MEHARRY®
MEDICAL COLLEGE

RESEARCH CAPABILITIES

ABOUT MEHARRY MEDICAL COLLEGE

Founded in 1876 as the Medical Department of Central Tennessee College, Meharry was the first medical school in the South for African Americans. It was chartered separately in 1915.

Today, Meharry includes a medical school, a dental school and a graduate school of research and is home to the Robert Wood Johnson Foundation Center for Health Policy at Meharry Medical College. Meharry is recognized as a top producer of primary care physicians, ranked second among academic health science centers in the "social mission" of medical education. It is a leading producer of African-American dentists, graduating 41 percent of black dentists in the country. This academic health science center is also a leading producer of African-American Ph.D.s in biomedical science. *Diverse Issues in Higher Education* annually lists Meharry as a leading national educator of African Americans with M.D. and D.D.S. degrees and Ph.D. degrees in the biomedical sciences.

Meharry offers the following degree programs: Doctor of Medicine (M.D.); Doctor of Medicine/Doctor of Philosophy (M.D./Ph.D.); Doctor of Dental Surgery (D.D.S.); Doctor of Dental Surgery/Doctor of Philosophy (D.D.S./Ph.D.); Doctor of Philosophy (Ph.D.); Master of Science in Public Health (MSPH); Master of Health Science (MHS); Doctor of Medicine/Master of Health Science (M.D./MSPH).

Research at Meharry spans the distance from molecules to exposomes. While focusing on health problems that disproportionately affect the underserved, data generated from our research endeavors benefits all.

MEHARRY® MEDICAL COLLEGE

ANIMAL CARE FACILITY

The Animal Care Facility (ACF) at Meharry Medical College (MMC) has been accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC) since 1972 and operates in compliance with the Animal Welfare Act as Amended (7 USC, 2131-2156); Health Research Extension Act of 1985 (Public Law-158); follows the Public Health Service policy on Human Care and Use of Laboratory Animals (revised 2015); and the Guide for the Care and Use of Laboratory Animals (revised 2010); Laboratory animal veterinarian and technical staff provide primary and veterinary care to all animals housed, as well as investigator training, technical assistance and guidance, and access to health status and laboratory services. Our goal is the maintenance of an enriched, variable-free, secure and humane environment for our animal subjects, as well as superb customer service for our research clients.

PAST PERFORMANCE

Research accomplishments within the school have been funded by federal agencies such as the National Institutes of Health (NIH).

SPECIALIZED EQUIPMENT

Tecniplast BSC-II Biosafety Cabinets/Animal Change Stations

- The Vivarium is equipped with two (2) stationary Tecniplast BSC-II biosafety cabinets, as well as five (5) mobile LabProducts and three (3) Tecniplast CS 5 EVO plus animal change stations. IsoTech/SurgiVet Isoflurane Vaporizers (2) serviced annually via a certified vaporizer service provider

Microisolator and IVC-rodent caging available Tecniplast

- Caging Equipment Model Greenline Sealsafe pluse ventilated mouse racks (six) and rat (two) with 4 smartflow units are in use in the Vivarium with test data provided by the manufacturer showing typical cage air exchange rates of 58 to 60 changes per hour, airflows of 0.20 cubic feet per minute and a nominal air velocity (in the cage) of 69 linear feet per minute. These racks are configured to draw supply air.
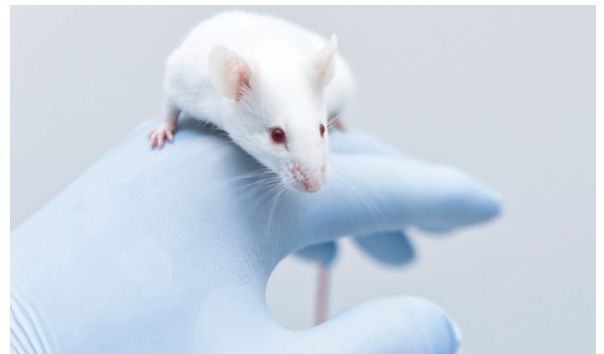
BIOINFORMATICS

The Meharry Microarray and Bioinformatics Core (MBC) and The Meharry Proteomics Core (MPC) provide state of the art training, instrumentation, services and bioinformatics-driven data analysis to the Meharry Community in Transcriptomics and Proteomics experimental design, all the way through to advanced data analysis and integration of large scale "Omics" data sets for biomedical research and discovery. These Core Resources provide Meharry investigators and trainees with the tools and expertise needed for high performance computation in Genomics, Proteomics, Systems Biology and Biological Network Analysis. It is our aim to keep this facility up to date computationally and intellectually with state of the art "Omics" services to support education and research in microarray, genomics and proteomics data analysis, computational biology and systems biology.

PAST PERFORMANCE

Research accomplishments within the school have been funded by federal agencies such as Health Resources & Services Administration (HRSA), National Cancer Institute (NCI), National Institute on Minority Health and Health Disparities (NIMHD), National Institute of Allergy and Infectious Diseases (NIAID), Centers for Disease Control (CDC), Nuclear Regulatory Commission (NRC), National Science Foundation (NSF), Department of Education, National Center Minority Health/Health Disparities (NCMHD), National Human Genome Research Institute (NHGRI). State funding at Meharry includes Tennessee Department of Health (TDH). Foundation and Industry funding includes Fuji Oil Company, American Society for Cell Biology, Das, Gilead Sciences, Inc., Astellas Pharma US, Inc., Pfizer Inc., Merck Sharp & Dohme Corp., Genetech, Inc., Bayer AG, United Way of Metropolitan Nashville, Ford Foundation, Lakewood-Amedex, Inc., Patient Advocate Foundation, American Heart Association, and the Peter F. McManus Charitable Foundation among others.

SPECIALIZED SOFTWARE

CLC Genomics Workbench 8.0 for Next-generation sequencing (NGS) analysis including Whole Genome Sequencing and RNA-Seq assembly and analysis

Partek Genomics Suite version 6.x for Gene Expression microarray, RNA-Seq and miRNA analysis

PEAKS Proteomics Software version 8.0 for Protein Database search, quantitative proteomics profiling and post-translational modification identification

MATLAB statistical programming environment with bioinformatics, statistics and proteomics analysis

FileMaker Pro for database prototyping

TABLEAU version 9.0 for visual analytics and big data applications

Open Source Bioinformatics / Analytics program expertise:

CYTOSCAPE Systems Biology Tool Kit for visualizations and biological interactions level visualizations in order to frame Omics data results into a biological context.

R statistical packages including Bioconductor for Transcriptomics / Genomics level analysis and visualizations.

REDCap database domain knowledge and training

SPECIALIZED EQUIPMENT

Thermo Finnegan LTQ Ion Trap Mass Spectrometer program software i.e. Nanodrop 1000 and 2000 • LI-COR, BIO rad spectrometers • Synergy microplate reader • Real Time PCR-CFX96 c1000 • LI-Cor odyssey, Agilent 2100 Bioanalyzer • genetic analyzer ABI Hitachi

BIOMEDICAL SCIENCE

At Meharry Medical College our work in biomedical science is defining the underlying mechanisms of human disease, identifying new therapeutic targets responsible for disease, and laying the foundation for the development of novel therapies to counter disease. We work with DNA, tissues, microorganisms, viruses and complex proteins while taking into account race, socioeconomic status, gender and age in order to gain the pertinent knowledge that will enable us to serve the community. The Meharry Morphology Core is a microscopy facility that provides state of the art instrumentation, training, and data analysis to the Meharry Community to advance the understanding of biological systems by connecting basic and clinical findings with molecular scale mechanisms. Our faculty researchers provide new insights about the causes and treatments of various human diseases including cancer, diabetes, cardiomyopathies and infectious diseases like HIV/AIDS. Meharry is dedicated to educating and training M.D.s and Ph.D.s who become biomedical researchers, physician scientists and clinical investigators whose focus is to advance theoretical knowledge and create new technology for products and services that promote optimal health.

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SPECIALIZED EQUIPMENT

AB Sciex Tempo Nano- 1 Dplus HPLC • AB Sciex 920 Auto sampler with cooling module • Nano SPRAY ESI source •Thermo Scientific Xcalibur Mass Spectrometry Controller Software • Thermo Scientific Proteome Discoverer Mass Informatics Platform Software • program software i.e. Nanodrop 1000 and 2000 • LI-COR, BIO rad spectrometers • Synergy microplate reader • Real Time PCR-CFX96 c1000 • LI-Cor odyssey, Agilent 2100 Bioanalyzer • genetic analyzer ABI Hitachi • Nikon TE2000E wide-field microscope • Olympus BX 50 stereology microscope • Nikon C1 confocal microscope • Nikon A1R confocal microscope

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CANCER

According to the American Cancer Society and the National Cancer Institute, combined cancer deaths exceed cardiovascular diseases-related deaths in the United States. In both men and women, lung cancer still remains the leading cause of cancer death. Prostate cancer and breast cancer account for the second highest cause of cancer deaths in men and women, respectively.

Unfortunately, African Americans suffer disproportionately from the burden of cancer incidence and cancer deaths in the United States, having the lowest five-year survival rates for lung, prostate, breast, colorectal and ovarian cancers. The trend is nearly identical in colon, lung and ovarian cancers. While we don't fully understand the causes for the alarming cancer health disparities, multiple factors including biological, genetics, environment, nutrition, education status, socio-economics factors and lack of access may play vital roles.

Meharry Medical College has partnered with the Vanderbilt-Ingram Cancer Center (VICC) and, most recently, with Tennessee State University (TSU) in an effort to address some of the causes of the high incidence of cancer among minorities, as well as develop strategies to reduce cancer health disparities in Tennessee. Using cancer partnership research funding from the National Institutes of Health (NIH), we have successfully developed strong infrastructure for cancer patient care and cancer research in areas of basic sciences, population, clinical and translational research. We have also expanded education and training in cancer research at Meharry.

Our successes in these endeavors have enabled us to enhance our ability to provide oncology patient care while significantly enhancing recruitment of African Americans and other minorities into nationally approved oncology clinical trials. We have established a tissue acquisition core to enhance collection, banking and usage of critically needed tissues from cancer patients for research. Thus, we will be able to identify new biomarkers for cancer diagnosis as well as contribute to our understanding of the biological basis for cancer and cancer disparities.

PAST PERFORMANCE

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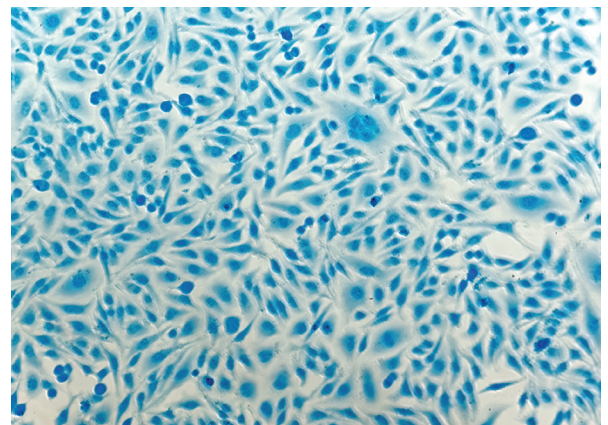
DATA SCIENCE

The Data Science Center (DSC) collaborates with the Schools of Medicine, Dentistry and Graduate Studies and Research to develop a curricular "thread" that uses inter-professional education and small group learning. This thread provides an introduction to the concepts of "big data" science, precision medicine and population health management.

The DSC draws from more than 25 sources within the schools, bringing together data into a structured and unstructured data ecosystem to allow aggregation, integration and analysis particularly in support of clinical operations and public health. Analyzing clinical data from outpatient services which are delivered to underserved populations in the greater Nashville area provides insights toward achieving health equity. Such data may also be available for analysis with various biorepositories as well as genomics data, providing an opportunity to apply "big data" analytic techniques to the health equity problem.

Meharry Medical College has contracted with Clearsense, a company that specializes in data management analytics, to build the data ecosystem in which all of the data and analytics will reside.

In the area of public health, the DSC has already aggregated the data from the public health exposome which incorporates publicly available health and environmental data at the neighborhood level. This data includes air quality metrics, crime statistics, information on access to affordable housing, violence, poverty and availability of grocery stores, liquor stores or other retail outlets. The data set has been used to examine the socioenvironmental and social determinants of health triggers for various chronic diseases.

SPECIALIZED FACILITIES

- Clearsense, LLC
- PCORI
- eMERGE

SELECT ACTIVITIES

- Data Ecosystem
- Machine Learning
- Data Mining/Predictive and Prescriptive analytics
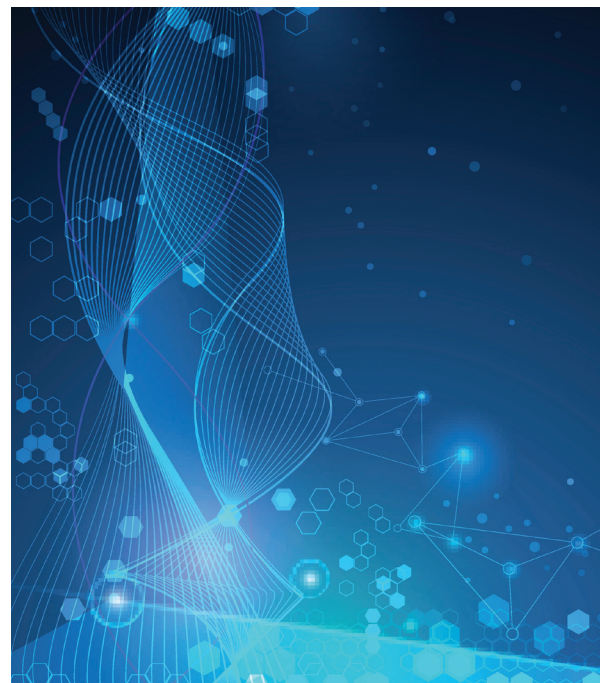
DENTISTRY

Meharry Medical College remains at the forefront in dental research, which consists of evaluation, diagnosis, prevention and treatment of diseases, disorders and conditions of the soft and hard tissues of the jaw, the oral cavity, maxillofacial area and the adjacent and associated structures and their impact on the human body. By selecting a diverse body of students who individually demonstrate a commitment to service, possess cultural understanding, indicate the ability to successfully complete the rigorous curriculum, conduct research and serve underserved populations in the Meharry tradition, the School of Dentistry plays a vital role in meeting the oral health care needs of everyone. Our graduates have received international recognition for their achievements, performance and research, blazing trails with innovative ideas.

PAST PERFORMANCE

Research accomplishments within the school have been funded by federal agencies such as National Dental Association Foundation (NDAF), Health Resources & Services Administration (HRSA), National Cancer Institute (NCI), National Institute on Minority Health and Health Disparities (NIMHD), National Institute of Allergy and Infectious Diseases (NIAID), National Institute of General Medical Sciences (NIGMS), Centers for Disease Control (CDC).

SPECIALIZED ACTIVITIES

Our team of faculty, highly trained dental students, residents and friendly staff are dedicated to helping you achieve and maintain excellent oral health by offering a full range of general and specialty dental services in the following areas:
- Restorative Dentistry
- Oral and Maxillofacial Surgery
- Endodontics
- Periodontics
- Oral Diagnostics
- Pediatric Dentistry
- Orthodontics
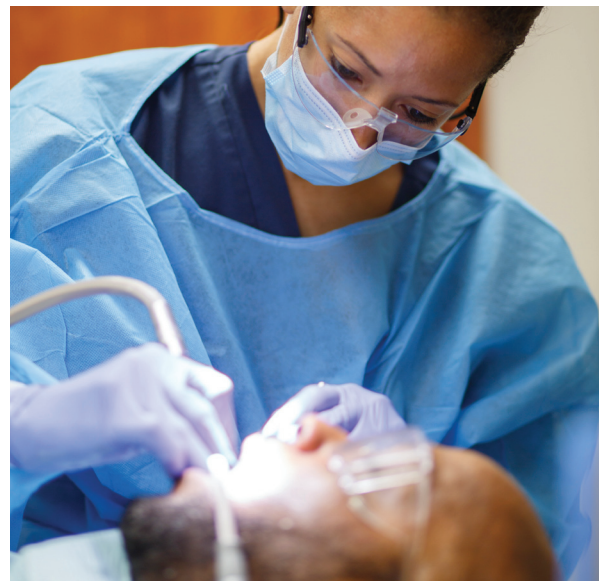
GEOSPATIAL INFORMATION TECHNOLOGY

Maps are a visual representation of data. We are developing an extensive county level, exposome database with over 13,000 health behavior and outcomes variables and over 20,000 environmental exposure variables. We also have data by census tract, zip code and other administrative units. While maps provide an opportunity to visualize how the characteristics vary by place, the underlying database provides an opportunity to analyze spatial and temporal relationships between health and environmental exposure data. We work statisticians and computer scientists to apply a broad range of statistical and computational analytics to understand these relationships.

Our long term goal is to increase the temporal dimension of the database to include measures from 1980 to present and to shrink the spatial unit from county level to census tract level wherever possible. This database will allow us to begin to look at relationships between environmental exposures and population health outcomes over time. While putative relationships are not indicators of causality, they can provide preliminary data for developing models, testing hypotheses and designing randomized controlled trials (RCTs).

SERVICES PROVIDED

- Technical assistance in conducting community environmental assessments
- Technical assistance in conducting community
- Health assessments
- Support communities in conducting public participatory GIS (PPGIS)
- Education on health outcomes associated with environmental exposures
- Analysis of complex data sets (including multi-level analysis, spatial analysis and computational analysis)
- Mapping of environmental and health dataTraining of community groups to collect, map and analyze environmental and health data at a local level
- Web development for sharing maps and Information

SELECT ACTIVITIES

- Geographic Information Systems (GIS
- Community Mapping
- MAPPLER MOBILE (SMARTPHONE APPLICATION TO SUPPORT COMMUNTY MAPPING)
- MAPPLERX (WEB APPLICATION TO SUPPORT COMMUNITY MAPPING)
- Spatial Analysis (ESRI ArcView 10.1)
- Multi-level analysis (STATA, SAS, SPSS Computational

HEALTH DISPARITIES

Meharry Medical College conducts research and other scholarly activities designed to identify, understand and eliminate factors responsible for the profoundly disproportionate burden of AIDS and HIV infection among minority populations in the United States. The medical field has made some advances in the overall health of the nation in the past two decades. However, in spite of these advances, striking disparities remain in the rates of diseases that affect the livelihood and health of racial and ethnic minorities. These disparities are inequalities that occur in the provision of health care and access to health care across different racial, ethnic and socioeconomic groups. They affect a vast group of people that Meharry is honored to serve and enact the notion of "health caring."

PAST PERFORMANCE

Research accomplishments within the school have been funded by federal agencies such as Health Resources & Services Administration (HRSA), National Institute on Minority Health and Health Disparities (NIMHD), National Institute of General Medical Sciences (NIGMS), Substance Abuse and Mental Health Services (SAMHSA), Centers for Disease Control(CDC), Metropolitan Development and Housing Agency(MDHA), National Institute of Justice (NIJ), Department of Education, National Center Minority Health/Health Disparities (NCMHD), National Institute of Allergy/ Infectious Diseases (NIAID).

SPECIALIZED FACILITIES

- **The Center for AIDS Health Disparities Research** (CAHDR) at Meharry Medical College conducts research and other scholarly activities designed to identify, understand and eliminate factors responsible for the profoundly disproportionate burden of AIDS and HIV infection among minority populations in the United States. The Center is reducing the burden of AIDS in local minority communities through basic, clinical and translational research.

- **The Center for Women's Health Research** (CWHR) at Meharry Medical College is one of the nation's first research centers devoted exclusively to understanding why women of color are at greater risk of certain diseases and how biology, race and economics contribute to women's health disparities.

- **Community Networks Program** (CNP) was established in 2005 to reduce cancer health disparities through community-based participatory education, training and research among underserved populations.

INFECTIOUS DISEASE

Meharry Medical College is dedicated to enhancing prevention and treatment of infectious diseases through discovery and application of new knowledge that is seamlessly integrated with mentoring students to become the next generation of national leaders in the field. Faculty participating in the Center for AIDS Health Disparities Research at Meharry Medical College address bases for HIV entry, replication and propagated infection, as well as the factors that modulate the immune response to this infection and the efficacy of therapeutic intervention. Patient focused research innovations are being developed for HIV, Acinetobactor and other pathogens such as those that previously ravaged third-world countries, but now are appearing in our country as opportunistic infections of HIV/AIDS, and hospital and emerging/re-emerging infections.

PAST PERFORMANCE

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SPECIALIZED EQUIPMENT

• BSL-3 laboratory for restricted pathogens • FACSAria III • Biotek Synergy Neo2 mutli-mode High Throughput Reader for drug discovery • program software i.e. Nanodrop 1000 and 2000 • LI-COR, BIO rad spectrometers • Synergy microplate reader • Real Time PCR-CFX96 c1000 Thermo Finnegan LTQ Ion Trap Mass Spectrometer • AB Sciex Tempo Nano- 1 Dplus HPLC • AB Sciex 920 Auto sampler with cooling module • Nano SPRAY ESI source •Thermo Scientific Xcalibur Mass Spectrometry Controller Software •Thermo Scientific Proteome Discoverer Mass Informatics Platform Software • LI-Cor odyssey, Agilent 2100 Bioanalyzer • genetic analyzer ABI Hitachi

NEUROSCIENCE

Graduate, medical and dental scholars are trained to conduct basic, translational, clinical, social and behavioral research, generating new knowledge that contributes to research in an effort to reduce health disparities in the areas of neurological disease, mental health and drug abuse/addiction—including alcoholism. Along those same lines, we provide students with an intensive knowledge of pharmacology as a science, exposing them to pharmacological research methodologies that provide skills in the practice of the science, and the opportunity to apply these skills in pharmacological research. Students gain a problem-solving approach to the understanding of pharmacology that makes a reasoned, objective correlation between pharmacological and other types of knowledge; this approach serves as both a foundation and methodology toward developing solutions.

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SPECIALIZED EQUIPMENT

Real Time PCR-CFX96 c1000 • LI-Cor odyssey, Agilent 2100 Bioanalyzer • genetic analyzer ABI Hitachi •Thermo Finnegan LTQ Ion Trap Mass Spectrometer • AB Sciex Tempo Nano- 1 Dplus HPLC • AB Sciex 920 Auto sampler with cooling module • Nano SPRAY ESI source • FACSAria III • Program software i.e. Nanodrop 1000 and 2000 • LI-COR, BIO rad spectrometers • Synergy microplate reader •Thermo Scientific Xcalibur Mass Spectrometry Controller Software •Thermo Scientific Proteome Discoverer Mass Informatics Platform Software BSL-3 laboratory for restricted pathogens

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