

THE DEPARTMENT OF BIOMEDICAL SCIENCES

2023 Year in Review





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WELCOME TO THE DEPARTMENT OF BIOMEDICAL SCIENCES

Welcome to the Department of Biomedical Sciences at the UND School of Medicine & Health Sciences! Our faculty conduct internationally recognized research in areas of addiction, cancer, cardiovascular disease, epigenetics, host-pathogen interactions, lipid metabolism, neuroscience, and obesity. These efforts are supported by state-of-the-art core facilities and help foster collaborations with regional, national, and international entities with the goal of stimulating multi-disciplinary and increasingly translational research.



UND SCHOOL
& HEALTH SCIENCES
UNIVERSITY OF NORTH DAKOTA



MESSAGE FROM THE CHAIR

The Department of Biomedical Sciences is an exciting setting for discovery that also provides the foundation of our active learning-based interdisciplinary graduate programs with optional specialties. Our innovative graduate training is designed to offer not only the broad base of core competencies that researchers need to be successful, but also the practical experiences and skill set required for a career in



academic or industrial research and teaching. Moreover, our additional focus on educational research helps to ensure that our program is always improving to meet the changing needs of graduate training and workforce development for a 21st century economy. The Department also provides strong support for both undergraduate and medical student research opportunities and hosts a variety of programs throughout the academic year and summer. Explore our website at med.UND.edu/biomedical-sciences to learn about our faculty interests, meet our graduate students and post-doctoral fellows, read about the Department's recent events and accomplishments, consider our graduate program, or identify research opportunities.

Sincerely,

Colin Combs, Ph.D.
Chester Fritz Distinguished Professor and
Associate Dean for Research

FACULTY AND SPECIALIZATIONS

Colin Combs, Ph.D.

Chester Fritz Distinguished Professor and Chair

Neuroimmune interactions during aging and Alzheimer's Disease.

David Bradley, Ph.D.

Associate Professor

Natural and inducible immune responses to viruses and bacteria and to cancers.

Catherine Brissette, Ph.D.

Associate Professor

Bacterial pathogenesis, host-pathogen interactions, Lyme disease, relapsing fever, spirochetes.

Holly Brown-Borg, Ph.D.

Chester Fritz Distinguished Professor

Assistant Dean for Gender Equity

Contributions of the endocrine system and metabolism to mechanisms of biological aging, and age-related diseases.

Pat Carr, Ph.D.

Associate Professor, Assistant Dean for Medical Curriculum.

Tim Casselli, Ph.D.

Research Assistant Professor

Host-pathogen interactions during Lyme borreliosis; Neuroborreliosis; Meningeal immunity.

Xuesong Chen, Ph.D.

Associate Professor

Role of endolysosome in the pathogenesis of neurological disorders including Alzheimer's disease, HIV-associated neurocognitive disorders, and COVID-associated neurological complications.

Archana Dhasarathy, Ph.D.

Associate Professor

Chromatin, Epigenetics, Molecular biology, Breast cancer, Genomics.

Van Doze, Ph.D.

Associate Professor

Adrenergic modulation of behavior, Aging brain, Epilepsy, Alzheimer's disease.

Jane Dunlevy, Ph.D.

Associate Professor

Medical education, Cellular & molecular biology, Extracellular matrix, Cell adhesion, Cytoskeleton.

Susan Eliazer, Ph.D.

Assistant Professor

Epigenetic mechanisms underlying the maintenance of skeletal muscle stem cells in disease and aging.

James Foster, Ph.D.

Assistant Professor

Regulation of the dopamine transporter via the post translational modifications, palmitoylation and phosphorylation and their role in health and disease.

Jonathan Geiger, Ph.D.

Chester Fritz Distinguished Professor

Mechanisms underlying the pathogenesis of neurodegenerative diseases with a focus on inter-organellar signaling.

Mikhail Golovko, Ph.D.

Associate Professor

Stroke research, Brain ischemia, Hypoxia, Angiogenesis, Neurochemistry, Lipid and purine metabolism, Mass spectrometry.

Bryon Grove, Ph.D.

Associate Professor

Vascular biology, Angiogenesis, Cellular signaling, A-kinase anchoring proteins, Microscopic imaging.

Amanda Haage, Ph.D.

Assistant Professor

A&P Coordinator, Diversity & equity in STEM, Cell migration & adhesion, Cancer metastasis.

Peter Halcrow, Ph.D.

Research Assistant Professor

Understanding how cells interpret and respond to their environment as they move through the complexities of the human body. Teaching as a pathway to science for everyone.

L. Keith Henry, Ph.D.

Associate Professor

Molecular, pharmacological, epigenetic, and computational analysis of the serotonin and dopamine transporters and their role in human disease.

Junguk Hur, Ph.D.

Associate Professor

Bioinformatics, Systems pharmacology, Epigenomics, Diabetic peripheral neuropathy, literature mining.

Saobo Lei, Ph.D.

Professor

Neurotransmitters, Neuropeptides, Synaptic transmission and plasticity, Ion channels, Learning and memory, Epilepsy, Anxiety, Schizophrenia, Alzheimer's disease, Autism, Hippocampus, Entorhinal Cortex, Interneuron, Patch-clamp, Electrophysiology.

Masfique Mehedi, Ph.D.

Assistant Professor

A Virologist developing therapeutic drugs and vaccines for respiratory viruses.

Barry Milavetz., Ph.D.

Professor

Epigenetic mechanisms controlling the Simian Virus 40 life cycle.

Santhosh Mukundan, Ph.D.

Research Assistant Professor

Bacterial pathogenesis.


Eric Murphy, Ph.D.**Associate Professor**

Lipids biochemistry, Fatty acid binding proteins, N-3 fatty acids, Brain lipid metabolism, Higher education, Faculty governance.

Michelle Murphy, Ph.D.**Assistant Professor**

Integrative systems physiology; Systems thinking and modeling in physiology education.

Kumi Nagamoto-Combs, Ph.D.**Assistant Professor**

Effect of peripheral inflammation on brain function and behavior, Neuroinflammation via gut-immune-brain communications, Allergy and behavioral disorders.

Sergei Nechaev, Ph.D.**Associate Professor**

Gene regulation, Epigenetics, Transcription, Genomics.

Matthew Nilles, Ph.D.**Associate Professor**

Interactions of the plague bacillus with the innate immune system and protein interactions that control the type III secretion system in *Yersinia pestis*.

Suba Nookala, Ph.D.**Research Assistant Professor**

HLA-Class II mediated immune responses to infections.

Monica Norby, Ph.D.**Teaching Instructor**

Undergraduate Microbiology Courses and Medical Microbiology Laboratory.

James Porter, Ph.D.**Associate Professor**

Pharmacology, Sympathetic nervous system, Innate immunity, G-protein coupled, Peptide and toll-like receptors, Receptor cross-talk, signal transduction, Molecular mechanisms of pharmacological action, Arrestins, G-protein coupled receptor kinases, Gq-G11 GTP-binding proteins, MAP kinase signaling.

Benjamin Roche, Ph.D.**Assistant Professor**

Molecular mechanisms of cellular quiescence, epigenetic regulation of G0 state/metabolism, yeast genetics.

Thad Rosenberger, Ph.D.**Associate Professor**

Alzheimers disease, Multiple sclerosis, Spinal cord injury, Neurodegeneration, Neuroinflammation, Lipid metabolism, Brain energy metabolism, Lipid-mediated signal transduction, Acyl-CoA, Arachidonic acid, Eicosanoids, Ether phospholipid, Plasmalogen, Phospholipases, Analytical lipid techniques.

Kenneth Ruit, Ph.D.**Associate Professor, Senior Associate Dean for Education Medical Accreditation and Faculty Affairs**

Establishment of academic performance standards and implementation of valid and reliable methods of which student learning is assessed.

Anthony Schroeder, Ph.D.**Assistant Teaching Professor****John Shabb, Ph.D.****Associate Professor**

Proteomics, Bio-markers, Discipline-based education research.

Shahram Solaymani-Mohammadi, Ph.D.**Assistant Professor**

Immunology, Mucosal immunology, Gut immunology, Mucosal inflammation microbiome, Infectious diseases, Parasitology host-pathogen interaction, Vaccine development.

Sarah Sletten, M.S., PhD.**Associate Professor,****Director of Learner Research**

Scholarship of Teaching and Learning

Motoki Takaku, Ph.D.**Assistant Professor**

Epigenetics and chromatin regulation in cancer, Breast cancer reprogramming, Biochemistry, Cell biology, Genomics, Genome editing, cell free DNA.

Chernet Tessema, M.D., Ph.D.**Associate Professor**

Human anatomical variation: a cadaver dissection-based study of human structure.

Alexei Tulin, Ph.D.**Professor**

Epigenetics in normal development and pathogenesis, Chromatin regulation, Role of poly (ADP-ribose) metabolism in transcription regulation and oncogenesis, PARP-1 inhibitors in oncology, *Drosophila* and mammalian model organisms.

Roxanne Vaughan, Ph.D.**Chester Fritz Distinguished Professor**

Dopamine transporter structure and function, Molecular mechanisms of cocaine and amphetamine, Protein post-translational modifications, Dopaminergic disorders.

John Watt, Ph.D.**Associate Professor**

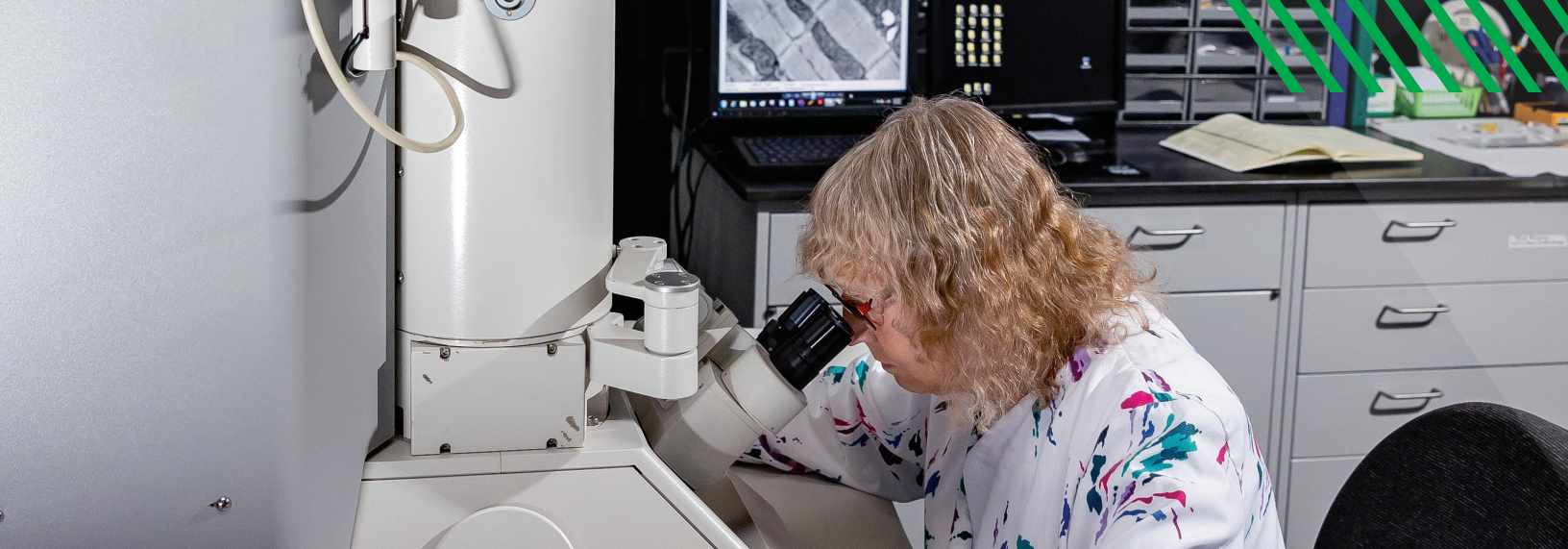
Neural regeneration, Neuron-glia interactions, Neuroinflammation, CNS response to injury.

WHERE ARE THEY NOW?

Positions that Department of Biomedical Sciences students have taken since completing their graduate training

Student	Degree	Advisor	Position Taken After Graduation
2023			
Oluwatobiloba "Tobi" Aminu	M.S.	Hur	Graduate program in Bioinformatics and Computational Biology, Iowa State University, Ames, Iowa
Gblohblan Bamgbose	Ph.D.	Tulin	Postdoctoral Fellow: Dana-Farber Cancer Institute-Harvard, Boston, Mass.
Cody Boyle	Ph.D.	Lei	Medical Student, UND School of Medicine & Health Sciences, Grand Forks, N.D.
Madison Jochim	M.S.	Murphy	Paraprofessional, Phoenix Elementary, Grand Forks Public School System, Grand Forks, N.D.
Nathan Velaris	Ph.D.	Bradley	Biomedical Sciences Department, UND School of Medicine & Health Sciences, Grand Forks, N.D.
2022			
Zahra Afghah	Ph.D.	Geiger	Grant Writer/Biomedical Scientist, Center for Innovation, Grand Forks, N.D.
Sayem Bhuyan	Ph.D.	Tulin	Field Application Scientist, Axion BioSystems, Seattle, Wash.
Chris Brown	Ph.D.	Foster	UND School of Medicine & Health Sciences, Grand Forks, N.D.
Sema Oncel	Ph.D.	Basson	Postdoctoral Fellow, USDA Human Nutrition Research Center, Grand Forks, N.D.
Jason Power	Ph.D.	Doze	INMED Program, UND School of Medicine & Health Sciences
Sattya Talukdar	Ph.D.	Mehedi	Postdoctoral Fellow, John Hopkins Bloomberg School of Public Health, Baltimore, Md.
Betsy Young	M.S.	Nilles	Laboratory Technician, Mayo Clinic, Rochester, Minn.
2021			
Temidayo Adeluwa	M.S.	Hur	Ph.D. Student, University of Chicago, Program in Genetics, Genomics and Systems Biology, Chicago, Ill.
Ashrifa Ali	Ph.D.	Grove	Postdoctoral Fellow, Department of Ophthalmology, University of Pittsburgh School of Medicine, Pittsburgh, Pa.
Sarmad Al-Marsoum	Ph.D.	Basson	Postdoctoral Fellow, Department of Pathology, UND School of Medicine & Health Sciences, Grand Forks, N.D.
Malak Alzidaneen	M.S.	Watt	Ph.D. Student, Bioinformatics Program, North Dakota State University (NDSU), Fargo, N.D.
Leo Lakpa	Ph.D.	Geiger	Medical Student, University of Wisconsin Madison, Madison, Wis.
Regan Lawrence	M.S.	Murphy	Medical Student, UND School of Medicine & Health Sciences, Grand Forks, N.D.
Nicole Miller	Ph.D.	Geiger/Chen	Medical Student, College of Osteopathic Medicine William Carey University, Hattiesburg, Miss.
Meghan Rodriguez	Ph.D.	Henry	Assistant Teaching Professor, Anatomy and Histology, University of Missouri-Kansas City (UMKC), Saint Joseph, Mass.
Smruthi Rudraraju	Ph.D.	Dhasarathy	Technology Specialist, Clark and Elbing Intellectual Patent law firm, Boston, Mass.
Taylor Schmit	Ph.D.	Khan	Teaching Faculty, University of Minnesota, Crookston, Minn.

Updated version of this list can be found: med.UND.edu/biomedical-sciences/former-students.html



Cores

Imaging Core

The Imaging Core is a 3350 sq. ft. facility housed in the UND School of Medicine and Health Sciences that provides investigators on the UND campus and within the surrounding region with access to both light and electron microscopy. Instrumentation available for light microscopy includes a Leica Stellaris 5 confocal microscope, an Olympus FV1000MPE basic multiphoton/single photon system on an upright microscope, an Olympus cellTIRF system on an IX83 fluorescence microscope and a Leica DMI8 Thunder Imager system for 3D imaging of fluorescently labeled cellular material. A Dell workstation equipped with imaging analysis tools is also available. The Leica Stellaris 5 system is a 4 laser, multichannel system equipped for superresolution and capable of imaging a wide variety of fluorochromes in fixed and live tissues and cells. The Olympus FV1000MPE system is configured for confocal and multiphoton microscopy of fixed samples, live cells and intravital microscopy using animal models. The Olympus cellTIRF microscope is a four laser system configured for multicolored TIRF microscopy, ratiometric imaging of Fura2 and FRET biosensors, SRRF superresolution microscopy, and long term live cell imaging. Instrumentation in the electron microscopy suite includes a Hitachi 7500 TEM equipped with a high resolution SIA digital camera and a Hitachi 4700 field emission SEM. Additional instrumentation for sample preparation includes an ultramicrotome, a Denton sputter coater and a vacuum evaporator for SEM sample preparation. Applications supported by the imaging Core include multi-label fluorescence imaging of fixed and live material, FRET, FRAP, FLIP, 3D imaging, channel separation using spectral fingerprinting, ratiometric fluorescent imaging, TIRF microscopy, thin section transmission electron microscopy, and scanning electron microscopy. The Core director, Dr. Bryon Grove, and two Core staff maintain the facility, provide microscopy services, training on the equipment, and assistance with sample preparation and image analysis. (med.UND.edu/imaging/index.html).

North Dakota Flow Cytometry and Cell Sorting (ND-FCCS) Core

The North Dakota Flow Cytometry and Cell Sorting (ND-FCCS) core, located in the UND SMHS in the Janice I. Schuh Suite and is joint effort between the departments of Biomedical Sciences and Pathology, and the Host Pathogen COBRE (P20GM113123) and the North Dakota INBRE (P20GM103442) and the SMHS. The core staff, consisting of Dr. David Bradley (Director) who has 30+ years of flow cytometry experience, Dr. Suba Nookala (Assistant Director) who has 20 years of flow cytometry experience, and Steven Atkins (Core Technical Advisor) with 15 years of flow cytometry experience, provides training on the instrumentation and software as well as consultation for experimental design and data analysis. The ND-FCCS core contains 3 major instruments: a) BD FACS Aria II flow cytometer which has 3 lasers (UV (355 nm), Blue (488 nm), and Red (640 nm)) with simultaneous analysis of 9 colors in addition to FSC and SSC, first pass 4-way sorting, aseptic sorting, automated cell deposition, temperature control, and aerosol management capabilities; b) BD FACSymphony A3 equipped with 4 lasers [Blue (488nm), Violet (405 nm), and Yellow Green (561 nm), and Red (638 nm)], and filter sets to increase multicolor panel possibilities and enable the simultaneous measurement of more than 27 different markers on a single cell for phenotyping, apoptosis, proliferation or cell-cycle analysis, with capability to run a reliable high throughput acquisition platform; and c) Sony MA900 Cell Sorter that is equipped with 4 excitation lasers [Blue (488nm), Violet (405 nm), and Yellow Green (561 nm), and Red (638 nm) that is split into two laser beams], a temperature controlled 4-way sorting with adjustable speeds into multiple tube types including multi-well and 96 well plate deposition system, with capabilities for automation, microfluidics chip-based design, and a user-friendly software for easy compensation of up to 12 fluorescence parameters. The ND-FCCS core also maintains the current release of BD FACS Diva and twelve licensed copies of FlowJo analytical software, all of which

are available to all users for analysis. The ND-FCCS core is open to all users within the state of North Dakota, with the core providing both full service and self-service flowcytometric data and/or cell collection on for fee basis, as well as training, initial support and oversight of panel design, data analysis, and multiparameter aseptic for downstream applications.

UND Genomics Core

The Genomics Core at the University of North Dakota is a full-service facility providing state of the art genomics services to investigators at UND, institutions across the northern Midwest, as well as external commercial clients. The Core is an NIH Center of Biomedical Research Excellence (COBRE) funded operation intended to help regional researchers navigate next-generation sequencing technologies in basic and translational genomic research. Core staff are available to help with design, analysis, and visualization of sequencing data based on the needs of individual investigators and research projects. The Genomics Core lays emphasis on enabling investigators with little to no experience in genomics-based tools to design and prepare experiments utilizing Next-Generation Sequencing technologies.

The Core offers state-of-the-art sequencing services and technologies to support diverse research needs in genomics. With a well-equipped laboratory, the Core is dedicated to providing high-quality library preparation, sequencing and analysis solutions tailored to the requirements of investigators.

The Core provides a wide range of library preparation services for long-read and short-read sequencing, including whole genome sequencing, methylation analysis (EM-seq or Nanopore), 16S metagenomics, amplicon sequencing, small RNA sequencing, bulk RNA-seq (Poly-A selected and Ribo-depleted; both directional and non-directional), single-cell RNA-seq/ATAC-seq (from fresh, frozen or fixed samples) and Spatial transcriptomics. The Core also processes ATAC-seq, CUT&TAG, and ChIP-seq samples for QC and ships externally for 3rd party providers of the Illumina NovaSeq platform.

To support these services, the Genomics Core is equipped with advanced instrumentation. The facility features an Illumina Miseq platform for short-read sequencing and the Nanopore GridION with a P2 solo attachment for on-site long-read sequencing of both small (e.g. bacteria, yeasts) and large genomes, (e.g. human and mouse). For single-cell applications, a 10X Genomics Chromium iX system is available, complemented by the Nexcelom Cellometer K2

advanced cell counter and LevitasBio LeviCell to optimize sample input. In addition to sequencing platforms, the Core has acquired a NanoString GeoMx Digital Spatial Profiler for spatial transcriptomics and proteomics directly from tissue slides. The core also has an Agilent BRAVO liquid handling system for automated NGS library preparation and pooling. Quality control analysis of samples is conducted using a TapeStation 4200 or an Agilent Bioanalyzer 2100, supplemented by the Thermo Scientific Nanodrop One for assessing sample purity. For library quantification, the Core employs an Invitrogen Qubit 4 Fluorometer and a BioRad QX200 Droplet Digital PCR system. In addition, the Core has a Maxwell(R) RSC System (Promega) for automated isolation of DNA/RNA and bead-based cell separation. Furthermore, the Core offers a variety of shared-use equipment for trained users within the university. Patrons may sign up for access to a Covaris S220 Focused-ultrasonicator, Bio-Rad CFX384 Touch Real-Time PCR Detection System, Li-Cor Biosciences' Odyssey Fc Dual-Mode Imaging System, Aplegen OmegaLum C Imaging System, BioRad NGC Quest 10 Chromatography system, Thermo Scientific Sorvall MTX 150 micro-Ultracentrifuge, and BioRad Personal Molecular Imaging System. Additionally, the Core provides access to third-party spatial transcriptomics services, including AtlasXomics spatial ATAC-seq and 10x Genomics Visium platform providers.

The Genomics Core provides bioinformatics services as well. Understanding the growing need of the great majority of biologists to independently analyze genomics data, the Core has developed an innovative bioinformatics platform, genomEX (genomex.med.UND.edu). This platform provides fully personalized (adjustable CPU/GPU numbers and memory/storage capacity), dedicated (resources available 24/7 without any queue) and customizable (users have administrator rights) cloud-based high-performance computing environments. GenomEX offers a full range of one-click pipelines, from RNA-seq to genome assembly, all accessible and editable as needed. Providing admin privileges, genomEX is not limited in its offerings and can be expanded to accommodate any project specifically.

Data analysis is supported by four servers along accessible to users and Core personnel. The servers are located at SMHS in a secure, climate-controlled, power-backed up, and fire-protected room alongside other SMHS IT infrastructure. These servers include: (1) Two Dell Precision T7610 Tower Servers, running Red Hat Enterprise Linux Server release 7.4, each equipped with Intel Xeon E5-2687W v2 Eight-core 3.4 GHz Turbo, 25 MB CPU, 256

GB 1866MHz DDR3 RAM, 1GB NVIDIA Quadro K600 Video card, 256 GB Solid-state drive, two 4 TB SATA drives, 10 Gb network adapter, and an Nvidia Tesla K20C GPU; (2) Two Dell PowerEdge R760 Server, running Red Hat Enterprise Linux Server release 9.4, each equipped with Intel Xeon Gold 6428N 1.8G, 32C/64T, 16GT/s, 60M Cache, Turbo, HT (185W) DDR5-4800, 6 x 1.92TB SSD SATA Mix Use 6Gbps 512 2.5in Hot-plug AG Drive, 3 DWPD, 2 x PowerCord, 250V, 2FT, C19/C20, US, 2 x NVIDIA L40S, PCIe, 350W, 48GB Passive, Double Wide, Full Height GPU, 12 x 64GB RDIMM, 4800MT/s Dual Rank, 16 x 2.4TB Hard Drive SAS ISE 12Gbps 10K 512e 2.5in Hot-Plug; (3) One Dell Precision T5610 Tower Server equipped with an Intel Xeon E5-2687W v2 Eight-core 3.4 GHz Turbo, 25 MB processors (capable of 16 independent three processes), 64 GB 1866MHz DDR3 RAM, 1 GB NVIDIA Quadro K600 Video card, 256 GB Solid-state drive, two 1 TB SATA drives, DVD-RW drive, and a 10 Gb network adapter. The Core is also supported by two AI workstations: 2 Precision 7960 Tower, each equipped with Intel Xeon w9-3495X (105MBCache, 56 cores, 112 threads, 1.9GHz to 4.8GHz Turbo 350W), 3x A800 40GB, 1x T1000, 1 TB memory, 8 TB Solid State Drive and 72 TB SATA HDD storage.

Data storage: Raw and analyzed data collected by the Core and UND epigenetic investigators are stored redundantly on the High-Availability NSS Dell storage appliance and on a Dell PowerEdge R720xd (6 core Intel Xeon processor) with a dedicated NIC setup with 4 TB SATA hard drive platters configured for file versioning configured with RAID 6 Disk Redundancy to protect from disk failure. The total storage capacity of these servers is currently 174TB, with additional capacity to be added as needed. The storage servers as well as all the above 5 mentioned analysis servers undergo daily automated backup to UND Computational Research Center (CRC) storage. The server's data are replicated to an off-site server via DFS Replication, and VSS shadow copies of the data have been implemented to allow restoration of any folder or file, back to a previous state. Additional storage up to 500 TB allotted to SMHS is available through UND-CRC on a UND server (Talon, described below). Permissions and access to all servers in conjunction with Medical School IT, and set up to provide all investigators and their lab members storage space as well as provide them access to other group's data (with permission) to facilitate and encourage collaboration.

Mass Spectrometry Core

The Mass Spectrometry Core facility is a state-of-the-art 1,500 sq. ft. facility and very well equipped to perform mass spectral analysis of small molecules and proteins, including accurate mass

high resolution analysis and targeted quantification. The high-resolution analyzers include Q-TOF G2S (Waters) with UPLC inlet, and QExactive orbitrap (Thermo Scientific) with nano-UPLC inlet. A high sensitivity targeted analysis is performed on Xevo triple quad UPLC-MS system (Waters), API 3000 triple quad HPLC-MS system, and a Thermo Scientific TSQ 9000 triple quadrupole GC-MS/MS system. The ion sources include ESI, nano-ESI, APPI, APCI, and solid probe ion sources, EI, ECI. Waters UPLC and nano-UPLC, and Agilent and Backman HPLC systems connected to MS analyzers consist of binary pumps, autosamplers, column heaters, and DDA detectors. Processing workstations include MarketLynx, MetaboLynx, Progenesis for small molecules and proteins, Lipid Search, and PLGS processing software. In addition, the MS Core is equipped with Beckman 2-D HPLC system to allow for protein fractionation. The core director, Dr. Mikhail Golovko, and full-time staff are available for help with project design, sample preparation, data analysis and interpretation, as well as data presentation.

Histology Core

Established in 2016 within the School of Medical and Health Sciences, the Histology Core provides routine histology, including tissue processing, embedding, sectioning, and slide digitization services to support clinical and basic science research at the University of North Dakota. The objective of the Core is to collaborate with, train, advise, and provide technical support for individuals in need of histology services for research, teaching, or clinical interests. The Core is designed for 24/7 access to instrumentation critical to high-quality preparation of tissue samples, and to assist with experimental design, specifically with application-specific sample preparation techniques, to identify appropriate analytical tools available, resolution restrictions, and quantitative morphological data analysis. The Core boasts an impressive array of conventional and state-of-the-art equipment: automatic tissue processor, Barnstead Smart2Pure Water Purification System, microtome, cryostats, antigen retrieval processor, Leica Autostainer XL, Leica automated cover-slipper, 48 Dako Autostainer IHC & PT Link, and high-resolution NanoZoomer Digital Pathology scanner. Under the directorship of Dr. Colin Combs, the Core is managed by Donna Laturnus, a full-time histology technician. The Core is supported by funding from the NIH/NIGMS and the UND SMHS.



COBREs

The **Center of Biomedical Research Excellence in the Epigenomics of Development and Disease** was established at UND in 2013. The Epigenetics Working Group at UND unites multiple research teams across disciplines and departments using different conceptual frameworks and experimental approaches to study epigenetic mechanisms regulating development and pathophysiology. Using a wide range of experimental systems, research teams are aiming to uncover the epigenetic basis for normal as well as disease states including muscle health, aging, cellular quiescence, cancer, infection, and neurodegenerative disorders. As a group, our investigators are targeting molecular mechanisms of local and reversible genome-wide reprogramming, cellular heritability of epigenetic changes, and fine-tuning of local gene activity that can be recruited for therapeutic applications.

The **Center of Biomedical Research Excellence in Host-Pathogen Interaction** was initiated at UND in 2016. The objective of the COBRE in Host-Pathogen interaction is to establish a highly interactive and dynamic group of junior investigators whose research focuses on the intersection between the host and microbial agents. These investigators with expertise in viral, bacterial, and parasitic infections are working in a cohesive and collaborative manner to uncover immune mechanisms regulating the pathogenesis of

these diverse infectious diseases, likely identifying novel treatment targets, and to identify microbial influences altering susceptibility and onset of disease. The cutting edge, critical research proposed in this grant will be accomplished by utilizing state-of-the-art infrastructure supported by core facilities equipped with modern instrumentation and technology (Flow Cytometry, Imaging, Histology, and Computational Data Analysis). A key facet of this COBRE, the Computational Data Analysis Core, which is consistent with our global, strategic mission to address the needs of North Dakota's aging, largely rural population that are prone to infectious diseases such as pulmonary infections, sepsis, neuroinflammation and vector-borne disease. This center nurtures a focused group of investigators working to establish a collaborative and sustainable Center of Excellence in Host-Pathogen Interactions capable of attracting the brightest and most talented faculty, students, and fellows to conduct world-class research in the field of infectious diseases, the significance of which has recently been demonstrated on the world's stage. UND is fully committed to ensuring the growth and sustainability of this group even after the COBRE grant ends, which will establish and maintain UND as an emerging infectious disease center in the U.S.

2023 PUBLICATIONS

Bordet G, Tulin A, Using Drosophila Genetics to Identify Factors that Affect PARP1 Activity In Vivo, *Methods Mol Biol.* 2023;2609:339-352. doi: 10.1007/978-1-0716-2891-1_20. PMID 36515845

Karpova Y, **Guo D**, **Tulin AV**, Cell-Based Screening for New PARP Inhibitors Utilizing PARG-Mutated Mouse Embryonic Stem Cells, *Methods Mol Biol.* 2023;2609:375-385. doi: 10.1007/978-1-0716-2891-1_23. PMID: 36515848

Karpova Y, **Tulin AV**, Generating PARP Knockout D. melanogaster with CRISPR/Cas9 System, *Methods Mol Biol.* 2023;2609:353-362. doi: 10.1007/978-1-0716-2891-1_21. PMID: 36515846

Bordet G, **Bamgbose F**, **Bhuiyam SH**, **Johnson S**, **Tulin AV**, Chromatin Immunoprecipitation Approach to Determine How PARP1 Domains Affect Binding Pattern to Chromatin, *Methods Mol Biol.* 2023;2609:297-313. doi: 10.1007/978-1-0716-2891-1_17. PMID: 36515847

Karpova Y, **Tulin AV**, TaqMan Multiplex qPCR Method to Genotype PARG Knockout Mice, *Methods Mol Biol.* 2023;2609:363-371. doi: 10.1007/978-1-0716-2891-1_22. PMID: 36515847

Haage A, Tanentzapf G., Analysis of Integrin-Dependent Melanoblast Migration During Development, *Methods Mol Biol.* 2023;2608:207-221. doi: 10.1007/978-1-0716-2887-4_13. PMID: 36653710

Sakowski SA, **Savelieff MG**, Feldman EL, Disrupted axon-glia communication leads to neurodegeneration in metabolic diseases, *Neurobiol Dis.* 2023 Feb;177:105994. doi: 10.1016/j.nbd.2023.105994. Epub 2023 Jan 9. PMID: 36632920

Han J, Wang J, Shi H, Li Q, Zhang S, Wu H, Li W, Gan L, **Brown-Borg HM**, Feng W, Chen Y, Zhao RC, Ultra-small polydopamine nanomedicine-enabled antioxidation against senescence, *Mater Today Bio.* 2023 Jan 21;19:100544. doi: 10.1016/j.mtbio.2023.100544. eCollection 2023 Apr. PMID: 36747580

Chittimalli K, Jahan J, Sakamuri A, Weyrick H, Winkle W, **Adkins S**, Vetter SW, Jarajapu YPR, Reversal of aging-associated increase in myelopoiesis and expression of alarmins by angiotensin-(1-7), *Sci Rep.* 2023 Feb 13;13(1):2543. doi: 10.1038/s41598-023-29853-w. PMID: 36782016

Color Code: **Faculty/Adjunct** – **PostDoc** – **Student** – **Staff**

Huang H, Even Z, Wang Z, Li L, Erickson A, **Golovko M**, Golovko S, Darland D, Mathur R, Wang X, Proteomics Profiling Reveals Regulation of Immune Response to Salmonella enterica Serovar Typhimurium Infection in Mice, *Infect Immun.* 2023 Jan 24;91(1):e0049922. doi: 10.1128/iai.00499-22. Epub 2022 Dec 13. PMID: 36511704

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2023 BY THE NUMBERS

8

Graduate
Students
Accepted

5

Ph.D.
Degrees
Awarded

35

Active
Graduate
Students

46

Faculty &
Adjunct
Faculty

98

Active
Research
Projects

#1

Biomedical Science
Departments, Ranked
Nationally in terms
of NIH funding
(BlueRidge Ranking)

\$13.2

Million Awarded
in Grant Funding

73

Department
Publications

Publications Authorship:

87

Faculty/Adjunct Faculty

27

Postdoctoral Fellow

38

Student

32

Staff

75

Invited Presentations/
Seminars Delivered

83

Local/Regional

62

National and
International



SPECIAL EVENTS

FRANK LOW RESEARCH DAY WINNERS

Graduate Students:

Best Poster

- **Danielle Germundson** – “Histamine H3 receptor antagonism mitigates food-hypersensitivity-associated depressive behavior and neuropathology in a mouse model of cow’s milk allergy” (co-author Kumi Nagamoto-Combs)
- **Dilini Ekanayake** – “Leukocytes as mediators of gut-brain communication” (co-authors Suba Nookala, Kumi Nagamoto-Combs)

Honorable Mention

- **Gbolahan Bamgbose** – “PARP-1 and PR-Set7/H4K20me1 collaborate in regulating gene expression programs during development and heat stress response” (co-author Alexei Tulin)
- **Sakuntha D. Gunarathna** – “Predicting Cancer from Cell-Free DNA: A Machine Learning Approach” (co-authors Nazim Belabbaci, Regina Nguyen, Aerica Nagornyuk, and Motoki Takaku)

Postdoctoral Fellow:

Best Poster

- **Geetika Verma** – “Continuous consumption of whey protein maintains neuroinflammation in a mouse model of asymptomatic cow’s milk allergy” (co-author Kumi Nagamoto-Combs)

SCHOOL OF MEDICINE & HEALTH SCIENCES TEACHING AWARDS:

Golden Apple Awards

Nominated by Class of 2026: Patrick Carr, Ph.D.

Outstanding Unit 5 Instructor Award

(Given by the medical class of 2026)

Pat Carr, Ph.D.

Ken Ruit, Ph.D.

Outstanding Unit 2 Instructor

Xuesong Chen, Ph.D.

Outstanding Unit 1 Instructor (Class of 2027)

Jane Dunlevy, Ph.D.

UND FOUNDER’S DAY HONORS/AWARDS

- **Alexei Tulin**, Professor – UND Foundation/McDermott Faculty Award for Excellence in Research and/or Creative Activity
- **Min Wu**, Professor – Retirement
- **Margaret Smith**, Research Specialist – Retirement

EIGHT ANNUAL HOST-PATHOGEN INTERACTIONS VIRTUAL SYMPOSIUM

On Tuesday, September 19, 2023, the Center for Biomedical Research Excellence (COBRE) for Host-Pathogen Interactions invited researchers and clinicians interested in infection, immunity, and inflammation to participate in the Eighth Annual Host-Pathogen COBRE Symposium. Both oral and poster presentations from local investigators were featured.

The Symposium aims to promote interaction and collaboration among researchers in the area and to provide opportunities to learn about cutting-edge tools, approaches, and resources to advance their research in broad areas of infection and inflammation.

BIOMEDICAL SCIENCES IN THE NEWS

Headlines featured on the Biomedical Sciences News Page in 2023:

- **Brown-Borg Awarded \$3.5 million Hevolution Foundation Grant**

Holly Brown-Borg, Ph.D., Chester Fritz Distinguished Professor with the Biomedical Sciences Department at the UND School of Medicine & Health Sciences has been awarded a 5-year, \$3.5 million grant from the Hevolution Foundation titled, “Cellular Mechanisms of Frailty Onset.” This project focuses on the underlying aging biology that leads to age-related dysfunction and disease. The grant includes a sub-contract to Dr. LaDora Thompson of Boston University.

- **Chen awarded 2 NIH Grants**

Xuesong Chen, Ph.D., an Associate Professor with the Biomedical Sciences Department at the University of North Dakota’s School of Medicine & Health Sciences has recently been awarded 2 NIH Grants. Dr. Chen’s 2 new grants are a 5-year, \$2,299,000 R01 titled, “17 α -estradiol and sex-differences in HAND with methamphetamine” and a 3-year \$1,997,121 RF1 titled, “Intersection of HIV-1 Tat and SARS-CoV-2 S1 on neuroinflammation.”

- **Golovko Receives NIH R01 Grant Supplement**

Mikhail Golovko, Ph.D., Associate Professor in the Biomedical Sciences Department within the University of North Dakota School of Medicine & Health Sciences, has been funded with an NIH R01 Supplement Grant. The award is \$323,800. Dr. Golovko’s group has recently discovered a novel brain pro-

Speakers

- Scott Weaver, M.S., Ph.D.
Professor, The University of Texas
“Urban Arboviral Emergence: Mechanisms and Constraints”
- Stephanie Shames, Ph.D.
Professor, Michigan State University
“Cell-autonomous Host Defense by a Legionella Pneumophila Effector Protein”

angiogenic mechanism activated under low-energy conditions. The project funded by NIH NINDS/NIA will address alterations in this mechanism in the aging brain and its contribution to age-related neurodegenerative disorders.

- **Wendie Hasler Receives International Society for NeuroVirology Award**

Wendie Hasler, a graduate student in the Biomedical Sciences Department, was recently honored at the recent 19th Annual International Symposium on NeuroVirology. The International Society for NeuroVirology awarded Ms. Hasler with the “Donald Gildea M.D. 2007 ISNV Pioneer in NeuroVirology Lectureship Award” for her role in her lab’s abstract submission and oral presentation. Wendie is a member of the Xuesong Chen lab within the Biomedical Sciences Department; University of North Dakota School of Medicine & Health Sciences.

- **Yingying Liu Awarded Postdoc Award**

Dr. Yingying Liu has been selected as the 2022 recipient of the Outstanding Postdoc Award. Dr. Liu’s impressive scholarly production included publishing 6 papers with Dr. Min Wu including her first author paper published in Science Advances in 2022 (Impact Factor: 14). She has two additional publications coming soon. This award is accompanied by a \$1,000 travel award and a commemorative plaque that will be presented at a special seminar (TBA).

GUEST SPEAKER SEMINARS

March 1

Sarah Diermeier, Ph.D.

Senior Lecturer and Ruthford Discovery Fellow
University of Otago (New Zealand)
Chief Scientific Officer and Founder, Amaroq Therapeutics
“Long Non-coding RNAs as New Regulators of Cancer Growth”
Sponsored by the Epigenetics COBRE

April 5

Peggy L. Kendall, M.D.

Professor of Medicine, Chief of Division of Allergy and Immunology
Department of Medicine, Washington University School of Medicine
“B Lymphocyte Signaling and Microbiome in Autoimmunity”
Sponsored by the Host-Pathogen COBRE

May 18 and 19 – Epigenetics Symposium

Pedro Rocha

NIH, Presidential Sponsored Speaker
“Untangling Enhancer-Promoter Interactions Throughout Mouse Development”

Danesh Moazed

Keynote Speaker
Harvard University Medical School
“Chromatin-Associated RNA Decay in Epigenetic Gene Silencing”

Sandipan Brahma

University of Nebraska Medical Center
“RNS Polymerase II, the BAF Remodeler and Transcription Factors Synergize to Evict Nucleosomes”

Haojie Huang

Mayo Clinic
“Noncoding RNA Regulation of Gene Transcription and RNA Methylation”

September 13

Samantha Pattenden, Ph.D.

Associate Professor,
Center for Integrative Chemical Biology and Drug Discovery
University of North Carolina-Chapel Hill
“Development of Epigenetic Technologies to Accelerate Cancer Biomarker and Therapeutic Target Discovery”

September 19 – HP COBRE Symposium

Scott Weaver, M.S., Ph.D.

Professor, The University of Texas
“Urban Arboviral Emergence: Mechanisms and Constraints”
Sponsored by the Epigenetics COBRE

Stephanie Shames, Ph.D.

Professor, Michigan State University
“Cell-autonomous Host Defense by a Legionella Pneumophila Effector Protein”

October 18

Fei Zhao, Ph.D.

Assistant Professor, Department of Comparative Biosciences
University of Wisconsin-Madison
“Cell Fate Decisions in Sex Duct Development”

October 21 – Department Retreat

Kelly L. Jordan-Sciutto, Ph.D.

Associate Dean for Graduate Education,
Perelman School of Medicine
University of Pennsylvania
“Genetic Variation in the Gene and Coding ER-Stress Kinase, PERK, Reveals Altered Stress Tolerance in Neurons and Glia: A Potential Contributor to HIV Associated CNS Changes”

November 1

Amanda Wasylshen, Ph.D.

Assistant Professor, Department of Cancer Biology
University of Cincinnati College of Medicine
“Epigenetic Regulators in Pancreas Homeostasis and Tumor Suppression”

November 15

Hanneke Vlaming, Ph.D.

Assistant Professor, Division of Genome Biology & Epigenetics,
Department of Biology, Utrecht University, Netherlands
“Unraveling the Control of Transcription Elongation”

December 13

Mamoru Takada, M.D., Ph.D.

Assistant Professor
Chiba University, Japan
“Discovery of Cytotoxic Anticancer Agents and New Microtubule Inhibitors for the Treatment of Breast Cancer”

BIOMEDICAL SCIENCES DEPARTMENT

2023 DISSERTATION DEFENSES



Cody Boyle

Advisor: Saobo Lei, Ph.D.

June 27, 2023

"Neuromodulatory Mechanisms of Neuropeptides in the Amygdala"



Madison Jochim

Advisor: Eric Murphy, Ph.D.

July 20, 2023

"The Effect of Sterol Carrier Protein 2 Gene Ablation and Dietary Cholesterol on Brain and Liver Lipid Composition in Male and Female Mice"

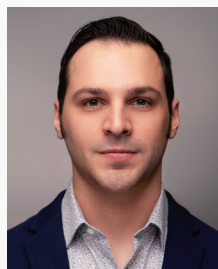


Toby Aminu

Advisor: Junguk Hur, Ph.D.

June 30, 2023

"Understanding Nanog's Role During Cell Differentiation"



Nate Velaris

Advisor: David Bradley, Ph.D.

November 28, 2023

"Staphylococcal Enterotoxin Immunotherapy Combined with HLA-DQ8 Induces Tumoricidal Activity with Low Superantigen Toxicity, Leading to Long-Term Survival and Tumor-Specific Memory Against Established B16-F10 Melanoma in Humanized HLA-DQ8AB Transgenic Mice"



Gblohblan Bamgbose

Advisors: Alexei Tulin, Ph.D.

July 5, 2023

"The Interplay Between PARP-1 and Histone Modifications in Transcriptional Regulation During Development and Heat Shock Response"



**CONGRATULATIONS TO ALL 2023
BIOMEDICAL SCIENCES GRADUATES!**



DEPARTMENT OF BIOMEDICAL SCIENCES

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