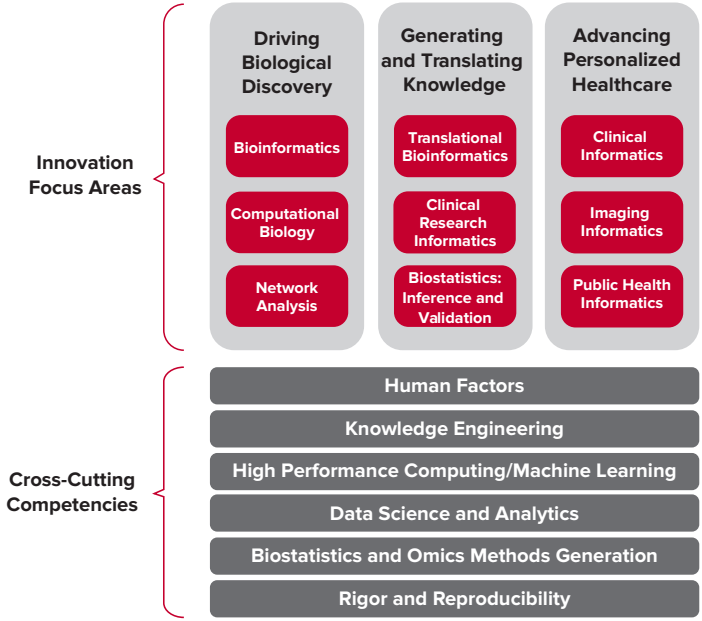
THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER

The Ohio State University
Department of Biomedical Informatics

The mission of The Ohio State University Wexner Medical Center is to improve people's lives through innovations in research, education, and patient care. In the Department of Biomedical Informatics, we seek to achieve this mission by advancing health and biomedicine through the development, application and dissemination of novel biomedical informatics theories and methods capable of **driving biological discovery, generating and translating knowledge and advancing personalized healthcare.** Biomedical informatics subdomains, such as bioinformatics, computational biology, translational bioinformatics, clinical research informatics, clinical informatics and imaging informatics generate these theories and methods. Crosscutting core competencies underlie our mission and vision and support and enable the research, education and service our department conducts. Specifically, the understanding of **human factors** influencing the design of intelligent systems; the use of **high performance computing, machine learning, biostatistics and omics methods generation** principles to facilitate the analysis of multi-dimensional data; the generation of information and knowledge from component sources using the principles of **data science and data analytics;** and the **rigor and reproducibility** in our study and research design.



BMI "By The Numbers"

These data cover fiscal years 2016 and 2017 (to date).

- Faculty: **27**
- Research staff: **45**
- Administrative staff and students: **8**
- Number of grant proposals submitted (to NIH, AHRQ, NSF, and other federal/ private external agencies): **43**
- Number of current funded awards: **140**
- Total potential funding of all submitted proposals (to NIH, AHRQ, NSF,and other federal/ private agencies): **$23,324,800**
- Total funding awarded (based on expenditure allocation): **$12,366,780**
- Number of publications: **205**

The Department of Biomedical Informatics was established in 2001 at The Ohio State University. Our rapidly expanding program of basic and applied biomedical informatics innovation is driven by biological and clinical problems generated by the comprehensive basic science and clinical units that make up The Ohio State Wexner Medical Center, as well as by ongoing collaborations with the larger research and operational communities found in the university and more broadly in central Ohio, nationally and internationally.

The department houses many undergraduate, graduate, post-graduate, professional, and both locally and nationally distance learning educational programs. The department is also home to a suite of biomedical informatics shared services whose expertise help to support and enable the needs of the basic, clinical and translational research communities in the university and central Ohio areas.

Reflecting its mission, the department is broadly organized into three divisions.

- **Clinical and Translational Informatics** is led by Interim Division Director Dr. Metin Gurcan and focuses on the development and application of informatics theories, methods and emergent technologies to address fundamental data, information and knowledge management challenges in clinical care, clinical research and translational research. The innovations derived from this division help to improve and enable personalized healthcare, standards for data used in clinical and population health studies and patient care workflows. The division includes individuals whose expertise encompasses clinical research informatics, translational bioinformatics and their intersections, clinical informatics, public health informatics, and health analytics.

- **Computational Biology and Bioinformatics** is led by Division Director, Dr. Kun Huang. The complementary disciplines of bioinformatics and computational biology in this division focus on collecting, classifying, storing and analyzing biochemical and biological information, particularly as applied to the basic, biomedical and clinical sciences. Faculty expertise in this division spans bioinformatics, computational biology,

genomics, next generation sequencing and translational bioinformatics. Dr. Kevin Coombes, professor in this division, research focuses are statistical, mathematical and computational methods and he serves as the director of Comprehensive Cancer Center Bioinformatics Shared Resource (BISR) and associate director of Comprehensive Cancer Center Biostatistics Shared Resource (BSR).

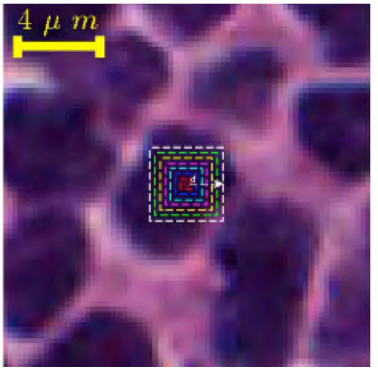
- **Data Science** is led by Dr. Soledad Fernández, who also serves as the director of the Comprehensive Cancer Center Biostatistics Shared Resource (BSR) and the director of the Biostatistics Program of the Center for Clinical Translational Science (CCTS). In addition, she serves as director of the biostatistics core in five active P01s and a SPORE (Retrovirus Models of Lymphocyte Transformation, and Disease, CA100730; Breast TumorMicroenvironment CA097189; Genetic and signaling pathways in epithelial thyroid cancer CA124570-02; Childhood Sarcoma CA165995; Oncolytic Virotherapy of Malignant Gliomas CA163205; The Ohio State University and MD Anderson Cancer Center Thyroid Cancer SPORE 1P50CA168505-01A1). Data science is a multidisciplinary field concerned with the generation of information and knowledge from diverse and heterogeneous component data sources. Data scientists employ a variety of quantitative and computational methods to place complex data sets in context and render them actionable in the form of human- or computer-interpretable knowledge. Our faculty expertise in this field span biostatistics, high performance computing, machine learning, and data analytics.

Research

The Department of Biomedical Informatics is home to a variety of interdisciplinary research projects, spanning numerous departments, colleges and organizations. Exemplary projects from faculty in each division can be found below:

Division of Clinical and Translational Informatics

Metin Gurcan, PhD



In conjunction with his Clinical Image Analysis Lab, Dr. Metin Gurcan is working in the imaging informatics research field. The qualitative analysis of histopathological, radiological and other clinical images is time-consuming and subject to inter- and intra-reader variations, undesirably affecting clinical outcome. The Clinical Image Analysis Lab at BMI (http://www.bmi.osu.edu/cialab) is developing image analysis systems for computer-assisted interpretations of clinical images to help pathologists, radiologists, dermatologists, biologists and oncologists, currently supported by the NIH (U24, R01, U01, R56 and R21), Department of Defense, American Acne and Rosacea Society, American Lung Association and Ohio State University Wexner Medical Center for Clinical and Translational Science.

Analysis of nuclei characteristics through image analysis. Kornaropoulos E, Niazi M, Lozanski G, **Gurcan MN**, "Histopathological image analysis for centroblasts classification through dimensionality reduction approaches," Cytometry: Part A, vol. 5, issue 85, pp. 242-255, 2014.

Courtney Hebert, MD, MS

Dr. Courtney Hebert leads a multidisciplinary team working to leverage local clinical and microbiology data to develop a model to estimate the probability of coverage of different antibiotic regimens ("Automation and Multi-site validation of a Personalized Empiric Antibiotic Advisor," R01 awarded by the National Institute of Allergy and Infectious Disease). The goal is to develop a decision support tool that will help physicians select antibiotics that have the best chance of working for each individual patient.

In conjunction with Dr. Susan-Moffatt-Bruce in the Deparment of Surgery, Dr. Hebert leads one of the three major projects as part of this quality and patient safety grant ("The Institute for the Design of Environments Aligned for Patient Safety," Dr. Hebert, P30 awarded by the Agency for Healthcare Research & Quality). The goal of this project is to create a robust data and novel visualization infrastructure in order to better track and prevent hospital-acquired infections.

Division of Computational Biology and Bioinformatics

Kun Huang, PhD
IGPSe: A visual analytic system for integrative genomic-based cancer patient stratification. BMC Bioinformatics. 2014 Jul 10;15:203.
doi: 10.1186/1471-2105-15-203.

Figure 5 The clustering analysis page.

Dr. Kun Huang developed a visual analytic system called Interactive Genomics Patient Stratification explorer (iGPSe) which significantly reduces the computing burden for biomedical researchers in the process of exploring complicated integrative genomics data. This system integrates unsupervised clustering with graph and parallel sets visualization and allows direct comparison of clinical outcomes via survival analysis. Using a breast cancer dataset obtained from the The Cancer Genome Atlas (TCGA) project, his lab was able to quickly explore different combinations of gene expression (mRNA) and microRNA features and identify potential combined markers for survival prediction (Ding, Huang and Machiraju. BMC Bioinformatics 2014 Jul 10;15:203).

Kevin Coombes, Ph. D.

Dr. Kevin Coombes is collaborating with researchers in Hematology and in Pathology to find statistical models from gene expression profiles that can predict response to treatment in chronic lymphocytic leukemia (CLL). Dr. Lynne Abruzzo (Pathology) performed microarray profiling experiments on samples from newly diagnosed CLL patients who were treated with the standard-of-care combined immunochemotherapy regimen of fludarabine, cyclophosphamide, and rituximab (FCR). His lab found a 25-gene signature that separates CLL patients into three groups with good, intermediate, or poor response. To validate the signature, his lab is working with a group of researchers in Germany who conducted the CLL8 trial of front-line FCR therapy.

Dr. Coombes is also working on another gene expression signature project in collaboration with Drs. John Byrd and Jennifer Woyach (Hematology). They performed an RNA-Sequencing study of CLL patients treated on clinical trials with ibrutinib, the most promising new therapy for CLL. Dr. Coombes' lab found a 60-gene signature that can predict which patients will undergo a Richter's transformation (i.e., the clonal development of a subsequent diffuse large B-cell lymphoma, which is usually fatal within six months). Drs. Byrd and Woyach are now collecting additional samples that will be used to validate this signature. Both gene expression signatures were based on novel methods developed by Dr. Coombes.

Division of Data Science

Research on power estimation and sample size calculations to control type I error. Faculty in the Department of Biomedical Informatics Center for Biostatistics work on methods to ensure studies are appropriately powered and sample sizes are such that animals or subjects in lab experiments, clinical trials as well as high throughput data studies are efficiently used.
Studies with inadequate sample sizes may produce false positive or false negative results, where spurious

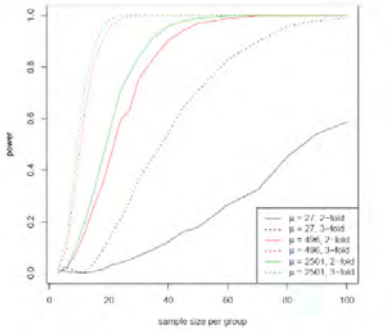


Figure 12 Power plot for the Wald test with equal dispersion parameter for TCGA breast cancer data set. Power is calculated at 3 different mean expression levels and 2 different fold changes under the alternative hypothesis with $\alpha = 0.001$. Power is higher for larger sample size and higher fold changes.

findings can lead to needless use of animals or subjects in subsequent studies; or potentially important findings go undetected. This is an important area of research that has direct implications in the design and planning of all biomedical studies, so resources are efficiently used and animals or subjects are not wasted. (Yu L. et al. Statistical Applications in Genetics and Molecular Biology. 2011. Vol. 10: Iss. 1, Article 42 ; methods research funded by P01: Genetic and signaling pathways in epithelial thyroid cancer CA124570-02)

Power Analysis for RNA-Seq Differential Expression Studies (Drs. Lianbo Yu, Soledad Fernández, and Guy Brock) Sample size calculation and power estimation are essential components of experimental designs in biomedical research. It is very challenging to estimate power for RNA-Seq differential expression under complex experimental designs. Moreover, the dependency among genes should be taken into account in order to obtain accurate results. Yu, Fernández and Brock developed a framework for power estimation of RNA-Seq data. The proposed procedure is able to control the false positive error rate properly at the nominal level. Yu, Fernandez, Brock. BMC Bioinformatics. 2016 (under review)

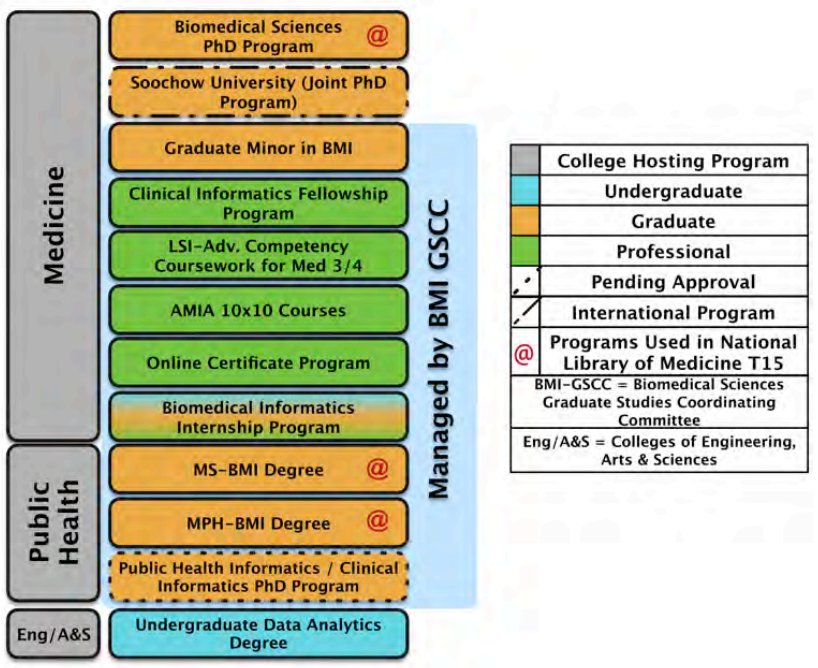
Options and Considerations for Adaptive Laboratory Experiments (Dr. Lai Wei) Lai Wei developed a sample size re-estimation design for lab experiments. This method described in the literature for large clinical trials has been adapted for small sample sizes and published by BMI-Center for Biostatistics faculty (Wei, and Jarjoura 2015; Stat Biosc. 2015 October 1; 7(2): 348–366). The approach allows for the need to run a second experiment when significance is not achieved in the first experiment, and unbiasedly combines the data from both experiments to increase power. This method strongly controls Type I error and it requires to run a second experiment when promising results are obtained from the initial experiment, i.e. it requires initial non-significant p-values from the first experiment to be smaller than a set threshold value (for example, 0.10).

Methods for re-use of nested case-control studies (Dr. Erinn Hade) While recent statistical methodologic literature have provided insight into the re-use of nested case control studies for estimating secondary outcomes, these methods are not regularly employed and very little has been published in the epidemiologic literature to endorse or illustrate their use. Moreover, best practices surrounding the re-use of more than one nested case control study is lacking and novel methods are needed to take advantage of these existing data. We develop methodology to optimize the re-use of these data and use them to examine the associations between omega-3 fatty acids and breast cancer risk in the Women's Health Initiative. (HHSN268201100002C NHLBI Women's Health Initiative Regional Field Center Program)

Projecting Waitlist Outcomes for Liver Transplant Candidates.
Dr. Brock and colleagues have used multistate models and causal inference methods to address the disparity in liver transplantation access between hepatocellular carcinoma (HCC) and non-HCC patients. This work has been published in two articles in the journal Liver Transplantation with an accompanying editorial for the 2nd article. Projected outcomes of 6-month delay in exception points versus an equivalent Model for End-Stage Liver Disease score for hepatocellular carcinoma liver transplant candidates.
Alver SK, Lorenz DJ, Marvin MR, Brock GN. Liver Transpl. 2016 Oct;22(10):1343-55. doi: 10.1002/lt.24503. PMID: 27343202

MELDEQ : An alternative Model for End-Stage Liver Disease score for patients with hepatocellular carcinoma. Marvin MR, Ferguson N, Cannon RM, Jones CM, Brock GN.
Liver Transpl. 2015 May;21(5):612-22. doi: 10.1002/lt.24098. PMID: 25694099

Education



The Department of Biomedical Informatics is home to a suite of educational programs, spanning the undergraduate, graduate, and professional levels, in both in-person and online modalities. The department's educational activities are organized and administered by the Biomedical Informatics Graduate Studies Coordinating Committee (BMI-GSCC), which is led by co-chairs, Drs. Courtney Hebert and Kevin Coombes. Given the interdisciplinary nature of the field, the programs span multiple colleges and are either directly managed by the BMI-GSCC or administered by staff in the other colleges. Programs that are directly managed by the BMI-GSCC, as indicated above, include recruiting, admissions, academic advising, teaching coursework, and monitoring trainee progress for graduation. Programs that are not directly managed by the BMI-GSCC are those which require trainees to take biomedical informatics coursework from our department, but are otherwise not affiliated with our department.

Biomedical Informatics Masters Programs

The master of science and master of public health programs (both with specialization in Biomedical Informatics) are graduate programs that the Department of Biomedical Informatics (in the College of Medicine) operates in conjunction as a hybrid program with the College of Public Health. The programs were created in 2012. The MS program is geared towards individuals who wish to pursue a research degree in the field of biomedical informatics, whereas the MPH degree is more operationally focused, allowing for trainees to pursue operational experience in their practicum experience under the direct guidance of an operational mentor. Both programs provide a foundation in the field of public health, requiring trainees to take coursework in biostatistics, epidemiology, health service management and policy, environmental health, and ethics in addition to the required biomedical informatics coursework. The programs are adaptable in that they can be focused to either the clinical and public health informatics spectrum or to the bioinformatics discipline depending on the electives trainees choose to take. The programs are both 48 credit hours long and take two years to complete full-time.

Year	# Applied	# Accepted	# Entered	# Ongoing	# Graduated	# Left
2012	6	5	5	1	4	0
2013	18	10	7	0	3	4
2014	17	11	8	5	3	0
2015	16	12	9	9	0	0
2016 (to date)	15	6	6	6	2	0
Total	**71**	**44**	**35**	**21**	**12**	**4**

Biomedical Informatics Related Doctoral Programs
The biomedical sciences graduate program is a nationally ranked integrated doctoral degree granting program housed in the College of Medicine. Doctoral trainees take a core curriculum in biomedical sciences and then are able to customize their educational experience by selecting a specialization field. The trainees involved in educational and research experiences with the Department of Biomedical Informatics are the ones who choose the Computational Biology and Bioinformatics or Translational Bioinformatics specialization research areas of emphasis. These specialization areas are led by Drs. Kevin Coombes and Kun Huang in the Department of Biomedical Informatics. The degree program takes four and a half years to complete.

Federally Funded Training Fellowships
The Department of Biomedical Informatics is home to a National Library of Medicine funded T15 program entitled, “Clinical and Translational Research Informatics Training Program (CTRIP)” and a Big Data to Knowledge (BD2K) funded supplement entitled, “Multi-Model and Integrative Data Analytics Training Program (MIDAS)”. The goal of these two programs is to provide a comprehensive educational and research experience for predoctoral (nine individuals) and postdoctoral (three individuals) trainees in the fields of biomedical data science, clinical research informatics, and translational bioinformatics.

Participating fellows also have the ability to gain vital industry experiencing through the robust list of non-academic partners whose expertise are in health analytics, health information management, GIS, nutritional analytics, cyber security, and software engineering found throughout Central Ohio. The T15 and T15 Supplemental programs are led by Dr. Kevin Coombes, whom is supported in this endeavor by Drs. Kun Huang, Soledad Fernández, Guy Brock, and Courtney Hebert.

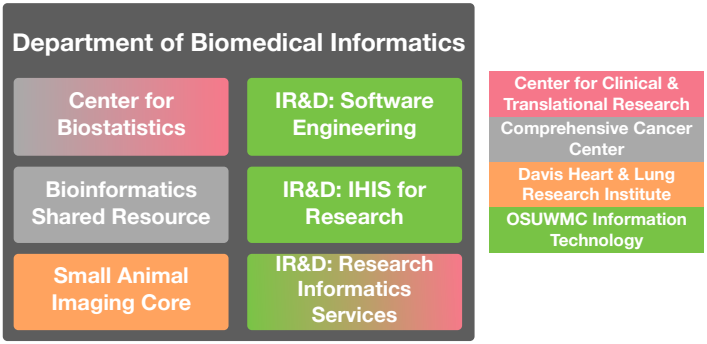
Summer Internship Program
The Department of Biomedical Informatics houses a summer internship program that is led by Dr. Po-Yin Yen, clinical assistant professor.
The program is in its fourth year of operation and receives over 200 applications annually for the 15-to-20 funded slots each year. The program is 12 weeks long and runs from the end of May until the beginning of August each year. The interns are selected from regional high schools, and undergraduate and graduate programs across the country. The program

involves two weeks of comprehensive training in performing research projects, followed by hands-on research experience in a variety of sub-disciplines of biomedical informatics depending on which faculty member they work with. Interns who have completed the program have gone on to publish in peer reviewed journals, received paper and presentation awards at national meetings, and to pursue graduate training in the field of biomedical informatics at prestigious universities across the country.

Undergraduate Data Analytics Program
The Department of Biomedical Informatics is part of a campus-wide data analytics undergraduate program, which includes a Biomedical Informatics emphasis track (http://data-analytics.osu.edu). As part of this program, undergraduate students in years 3 and 4 of their studies can specialize in a core didactic and experiential biomedical informatics curriculum. This new program will ultimately serve as a "feeder" for the graduate training programs at the university. The faculty contact for this specialization is Dr. Kun Huang. The program is housed in the College of Arts & Science, but includes coursework from the Colleges of Arts & Science, Agricultural Sciences, Engineering, Public Health, and Medicine.

Online Graduate Certificate Program
The certificate program in biomedical informatics is a program that is currently in the approval process at the university. It is entirely online and customizable to allow individuals to specialize in health analytics, clinical informatics, clinical research informatics, or translational bioinformatics. The program is five courses long and will take one-to-two years to complete full-time. The target audience for this program is mid-career professionals who need training in biomedical informatics tools, theories, and methods, but do not have time to pursue a full graduate degree. The program will allow us to expand our degree offerings into the professional and technical communities, including to those individuals who are working in the non-profit, healthcare, biomedical, clinical, and data science communities. This program is led by Dr. Bobbie Kite and is slated to be approved for admission by August 2017.

Service and Support



The Department of Biomedical Informatics in conjunction with other groups on campus, including the Center for Clinical and Translational Science (CTSA funded), the Comprehensive Cancer Center (NCI funded), Davis Heart and Lung Research Institute, and OSUWMC Information Technology, hosts several service lines to assist research investigators in the biomedical, cancer, clinical, and translational research communities at The Ohio State University and throughout Central Ohio. The department's shared services and service lines are coordinated under the direction of Dr. Fernández, Vice Chair of Operations in the Department of Biomedical Informatics.

Biomedical Informatics Shared Resource

The Biomedical Informatics Shared Resource (BISR), led by Dr. Kevin Coombes, 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. The BISR offers computational biology and bioinformatics consultative services that include:

- Analysis of next generation sequencing data including Exome-seq, RNA-seq, ChIP-seq and whole genome re-sequencing.
- Analysis of microarray datasets including mRNA (Affymetrix), SNP, and micro-RNA.
- Analysis of nCounter NanoString data.
- Analysis of publicly available datasets using search parameters defined by the OSUCCC client, for example from the Gene Expression Omnibus (GEO) database of microarray results, The Cancer Genome Atlas (TCGA), and International Cancer Genome Consortium (ICGC) data portals that allows access to results of thousands of deep sequencing projects.
- Pathway analysis of results from microarray and sequencing data.

Center for Biostatistics
The Center for Biostatistics, led by Dr. Soledad Fernandez, is composed of biostatisticians at the masters and doctoral level whose goal is to support and enable the research projects for investigators in the biological, biomedical, and clinical communities at Ohio State University, specifically in the Comprehensive Cancer Center and Wexner Medical Center. Their goals are to:

- to collaborate with investigators in planning and designing laboratory experiments, clinical trials, and population-based studies;
- to conduct statistical analysis of data, especially complex analysis and modeling needed for microarray studies and other types of high dimensional data; and
- to identify innovative and effective statistical methods in response to specific project needs that will enhance the quality of design, interpretation and communication of results.

IR&D: Software Engineering
The Software Engineering Group, led by Omkar Lele, in the Department of Biomedical Informatics, provides high-quality production grade software engineering and support within the informatics domain. Our focus is to provide customized solutions that leverage our expertise in technology to clients within the healthcare and allied research domains when their business/research strategies cannot solely be satisfied by off-the-shelf packaged software.
We work closely with our clients to understand their business objectives, accurately define requirements, provide subject matter expertise within the domains of healthcare and research as well as to design, develop, test and integrate the customized software utilizing an agile methodology. Our extensive experience includes a variety of deployment architectures which include enterprise, web, mobile and cloud-based models.

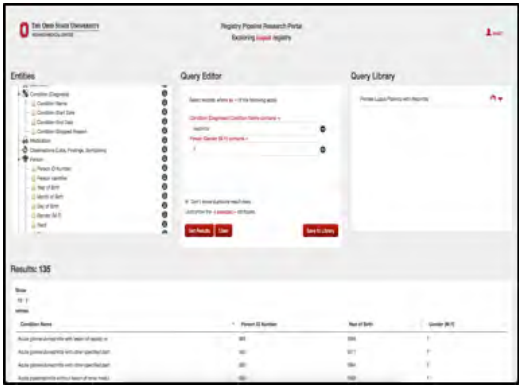
Our proprietary software products include some of the following: Electronic Data Capture (EDC) tools, custom web applications, clinical registries, as well as search and discovery applications shared across multiple geographically dispersed consortium sites which were customized for each client.

We provide the following core technology competencies:

- Software Development (Architecture & Implementation/Design & Development)
- Business Analysis
- Agile Development – Management
- Artificial Intelligence
- NLP
- Machine Learning
- Cognitive Science
- Semantics/Reasoning
- Data Mining
- Large Scale Computing (Hadoop etc.)
- Data Visualization
- User Interface (HCI)

Example interdisciplinary projects from Software Engineering:

Scarlet – Scalable Analytics Registry for Rapid Learning and Translational Science is a Disease Registry Platform.



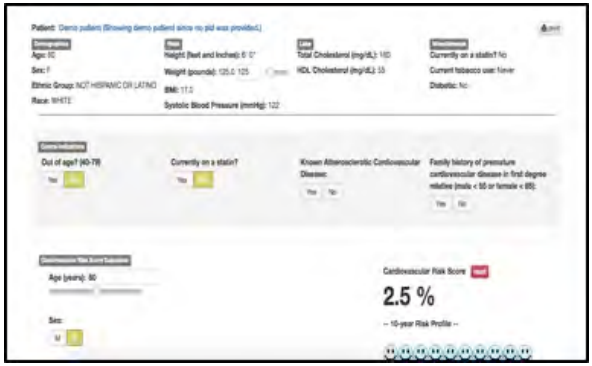
- Cohort data at your fingertips at any time, including approximately 2,000 labs, 3,000 procedures, 5,500 conditions and diagnoses, and 7,000 drugs, Lupus (278 patients), HCL (205 patients), Sarcoma (77 patients), Myeloma (1,576 patients)
- Data tool for the Health Science/Service Research Comm.
- Multi-source data aggregation (IHIS + Redcap)
- Cost-effective, secure and flexible access (no costly data request processes)
- Get started for $10,000

Cardiovascular Risk Score Calculator

- OSU health services research faculty collaboration
- With IHIS, in IHIS (no datamart updates, data pulled live)
- Patient centered design (for clinical encounters)
- Robust, extensible and scalable

IR&D: IHIS for Research

The Informatics Research & Development IHIS for Research service allows biomedical and clinical investigators at OSU to leverage the Ohio State Wexner Medical Center's Electronic Health Record IHIS for their research projects. This program is led by Jeremy Harper. Their services include:



- Modifying the Electronic Health Record (EHR) to support and maintain OSU's research mission
- Novel web applications that are directly embedded inside the EHR platform
- Collaboration on prospective studies and grants to identify potential methods to leverage the system to collect data
- Patient to subject recruitment services through the EHR
- Custom workflows, ensuring research compliance, data capture and efficiency
- Patient/Subject engagement in the research mission of The Ohio State University Wexner Medical Center
- Genomics research in relation to patient care

IR&D: Research Informatics Services

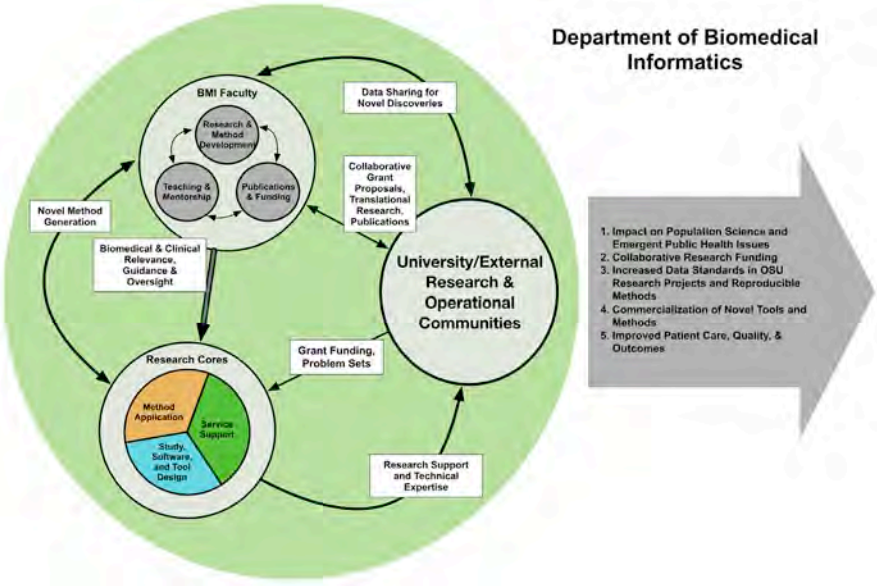
In collaboration with The Ohio State University's Center for Clinical and Translational Science (CCTS), the Informatics Research and Development Research Informatics Services (RIS) core provides investigators, trainees, and research staff at OSU and Nationwide Children's Hospital (NCH) with access to state-of-the-art biomedical informatics expertise, technologies and data management platforms. Our team leverages the skills and tools that exist within OSU's Department of BMI and OSUWMC's Information Technology Department (OSUWMC-IT) in order to provide an informatics-based catalyst in support of novel, multi disciplinary clinical and translational science endeavors. This group helps biomedical and clinical researchers with the following items:

- Research Data Capture
- Database Consultation
- Data Integration
- IW Data Access
- Letter of Support
- Collaboration Tools
- Informatics Training
- Informatics Consultation

Small Animal Imaging Core

The Small Animal Imaging Core, led by Dr. Kimerly Powell, is a state-of-the-art imaging core facility capable of imaging rodents and small animals for research purposes. It is available to all investigators at The Ohio State University as well as to those at other academic and industrial institutions. It includes high-resolution small animal imaging equipment, image post-processing hardware and software, technical support personnel, and a direct interface with the Ohio Supercomputer facilities.

The Intersection of Service, Research and Education



As in this graphic, there is an intrinsic relation between the faculty and research support units in the Department of Biomedical Informatics and the university and external research communities. The research and educational activities our departmental faculty are involved in translations into novel method generation which is developed into innovative tools and technologies in conjunction with the research service support groups in the department. Those developed tools and technologies are then turned into deployable tools and methods that enable and support investigators in the research communities at Ohio State. The findings from these supported projects generate data that are then shared with the biomedical informatics faculty to inform future research study design and hypothesis generation. This integrated approach to research, education, and service leads to novel, interdisciplinary research proposals, technology commercialization, increased detailed data quality, standards, and study design and publications in high impact journals.

Dedicated to creating the future of medicine
to improve people's lives.

THE MEDICAL CENTER

The Ohio State University Wexner Medical Center is comprised of the Ohio State University Health System (OSUHS), the College of Medicine, the health sciences library and the Faculty Group Practice. It is one of the largest and most diverse academic medical centers in the country and the only academic medical center in central Ohio. As the Midwest's highest ranked hospital for safety and patient care according to University HealthSystem Consortium, we are committed to continuously setting the standard for world-class care. Here at Ohio State's Wexner Medical Center, our mission is to improve people's lives through innovation in research, education and patient care.

Mission:

To improve people's lives through innovation in research, education and patient care

Vision:

Working as a team, to shape the future of medicine by creating, disseminating and applying new knowledge and by personalizing health care to meet the needs of each individual

Values:

Excellence; leadership; collaboration; integrity and personal accountability; openness and trust; diversity in people and ideas; change and innovation; simplicity in our work; empathy and compassion

PATIENT CARE

Ohio State's Wexner Medical Center is earning international distinction in several programs including Cancer, Critical Care, Heart, Imaging, Neurosciences and Transplantation. These programs, and key research programs of Behavioral Health, Biomedical Informatics and Human Genetics, are key to providing science-based and individually tailored patient care. In addition, we offer clinical care in virtually every medical specialty and subspecialty through a unified physician practice, representing more than 1,000 pre-eminent physicians. Our six hospitals and network of community-based offices and care centers manage more than 1 million patient visits each year.

Health care at The Ohio State University is future-focused and driven by our mission to improve people's lives. Our staff of more than 19,000 is earning international distinction by delivering health care that is predictive, preventive, personalized and participatory.

- *U.S.News & World Report* named us to its 2015 list of "America's Best Hospitals," based on quality, outcomes and reputation, for the 23rd consecutive year
- Ranked third among the 104 academic medical centers by the University HealthSystem Consortium and one of only 12 academic medical centers to receive a 2014 Quality Leadership Award for superior performance in delivering high-quality, safe, efficient, patient-centered and equitable patient care
- Named a 2013 Top Performer on Key Quality Measures® by The Joint Commission; one of only of 712 hospitals to achieve the Top Performer distinction for the past two years
- We had more treatments ranked (18 in all) than any other central Ohio hospital in Healthgrades' 2013 national survey of clinical outcomes, patient satisfaction, patient safety and health conditions
- Home to four Magnet® designated hospitals. Only 7 percent of registered hospitals in the United States earn this recognition for nursing excellence. We were the first hospital in central Ohio to achieve Magnet® status
- Provide more than $170 million in annual community benefits through charity care, outreach efforts and other support

OSU Wexner Medical Center hospitals statistics

	FY2013	FY2014	FY2015
Total Admissions	56,592	57,024	58,211
Live Births	4,482	4,861	4,882
Total Outpatient Visits	1,485,147	1,593,519	1,664,152
Total Emergency Visits	118,280	117,977	125,327
Total Inpatient Surgeries	15,877	15,561	15,951
Total Outpatient Surgeries	22,750	22,820	25,000

The James Cancer Hospital and Solove Research Institute, which opened in December 2014, combines patient care, teaching and research space on all floors.

THE OHIO STATE UNIVERSITY HEALTH SYSTEM INCLUDES SIX HOSPITALS:

- **University Hospital:** The flagship patient care facility offers more than 900 beds. It is a designated Level 1 Trauma Center.
- **James Cancer Hospital and Solove Research Institute:** An NCI designated comprehensive cancer center, it's one of the nation's premier centers for the prevention, detection and treatment of cancer. It features the world's most advanced cancer hospital, opened in December 2014, which combines patient care, teaching and research space on all floors.
- **OSU Harding Hospital:** This 73-bed hospital offers the most comprehensive psychiatric and behavioral health services in Central Ohio in inpatient and outpatient settings.
- **Richard M. Ross Heart Hospital:** A *U.S.News & World Report* top 50 Heart Hospital encompassing 150 beds.
- **University Hospital East:** A full-service 175-bed hospital with 14 operating rooms, a 23-bed Intensive Care Unit, a 9-bed preoperative suite and a 14-bed (plus 1 isolation bed) post-anesthesia care unit.
- **Dodd Hall Rehabilitation Hospital:** A 60-bed inpatient rehabilitation facility, ranked among the top programs in the country by *U.S.News & World Report*, specializing in stroke, brain and spinal cord rehabilitation.
- *Coming Soon* **Brain and Spine Hospital:** The 90-bed hospital, scheduled to open in 2016, will provide advanced clinical services and innovative research to improve the diagnosis, treatment and cure of neurological diseases.

Ohio State's Faculty Group Practice

Ohio State physicians belong to our Faculty Group Practice (FGP), a physician-led organization focused on clinical quality, patient safety and physician efficiency and productivity.

- The FGP facilitates collaboration among clinical departments and between physicians across Wexner Medical Center.
- Our physicians benefit from streamlined administrative functions so that valuable resources can be directed toward innovative program development, improved outcomes and quality assurance.
- The FGP supports and prepares its members and Ohio State in the rapidly changing healthcare environment.

The renovated Thompson Library, a learning hub for the campus, has won multiple awards for its design and user friendliness. More than 13,000 people visit the library each weekday.

EDUCATION

The Ohio State University is one of the most comprehensive universities in the world. Our breadth allows students to pursue their academic passions, while also benefiting from novel interdisciplinary collaborations.

Our College of Medicine is consistently ranked among the top 35 medical schools in the United States and among the top 11 at public universities. The college's innovative Lead. Serve. Inspire. curriculum places students in clinical settings from the start of their first year. It fully integrates foundational and clinical science to prepare students for the future of medicine. We are one of the few schools in the world to offer five dual medical degrees: MD/PhD, MD/MBA, MD/JD, MD/MHA and MD/MPH.

The School of Health and Rehabilitation Sciences offers seven undergraduate and five graduate programs, such as athletic training, health information management and systems, health sciences, medical dietetics, medical laboratory sciences, radiologic science and therapy and respiratory therapy. Graduate programs include physical therapy, occupational therapy, as well as traditional graduate programs in allied health and anatomy. The school has more than 1,700 students.

More than 60 accredited graduate and residency programs train more than 800 residents and fellows each year. In addition, physicians in more than 145 countries subscribe to Ohio State's web-based continuing medical education training programs each year.

The Ohio State University has seven health sciences colleges on our campus, more than any other U.S. university:

- **College of Dentistry**
- **College of Medicine**
- **College of Nursing**
- **College of Optometry**
- **College of Pharmacy**
- **College of Public Health**
- **College of Veterinary Medicine**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The Ohio State University Health Sciences Center

One of the most comprehensive health sciences campuses in America – with colleges of Medicine, Nursing, Pharmacy, Dentistry, Optometry, Public Health and Veterinary Medicine in close proximity – is adjacent to the tremendous resources and expertise of The Ohio State University campus in Columbus. This proximity fosters collaborations with other university departments, which makes Ohio State unique in the United States in its potential to promote scientific partnerships and the direct translation of research discoveries into new medical therapies and technologies. Such efforts have resulted in the Mathematical Biosciences Institute and the OSU Biomedical Engineering Center. Dual degree programs such as MD/MBA, MD/JD and MD/PhD have been developed with the College of Law, the Fisher College of Business and the College of Public Health.

Some of our most recognized research centers are:

- The Dorothy M. Davis Heart and Lung Research Institute
- The Ohio State University Comprehensive Cancer Center
- The Institute for Behavioral Medicine Research
- The OSU Center for Neuromodulation
- The Wright Center of Innovation in Biomedical Imaging
- The OSU Center for Microbial Interface Biology
- The OSU Center for Clinical and Translational Science

RESEARCH

Ohio State is home to many important research discoveries and the faculty and staff who support the research mission help make this a great place. Our medical center has more than 20 research centers and institutes, and 25 core research laboratories that promote collaboration among experts from virtually all departments, divisions and brand campuses of The Ohio State University. It has grown dramatically since 2000, exceeding the average growth rate of top-tier U.S. medical schools in funded research, journal publication and revenue-generating technology licenses.

- One of only 62 members of a National Institutes of Health consortium that speeds the translation of scientific discovery into better patient care
- Six faculty members currently elected to the Institute of Medicine and two to the National Academy of Sciences
- One of only 41 National Cancer Institute-designated comprehensive cancer centers (CCCs) in the United States; the NCI named our CCC “exceptional” – its highest ranking
- More than 1,000 active research studies in virtually every medical specialty

The Dorothy M. Davis Heart and Lung Research Institute brings together more than 500 experts from eight colleges at Ohio State.

SHARED GOVERNANCE

The Ohio State University Board of Trustees has full fiduciary authority for both the academic and health sciences organizations. The Ohio State University Wexner Medical Center Board is the governing body responsible to the University Board of Trustees for operation, oversight and coordination of the health sciences entities. The Wexner Medical Center Board is responsible for the development and strategic allocation of resources, planning and delivery of medical services, and other related powers and duties and is subject to the ultimate authority of the University Board of Trustees.

Ohio State's Wexner Medical Center Board is composed of up to 15 voting members:

- Up to five members of the University Board of Trustees appointed annually by the chair of the University Board of Trustees and ratified by the University Board of Trustees
- Up to six public members appointed by the chair of the University Board of Trustees in consultation with the university president and the chair of the University Board of Trustees Governance Committee and ratified by the University Board of Trustees
- Four ex-officio voting members consisting of the chair of the University Board of Trustees, the university president, the university chief financial officer, and the incumbent senior vice president of Health Sciences/CEO of the Wexner Medical Center
- Ohio State's Wexner Medical Center Board also includes the following ex-officio nonvoting members:
    - The dean of the College of Medicine
    - The chief executive officer of the Faculty Group Practice
    - One chief executive officer or executive director of a Wexner Medical Center hospital on a rotating basis for a two-year term as appointed by the chair of the University Board of Trustees and ratified by the University Board of Trustees

Sheldon M. Retchin, MD, MSPH

Dr. Sheldon M. Retchin serves as executive vice president of Health Sciences of The Ohio State University and chief executive officer of Ohio State's Wexner Medical Center.

Dr. Retchin is one of the nation's most respected and prominent academic medical center leaders. He previously served as senior vice president for Health Sciences at Virginia Commonwealth University (VCU) and CEO of the VCU Health System in Richmond, positions he has held since 2003. He is a board certified internist with qualifications in geriatric medicine. VCU Medical Center, part of a large public university in an urban setting, has been consistently ranked by *U.S.News & World Report* as one of the nation's top hospitals.

Dr. Retchin came to Ohio State with an extensive background in leadership and academic medicine, including helping design the Virginia Coordinated Care Program that has been celebrated as an exemplar of cost-effective programs caring for an inner city, uninsured population. He is also a recognized expert in health policy and healthcare delivery, serving on numerous national and international panels related to managed care, costs of care and assessments of the Medicare program.

Recently, Dr. Retchin was appointed to the Medicaid and CHIP Payment and Access Commission (MACPAC) by the U.S. Comptroller General. MACPAC is the federal agency that advises Congress, the Secretary of the U.S.

Department of Health and Human Services and states on a wide range of issues affecting these programs. He has testified before Congress as a recognized authority on the role of the safety net in health services delivery and has published more than 90 articles, chapters and books on the costs, quality and outcomes of care.

In his position, Dr. Retchin is managing an ambitious agenda to sustain and further advance the Wexner Medical Center's reputation for excellence. Broad initiatives include improving the medical center's competitive position, strengthening relationships with the university's other academic partners and developing a long-term strategy.

Dr. Retchin earned his bachelor's degree, medical degree and master's degree in Public Health from the University of North Carolina at Chapel Hill, where he was also a Robert Wood Johnson Clinical Scholar.

An avid swimmer, Dr. Retchin has patented the technology for an underwater recreational music device that uses bone conduction to transmit sound.

"I am a firm believer that health care is a team sport. At The Ohio State University Wexner Medical Center, we are focused on providing the highest quality and safest care to our patients, ensuring our continued commitment to sponsored basic and clinical research and continuing to train the best minds in medicine."


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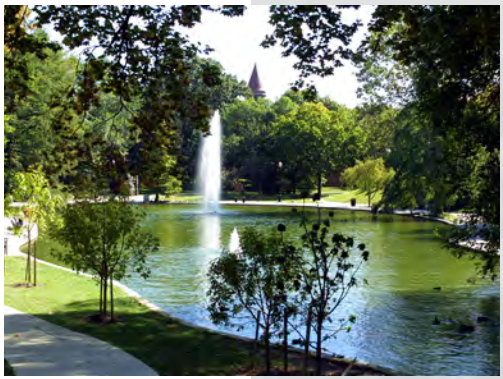
THE OHIO STATE UNIVERSITY

Founded in 1870 as part of the Morrill Land Grant Act, The Ohio State University is one of the nation's largest major comprehensive public research universities, serving more than 64,000 undergraduate, graduate and professional students. With more than 40,000 employees, OSU is Ohio's 5th largest employer. Located in Ohio's capital city of Columbus, The Ohio State University is a major educational and economic force through its teaching, research and service mission. With more than 500,000 living alumni around the world, The Ohio State University community is vast and diverse, having impact on our global society in education, research and public service.



The university's high-quality academic programs are extensive. There are 14 colleges at The Ohio State University, granting degrees in more than 160 major areas of study. The university's 49,000 undergraduates have broad opportunities to major in the arts, architecture, biological sciences, business, communication, education, engineering, food, agricultural and environmental sciences, human ecology, humanities, nursing, mathematics and physical sciences, music, natural resources, public health, social and behavioral sciences, social work, and health and rehabilitation sciences. Graduate-professional programs include these areas as well as dentistry, law, medicine, optometry, pharmacy and veterinary medicine.

One of Ohio's greatest assets, The Ohio State University is a world-class public research university and the flagship teaching and research institution in the state. The institution provides a distinctive educational experience for students and pursues cutting-edge interdisciplinary research that brings together scholars from diverse disciplines to solve key problems in society.

OHIO STATE'S PRESIDENT

Michael V. Drake, MD, was appointed president of The Ohio State University Jan. 30, 2014 and assumed responsibilities as president June 30, 2014.

Dr. Drake previously served as chancellor of the University of California, Irvine, a position to which he was appointed in July 2005. He also served as Distinguished Professor of Ophthalmology (School of Medicine) and Education (School of Education).

During his tenure at UC Irvine, the number of applicants for undergraduate admissions increased by more than 90 percent; in the 2013 admission cycle, 82,450 applications were received for just 6,000 openings. The university's four-year graduation rate has increased by more than 19 percent. Dr. Drake also has been a steadfast champion of inclusion and diversity. The number of undergraduate students from underrepresented minorities has risen by 59.1 percent in the past five years. Sixty percent of the entering freshmen in the Class of 2017 were the first in their families to attend a four-year college, and 40 percent came from low-income families; both percentages are among the highest in the nation.

In 2006, Dr. Drake oversaw the creation of the first new public law school in California in more than 40 years. More recently, the UC Irvine School of Education was established under his leadership in July 2012. Dr. Drake also has helped launch new programs in public health, pharmaceutical sciences and nursing science, which are already providing highly trained healthcare professionals to meet the critical needs of the community.

In Dr. Drake's time as chancellor, UC Irvine has added more than 5 million square feet of new space, including the 500,000-square-foot UC Irvine Douglas Hospital and the 275,000-square-foot Student Center, two of the more than 30 major construction projects delivered on time and under budget. The campus's built environment has received nationwide acclaim for its environmental sustainability and is among the nation's leaders with 11 buildings that have earned LEED Platinum status, the highest possible ranking.

Prior to Dr. Drake's arrival at UC Irvine, he served for five years as vice president for health affairs for the University of California system, overseeing academic program policy at the system's 15 health sciences schools, located on seven campuses, and more than two decades on the faculty of the UC San Francisco School of Medicine, ultimately becoming the Steven P. Shearing Professor of Ophthalmology and senior associate dean.

An alumnus of Stanford University (BA) and UC San Francisco (MD), Dr. Drake is a member of both the Institute of Medicine (National Academies) and the American Academy of Arts and Sciences. He has received numerous honors and awards for teaching, public service and research.

Dr. Drake has served as trustee and president of the Alpha Omega Alpha Honor Medical Society and as chair of the board of trustees of the Association of Academic Health Centers. He currently serves on the executive committee and the Division I Board of the National Collegiate Athletic Association and on the executive and membership committees of the Association of American Universities.

ABOUT COLUMBUS, OHIO

The nation's 15th largest city, with a population of more than 787,000, Columbus offers a diverse range of cultural and artistic events, sports, restaurants, festivals and more—all within close proximity to The Ohio State University campus.

Columbus area orchestras, ballets and operas are regionally renowned. Art lovers will appreciate the collections and exhibits displayed at Ohio State, the Columbus Museum of Art, and galleries in several Columbus arts districts, which also feature specialty and antiques shops and eateries. The Franklin Park Conservatory, Ohio's Center of Science and Industry, the Lifestyle Communities Pavilion and the nation's No. 1 ranked Columbus Zoo and Aquarium offer additional leisure activities. Theater, popular music and nightclubs are also readily available. Columbus is known for its fine dining, craft beverages and eclectic food carts.

Nature lovers have easy access to some of the most breathtaking parks and scenic rivers in the Midwest, offering hiking, camping, biking and boating activities. Nearby glacier-carved gorges, waterfalls and towering cliffs allow for one to explore the area's natural wonders, including Hocking Hills State Park, located just an hour away in the foothills of the Appalachian Mountains.

In addition to Ohio State Buckeye football, sports fans can enjoy the NHL's Columbus Blue Jackets, the Columbus Crew men's professional soccer team and Columbus Clippers baseball. The PGA Memorial Golf Tournament is held annually at Jack Nicklaus' Muirfield Village and each fall thousands run the Columbus Marathon.

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