train and mentor our research faculty and junior scientists through one-on-one consultation, software training and relevant workshops.

The Steve and Cindy Rasmussen Institute for Genomic Medicine (IGM) Technology Development Laboratory (Dr. Vince Magrini and Sean McGrath)

The Technology Development team focuses on translational approaches with new sequencing technologies and methodologies and supports the mission to provide high-quality genomics as a critical clinical resource. The group is actively researching integrating short-read (Illumina, 300-500 bp) and long-read (RNA: >500 bp, DNA: >12,000 bp) sequencing for basic and clinical research discovery followed by support for clinical diagnostics. The Development team works closely with Genomic Services and the Clinical NGS groups focusing on process improvements and protocol standardization within IGM. A significant process improvement includes automated sample processing (clinical and research DNA and RNA libraries) and sample multiplexing (adding unique molecular identifies, appropriate index sequence balancing and dual-indexing) with short-read sequencing technologies.

The Steve and Cindy Rasmussen Institute for Genomic Medicine (SCRIGM) Clinical Genomics Laboratory (Dr. Catherine Cottrell)

The Steve and Cindy Rasmussen Institute for Genomic Medicine Clinical Laboratory at Nationwide Children's Hospital performs high complexity molecular genetic analysis, cytogenetic analysis, and advanced genomic testing. The laboratory is accredited by the College of American Pathologists (CAP; #1637201 and #8162772) and holds a Clinical Laboratory Improvement Amendments (CLIA) certificate (#36D0665271 and #36D2131848). The laboratory is fully equipped with instrumentation and computational resources to perform diverse molecular, cytogenetic and advanced genomic analyses. In addition, the laboratory includes facilities for sample accessioning, tissue culture, cytogenetic analysis, fluorescence in situ hybridization, nucleic acid extraction, nucleic acid amplification, microarray analysis, methylation analysis, next-generation sequencing (NGS) and local freezer storage.

Research Regulatory Affairs (Dr. Kevin Bosse)

The Office of Research Regulatory Affairs (ORRA) helps move discoveries at the lab bench into clinical testing to develop novel approaches to prevent and treat pediatric diseases. The Food and Drug Administration (FDA) regulatory review process for clinical trials is complex. ORRA guides investigators through the regulatory landscape and provides a streamlined and uniform approach to translating preclinical studies into human clinical trials. ORRA works side-by-side with Clinical Research Services to assist with clinical design and regulatory submissions and with the Office of Research Compliance and Integrity to ensure compliance with all institutional, state and federal laws and regulations. ORRA offers consultation with investigators to discuss specific preclinical development plans, focusing on tasks needed to efficiently move the drug or device to the clinic according to FDA guidelines and provides insight into associated costs and complications that may arise during the process.

ORRA also offers consultation on the scientific information required to support an Investigational New Drug or Device application to the FDA. This consult includes characterizing the product, animal models of safety or efficacy, or toxicology. In addition, consultation is provided on the content of the investigational new drug (IND) application and FDA interactions in general. This support currently includes review and document creation for INTERACT, pre-IND and IND applications, annual reporting, and end-of-study phase interactions with the FDA.

IT Infrastructure and Operation

Nationwide Children's Hospital Information Services (IS) provides backbone IT infrastructure and IT operations for the entire Nationwide Children's organization including the Research Institute. They include high availability, high-speed, and secure network infrastructure, multi-tiered high-performance storage, desktop/laptop and server services, enterprise clinical and operational system and application support, communication, collaboration platform support and many other essential and mission critical services.

The Nationwide Children's Data Center

The designed to fully support the clinical and research mission with robust physical access controls and authorization requirements. The Nationwide Children's data center houses high availability servers running mission critical applications such as the clinical system Epic and other clinical applications. Hospital IS currently maintains over 300 servers and supports multiple Relational Database Management Systems, including SQL Server, Oracle, PostgreSQL, and MySQL etc. There are 5 dedicated database administrators overseeing database systems running on 62 servers. Two large computing clusters, Hadoop cluster and High-Performance Computing cluster, are also located in the data center.

Information Security, Privacy and Compliance

Maintaining the confidentiality, integrity and availability of information is a key element of managing ePHI (electronic Protected Health Information). There is a dedicated security team that establishes cyber security best practice and monitors security violations. They provide recommendation and oversight on risk management and compliance to various regulations such as HIPAA and FISMA. An information security and privacy governance group composed of senior executives oversees a full-time team of seven certified information security professionals. This group is accountable for establishing and maintaining a framework to ensure that information security strategies and capabilities are aligned with applicable laws, regulations and business objectives. Nationwide Children's protects information using reasonable and appropriate information security and privacy controls. Authentication and access control safeguards are implemented considering the risk profile of the information, the sensitivity of the information and the access vectors of the information. Access to Nationwide Children's information assets is granted only with appropriate authorization, a successful identification and authentication are required. Nationwide Children's information security operations management capabilities include monitoring, backup and storage, network security and vulnerability management processes, which facilitate the identification and remediation of system flaws. Additionally, information security and privacy practices are incorporated into Nationwide Children's service management capabilities that include problem and incident management, asset management, change and release management, system development lifecycle management and software acquisition management. The Research Institute at Nationwide Children's has demonstrated its commitment to and capabilities in information security and privacy through its participation in The Cancer Genome Atlas project, a federally funded multi-year project which requires FISMA compliance. Our experience, in conjunction with a corporate culture committed to serving those who have entrusted Nationwide Children's with their most private and personal information, has uniquely positioned our team to effectively address information security, privacy and compliance concerns.

Institutional High-Performance Computing Facility (HPC)

The High-Performance Computing Facility at The Abigail Wexner Research Institute comprises 20 general-purpose nodes each with 32 AMD Rome cores and 256 gigabytes (GB) of RAM, five large memory nodes each with 48 AMD Rome cores and two trillion bytes (TB) of RAM, and two redundant login nodes each with 32 AMD Rome cores and 256 GB of RAM. Additionally, five GPU nodes each have 32 AMD Rome cores, 256 GB of RAM, and two NVIDIA computational GPUs (two nodes have A100s with 40 GB, two have V100s with 16 GB, and one has P100s with 16 GB). These five GPU nodes give the cluster 1092 cores, 16.7 TB of aggregate memory, and a total theoretical performance of 127.6 TFLOPs. A 664 TB fault-tolerant GPFS filesystem, running on the cluster's 100 Gb/s InfiniBand fabric, provides user directories and high-speed

scratch space. In addition to the hardware, 2.5 full-time HPC specialists staff the facility and provide user support ranging from software installation to pipeline design and implementation, along with training for HPC users at all proficiency levels.

NCH INSTITUTE SHARED RESOURCES/CORE FACILITIES

Shared resources/Core Facilities are centralized facilities and services subsidized by Abigail Wexner Research Institute (AWRI) to provide significant cost savings to researchers. These resources include:

Animal Resources Core (Dr. Laurie Goodchild)

The Abigail Wexner Research Institute's animal use program is accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care (AAALAC) International and is registered as a research facility under the Animal Welfare Act (AWA) with the USDA. In addition, the NIH Office of Laboratory Animal Welfare (OLAW) has an assurance on file. These three buildings comprise 95,000 gross square feet (sq ft) of dedicated vivarium space. The animal facility within the Wexner and Research II buildings is contiguous space and provides 55,932 sq ft of space with 7,900 sq ft of conventional animal housing, a 15,450 sq ft mouse barrier facility, a 4,500 sq ft large animal facility, and 3,450 sq ft dedicated housing rodents involved in infectious disease (BL-2) research. All animal rooms within the mouse barrier are equipped with micro-isolator caging on ventilated racks and class II biological safety cabinets. Included in this space are ten general procedure laboratories and five surgery suites, four behavioral testing laboratories, a small animal imaging core and a quarantine facility. Environmental parameters within each animal room are continuously monitored electronically.

Behavioral Trials Office (Director, Dr. Joseph Rausch)

The Behavioral Trials Office (BTO), housed in the Center for Biobehavioral Health, is a point of entry service for social and behavioral clinical trials at NCH and a conduit through which investigators streamline connections to resources throughout the Institute (e.g., Clinical Research Services, Office of Technology-Commercialization). Certified Clinical Research Professionals, clinical staff including nurses and nurse practitioners, and biostatisticians in the BTO work with investigators to support efficient coordination of services necessary to initiate, implement and disseminate clinical trials according to Good Clinical Practice and federal, state and institutional regulations and guidelines. Supports tailored to social and behavioral trials include:

1. Data services such as power calculations; study design and analysis consultation; randomization; interim and final analyses; database design, creation, and oversight; and data reliability checks and cleaning;
2. Regulatory services such as protocol support and development, IRB preparation, submission, and oversight; assistance creating and maintaining the study regulatory binder and manual of procedures; guidance with meeting clinicaltrials.gov registration and reporting requirements; study monitoring services; and coordinating research and data agreements; and
3. Clinical safety services such as clinical protocol development; adverse event plan development, as well as adverse event collection, assessment, and reporting; liaising with clinical departments; inclusion and exclusion criteria assessment, medical chart abstraction; medication administration; biospecimen sample collection and storage; and interpretation of clinical labs.

In addition, the BTO provides clinical research education, training, and onboarding for staff engaged in social and behavioral clinical trials. The coordination of these supports in a centralized resource increases the pace, rigor, and translation of social and behavioral clinical trials by efficiently supporting all aspects of complex single- and multi-site trials including training, compliance, design, implementation, monitoring and dissemination.

Biobehavioral Outcomes Core (Dr. Kathryn Vannatta, Dr. Kelly McNally)

The Biobehavioral Outcomes Core assists investigators seeking to incorporate behavioral measures and methods into their research. Services include consulting on a research design that involves assessing behavioral, cognitive, emotional, or social outcomes and processes; selecting appropriate measurement techniques and instruments; assisting in preparing outcomes sections of grant applications; executing data collection protocols (e.g., standardized tests, qualitative interviews, focus groups), data scoring, consulting on data entry, management, and analysis for behavioral, cognitive, emotional and social outcome data; and assisting in preparing manuscripts describing these data.

Biopathology Center Core (BPC) (Dr. Nilsa Ramirez)

The Biopathology Center (BPC) Core provides biobanking services for projects sponsored by institutional PIs. The BPC is equipped with the expertise and infrastructure provided through the BPC's work with several funded biorepository-based efforts, including the Children's Oncology Group, NRG Oncology, SWOG (Southwestern Oncology Group), the Cooperative Human Tissue Network and Early Phase and Experimental Clinical Trials. The BPC Core provides a variety of services, including biospecimen accessioning, processing, nucleic acid extraction and quality control, banking, distribution and virtual microscopy.

Biostatistics Resource at Nationwide Children's (BRANCH) (Dr. Guy Brock)

The Biostatistics Resource at Nationwide Children's Hospital (BRANCH) is an extension of Ohio State University's Center for Biostatistics and assists investigators with formulating hypotheses, selecting appropriate research designs and bio statistically analyzing clinical, epidemiological and laboratory research data. Services include selecting appropriate study populations, control groups or matching characteristics, exposures and outcomes measures and datasets for secondary analysis.

Cell Based Therapies (Interim: Dr. Dean Lee)

The CBT core facility comprises over 2300 sq ft of laboratory suites, including ISO 7 cleanrooms, a QC laboratory, research and development, LN2 storage, inventory and associated offices. Current Good Manufacturing Practices (cGMPs) are followed for all CBT products. A robust quality assurance program is in place that includes environmental monitoring, continuous equipment and facility monitoring with remote alarms, appropriate gowning practices and documented facility and equipment cleaning and maintenance.

Cell Line Core (Dr. Kim McBride)

The Cell Line Core supports investigators who require live cell lines using tissue samples (non-tumor) obtained from human subjects. Services include generating EBV transformed B-cell immortalized cell lines from peripheral blood; creating fibroblast cell lines from skin biopsy samples; immortalizing fibroblasts and other primary cell types using lentiviral transduction of hTERT; extracting DNA from the initial sample, primary cell lines, and immortalized cell lines; and redundant archiving through a biorepository of cell lines.

Clinical Research Services (CRS) (Dr. Sarah O'Brien, Myeshia Harmon)

CRS is a portal through which clinical investigators access the efficient service coordination necessary to initiate and implement clinical research projects. CRS provides staff and/or services to manage a study from beginning to end according to Good Clinical Practice and federal, state and institutional regulations and guidelines. Services include clinical research education and training; clinical research project consultation; study design assistance; protocol development and feasibility; regulatory/IRB document preparation and management services; clinical research budget development, including research pricing; data collection for subject tracking to ensure proper invoicing/revenue capture; and overall study management provided by certified and extensively trained clinical research coordinators and nurses. CRS also has a core set of program coordinators who can oversee multisite programs and/or large research programs with multiple PI's and projects. CRS provides >7,000 sq ft of secure, dedicated clinical research space with six private exam rooms that are bariatric and handicapped equipped. Overnight space is available for overnight monitoring or

pharmacokinetic components of a project. The space contains a state-of-the-art clinical laboratory facility, an emergency care crash cart, observation rooms, and a dedicated reception/waiting area. Investigators also have access to all the services provided by Nationwide Children's Hospital, including the hospital's clinical laboratories, radiology, neuro-diagnostic testing, sleep diagnostic testing, cardiology/EKG, infusion clinic and a research pharmacy. Inpatient clinical research services are currently available at Nationwide Children's Hospital and Ohio State Clinical Research Center, located ten minutes from the Nationwide Children's Hospital campus.

CRISPR/Gene Editing Core (Dr. Meisam Naeimi Kararoudi)

The CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats)/Gene Editing Core at Nationwide Children's Hospital, in collaboration with The Ohio State University, provides investigators at both institutions with CRISPR/Gene Editing services. This shared resource allows researchers to gather preliminary data for grant applications and bring their novel uses of CRISPR/Gene editing closer to the clinic. The team of experts available through the CRISPR/Gene Editing Core has performed CRISPR/gene-editing in various cells, including primary immune cells, for researchers worldwide. The CRISPR/Gene-Editing Core works closely with investigators and research groups to meet their needs with reasonable turnaround times and affordable prices.

Flow Cytometry Core (Cecele Denman, Manager; Christopher Walker, Advisor)

The Flow Cytometry Core offers several platforms for phenotypic, functional and quantitative analyses of cells, cell-derived analytes, and small particles and is available to all trained investigators. Additionally, we provide data analysis training and access to Flow-Jo analysis software. Consultations for higher-level experimental design, data analysis, figure preparation or scientific writing are available on an as-needed basis.

Immune Monitoring Core (Cecele Denman, Manager; Dean Lee, Advisor)

As part of the Cell-Based Therapy core, Immune Monitoring Core also offers multiple platforms of immunological testing in support of clinical research trials and is available to all investigators interested in supporting assay harmonization for these complex and fragile methods.

Genomics Services Core (Dr. Amy Wetzel, Dr. Vince Mangrini)

The Genomics Services Laboratory (GSL, previously known as the Biomedical Genomics Core) has expertise in multiple aspects of genomics analysis, including consultation and assistance with experimental design, quality control of starting material (DNA or RNA), next-generation sequencing, and basic data processing. We provide service to both internal and external investigators. GSL has over a decade of experience with next-generation sequencing data generation and analysis. The GSL can assist investigators with multiple aspects of next-generation sequencing, including library preparation, sequence generation and data analysis. Advanced bioinformatics support for analyzing complex datasets, including integrated DNA and RNA sequence data, is a demonstrated strength.

High Resolution Research Imaging (Terri Shaffer, Dr. Laurie Goodchild)

The imaging core in RB II is part of the Animal Resource Core and occupies >1,500 sq ft of space. This space is divided into two areas. The first area consists of three separate rooms for small animal imaging. The second area consists of three different Rodent Nuclear Medicine (NucMed) imaging rooms. Also, the Research III animal facility houses a satellite imaging facility.

The PAIR Imaging Core (Dr. Ellen Chung)

The Radiology Department at NCH provides a Pediatric Advanced Imaging Resource (PAIR) core structure, which serves both clinical and research needs. The mission of this core is to concentrate and streamline radiologic resources that are typically dispersed across disciplines and laboratories into a single highly efficient and organized structure. The PAIR is organized by imaging modality (e.g., MRI, CT) into head and body

subdivisions. The director of the core is Dr. Mai-Lan Ho, a Radiologist, while the manager of core resource is Dr. Ramukumar Krishnamurthy, an MR physicist. Drs. Nelson and Halverson serve as co-directors of neuroimaging research within the core and Dr. Parthasarathya was recently hired as director of 3D printing. Personnel and resources for scientific consulting, image post-processing and data storage are also available for all users through the core.

The core oversees 5 MRI scanners including a newly acquired Siemens MAGNETOM Prisma 3Tesla scanner which is prioritized for research usage. In addition to MRI, the core oversees CT, SPECT, PET, ultrasound, fluoroscopy, x-ray and a variety of other radiological needs for both research and clinical application across Nationwide Children's Hospital and the Research Institute. All MRI scans performed at NCH are administered by a certified MR technician and read for incidental findings by a pediatric neuroradiologist. All MRI scanners undergo regular QC assessments by MR physicists. Two additional 3T magnets were added last year.

Morphology Core (Dr. Nilsa Ramirez and Cynthia McAllister)

The Morphology Core provides services in histology and electron microscopy (EM). Training for Atomic Force microscopy, confocal microscopy, and laser dissection microscopy is also available. The histology section of the core is College of American Pathologists (CAP) accredited.

IT Research & Innovation (IT R&I) (Dr. Yungui Huang)

IT R&I's mission is to collaborate and create evidence-based impactful health IT solutions, leveraging data, analytics, technology and user experience design. IT R&I comprises around 30 highly skilled professionals with diverse experience and knowledge in data modeling, data engineering, machine learning, predictive modeling, information retrieval, geographic information science, web/mobile application development, user experience design, technology innovation and other specialty areas. These diverse talents are organized into three highly collaborative and vertically integrated teams.

The Data Collaboration Team manages end-to-end data solutions across various platforms, including health information extraction, de-identification and multisite clinical research support. They manage a big data platform that enables the ingestion and archival of streaming bedside monitor data and makes these high-resolution data available for research, QI and clinical care. Multiple certified EPIC (clinical system Nationwide Children's Hospital uses) report writers are experienced in mapping and extracting clinical data. IT R&I has extensive clinical research and trial data management experience to host or support multisite data collaborations.

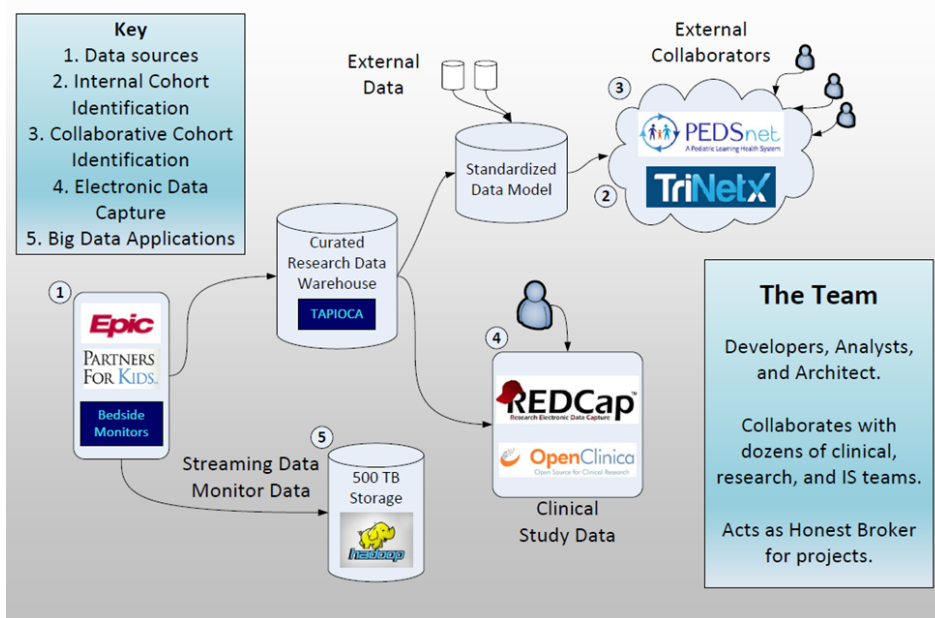
The Data Science team employs statistical, machine learning, deep learning, and geospatial methods to produce predictive clinical decision support and population health management models. Using advanced information retrieval and natural language processing methods, we extract knowledge from unstructured clinical notes to be presented in an intuitive and user-friendly fashion.

The Design + Technology team specializes in creating novel solutions to complex problems. Guided by a deep understanding of users, paired with the most appropriate technology, we co-design and co-create functional, interactive and user-centric web/mobile/AR/VR applications. We custom create multimedia, such as sound, graphics, video, animation and immersive virtual environments to enhance information consumption, user engagement and digital intervention.

Data Collaboration and Computing Capacities

The Data Collaboration team is key to supporting data-driven clinical research. The following diagram best depicts their comprehensive services.

Data Collaboration on a Page



Data Warehousing

Data Collaboration team maintains the Research Data Warehouse residing on an Oracle Exadata Database Enterprise Edition. Code and data are backed up nightly. A test server and a development server with the same setup as the production environment have also been established. Our research data warehouse contains data for patients from 2008 to present with the volume of patients and data points listed in the table below.

Data Extraction

The Data Collaboration team enables clinical research by assisting researchers and clinicians in obtaining data from multiple data sources.

Multisite Clinical Research Data Networks

The DC team has extensive experience supporting multisite collaboration efforts. The team is experienced with interoperability and multiple existing popular CDMs such as i2b2 (Informatics for Integrating Biology and the Bedside), OMOP (Observational Medical Outcomes Partnership) or Mini-Sentinel CDMs. Through our work with PEDSnet, which works with all the three previously mentioned models, the team has scripts to convert data from one model to another and can easily adapt them to fit the needs of a project.

Nationwide Children's Hospital has established an internal protocol on data sharing to safeguard the release of any data. The proper approval level required is based on the data's sensitivity and PHI exposure level.

Once data are prepared, an independent staff will validate the contents and ensure no unauthorized data or fields are included before the data is certified and released.

Data Query/Capture/Computing Tools and Services

In addition to managing the research data warehouse and Nationwide Children's Hospital site data feed to multisite research data consortium, the team also supports processes, tools, systems and platforms that enable self-service data query, electronic data capture, clinical trial data management and specialty computing environments.

Year	Total Unique (#)	
	Patients	Encounters
2021	479264	7030933
2020	401920	5821689
2019	429541	6299180
2018	414379	4617586
2017	415976	4436208
2016	404212	3916812
2015	379748	3409245
2014	373303	3044814
2013	350291	2772298
2012	338713	2497699
2011	320420	2168077
2010	300889	1903699
2009	291587	1693594
2008	259954	1449003

Data Science Capability

Our Data Science team employs innovative approaches for acquiring, managing, retrieving, and analyzing data. We employ statistical, machine learning and deep learning methods to produce predictive models for clinical decision support and population health management applications. We apply advanced information retrieval and natural language processing methods to extract knowledge from unstructured clinical notes, present that knowledge in an intuitive and user-friendly fashion and create structured predictors that can be incorporated into predictive models. Geospatial analytics allows us to employ patient and facility addresses to incorporate distance, location, socioeconomic status and consumer behavior into our predictive models. Our distributed big data infrastructure means that there are few practical limits regarding the volume, variety and complexity of data we can analyze. Finally, taking advantage of the combined medical/dental electronic health records for our patients, we have considerable analytical experience in the Dental Informatics domain.

Deep Learning

Deep Learning refers to a class of machine learning models that are based on large (deep) neural networks. Deep Learning facilitates the automatic learning of data representations that often lead to superior predictive models in various domains (e.g. computer vision, natural language processing, bioinformatics). We provide the capacity for state-of-the-art deep learning techniques with expertise in established neural network software libraries such as Tensorflow, Keras or PyTorch. Our high-performance computing cluster allows GPU-accelerated model optimization to tackle data at any scale.

Dental Informatics

We offer biostatistical support to pediatric dental residents and faculty in conducting dental research. We provide end-to-end statistical services from power and sample size analysis to data analysis and reporting. Our goal is to help dentists conduct high-quality cutting-edge research to achieve the highest quality of care with the lowest possible cost.

Geospatial Analytics

We offer spatial data integration services to geocode address data to enable spatial analysis of healthcare data. Many health-related issues are related to the geographic environment we live in. By using in-house geospatial analytical software ArcGIS and Alteryx, we can leverage thousands of socioeconomic and demographic variables and develop state of the art geostatistical procedures to optimize health and human services. Our goal is to help you achieve better outcomes by incorporating spatial intelligence into your analytical workflow.

Information Retrieval

Our team designs cross-platform web-based querying systems that make searching and analyzing unstructured and structured data easier, faster and more creative. We bring you the experience of instant search and data access on structured and unstructured documents with smart features such as auto suggestion, typo correction and highlighting results. The flexible web applications designed by our Design and Technology team enable users to instantly see the results as they are typing, check distributions of data fields through charts and save and export results in multiple formats. We also offer multi-lingual full text search with spell checking, auto-complete, highlighting and advanced customizable ranking capabilities.

Natural Language Processing

We develop Natural Language Processing (NLP) algorithms to glean data from unstructured medical records. Discrete values can be derived from millions of case narratives by an efficient and automated scan of medical notes using an NLP program. Some NLP techniques we employ include named entity recognition, topic modeling, text classification, and readability analysis, among others. With additional access to medical knowledge bases such as UMLS and SNOMED, our NLP capabilities can serve a broad range of user needs from routine text processing to evidence-based decision making.

Predictive Modeling

We employ state-of-the-art techniques drawn from artificial intelligence and statistics to build predictive models for a variety of patient outcomes, from dental caries to inpatient cardiopulmonary failure events. We work closely with our collaborators, whether healthcare providers or fellow researchers, from project inception through clinical validation to ensure the clinical decision support tools we build are precisely targeted to optimize clinical value and predictive performance.

Custom Application Development Capability

Design + Technology team specializes in custom application development (web, mobile or other devices) with expertise in problem formulation, literature/market research, interactive media, user interface/experience design, feasibility study and digital intervention effectiveness validation. They are also able to draw upon a vast reservoir of technical expertise to find creative solutions to incorporate new and emerging technologies into research studies in novel and unique ways. The team can rapidly prototype tailored solutions. The team has exemplified this ability in a multitude of clinical and research projects.

Native/Responsive Mobile/Web Application Development

Our team offers custom web and mobile application development which includes professional services in user experience, design and full stack engineering. We transform ambitious research proposals into functional applications using Node.js, React.js, SwiftUI Amazon Web Services and other exciting technologies.

Gaming and Immersion Experiences

We leverage multiple approaches to increase a user's engagement (visuals, stories, achievements, etc) to create desirable effects for the targeted user. We have experience in tailoring our approaches to address the unique requirements of healthcare applications. We use current technology, such as motion tracking and head mounted displays, to provide one of a kind immersive experiences.

Voice Enabled Technology

We are exploring ways voice technology can be used in healthcare, with the goal of improving patient care. We develop and refine voice interactive apps and skills that are compliant, scalable and interoperable. In collaboration with the Data Science team, we also look into how artificial intelligence can be used to generate personalized content, identify patterns and detect health issues from a person's voice.

UX/Co-design

User Experience (UX) focuses on having a deep understanding of users, what they need, what they value, their abilities and also their limitations while pairing that understanding with the most appropriate technology available today. User Experience (UX) best practices are employed to promote improving the quality of the user's interaction with and perceptions of your product and any related services. Our design process includes user research, co-design and usability testing.

Digital Biomarkers/Consumer Sensors/Wearables

Increasingly, our electronic devices are capable of collecting ongoing measurements of our physiological state, including heart rate, movement, and respiration. Furthermore, devices in our environment can be leveraged to collect data such as voice, video or motion that may help healthcare providers to monitor mood, activity or behavior. When this data is used to help us understand or predict health outcomes, we refer to these measurements as digital biomarkers. We can provide end-to-end assistance from the selection and setup of wearables or environmental sensors through the recording and analysis of digital biomarkers for your research study or clinical intervention.

Video Capture and Motion Detection

We collaborate with Data Science team to explore how to incorporate video modality into data collection and data analysis to answer research, clinical, or operational questions. By using AWS and Microsoft Azure platforms and open-source video stream analytics tools (e.g. OpenCV, ImageAI, TensorFlow), we can quickly explore how this new modality of data can be incorporated to provide insights to improve physical and behavioral health.

Ohio State External Collaborative CTR Resources

Healthy State Alliance

Bon Secours Mercy Health (BSMH) is the fifth largest Catholic health care system in the U.S. and one of the nation's 20 largest health care systems. With more than 50 hospitals, freestanding emergency departments, to specialty and primary care locations, lab facilities and imaging centers, involving 60,000 associates, including 3,000 providers in the U.S., BSMH is one of the largest health care systems in the country across seven states with 10 health systems in NE and SW Ohio. Providing care for the underserved including patients from historically underserved rural and urban setting is central to BSMH's mission. In 2018, Ohio State and BSMH created a strategic partnership with the intention of improving health equity through expanding access to life-changing care and discovering and implementing new approaches to engage in clinical and D&I research that will lead to superior clinical outcomes and services for all.

Ohio Association of Federally Qualified Health Centers

Federally Qualified Health Centers (FQHCs) serve at the front lines of clinical care and innovation within urban and rural communities facing the greatest health disparities. Ohio has a robust FQHC network, with 400+ locations spanning 72 of Ohio's 88 counties. Ohio FQHCs delivers over 3 million patient visits annually to 854,000 Ohioans (OACHC, 2022). Through caring for patients with public or no insurance (> 80%), Ohio FQHCs deliver high quality care while leading statewide health equity initiatives. Over 78% of Ohio FQHCs have received patient centered medical home designation from the National Committee for Quality Assurance (OACHC, 2022). Ongoing, multifaceted Ohio State and Ohio FQHC primary care and innovation collaborations (e.g. rural health, substance use disorder, maternal-child health, medical education and health care professional pipeline programs) serve as a strong foundation for engagement.



Ohio Colleges of Medicine Government Resource Center (GRC)

The GRC was founded in 2008 by the Ohio Council of Medical School Deans. Housed at Ohio State's Office of Health Sciences, GRC is a public university-based center for applied health policy research and technical assistance. GRC engages expert faculty and staff at Ohio's Colleges of Medicine and partners with state health and human services policymakers to improve the health and health systems for all Ohioans. The leadership of GRC consists of health policy and research experts who have had extensive leadership responsibilities within Ohio's health and human services agencies.