The Warren Roundup

Director's Note~

As the 2022 academic year comes to an end, a summary of this year's accomplishments is provided in the annual Warren Roundup. New instrumentation has been obtained for both the chemistry and biology cores, as described towards the end of this newsletter and was primarily purchased via financial support from the Scholl's Foundation, and can be used by any member of the Warren Center (Pictures and details are provided in this newsletter). In addition, all three cores (computational, synthesis, and biological) are directed by Ph.D. level scientists and available to researchers at Notre Dame. The Warren Center awarded the fourth annual Leahy-Filipi Family fellowship in neuroscience research, with a focus on drug discovery. There is also a graduate fellowship in neuroscience that complements the Leahy-Filip graduate fellowship, but focuses on research that can benefit patients with Cystic Fibrosis research by the Welter Family Foundation. Please see the articles below to see who received these prestigious awards. A new RFA for each of these fellowships will be announced in the coming year as well as an RFA for future grants from the Warren Center for Drug Discovery.

Drugs in the Pipeline

Hsiri Therapeutics (Miller and coworkers) continue their collaboration with Shionogi and hope to develop a new treatment for Nontuberculous Mycobacterial (NTM) infections and targeted anti-TB agents. Mishra and Blagg co-founded Grannus Therapeutics with John Foglesong, which aims to develop new anti-cancer agents and a treatment for various forms of glaucoma. Structured Immunity (Baker and colleagues) was launched in 2017 with the goal of partnering with established immunotherapy companies to help improve and optimize therapeutic pipelines via structural and computational biology. Professors Mobashery and Chang continue to develop a drug for the treatment of diabetic foot ulcers, with the goal of starting clinical trials in the near future. An additional technology that is proposed for the treatment of *C. difficile* infections from the Chang and Mobashery labs was recently licensed by a start-up company for development.

FREE Compound Screening

In an effort to facilitate collaboration and to enhance development of the Notre Dame library of small molecules, we will perform anti-proliferation assays against 5 cancer cell lines and an immortalized "normal" cell line to determine differential selectivities/ therapeutic window. The compounds must be provided in >5 mg quantities and must be >95% pure and evidence of purity must be provided in the form of at least an 1H NMR spectra. The molecules will also be added to the Notre Dame Library collection and will be screened against other targets during various high-throughput screening campaigns in the future. All biological data will be provided back to the PI. Please provide these molecules before the 1st of each month, as that is the date on which assays will be performed.

By the Numbers

Warren Center Researchers include 43 Principal Investigators, 36 Postdoctoral Researchers, 174 Graduate Researchers, 23 Research faculty, 126 Undergraduate Researchers and 10 Technicians. Combined, we published 148 scientific articles in 2022, of which 38 resulted from collaboration with other

Warren Center scientists, whereas 11 resulted from interdepartmental collaborations and 19 from departments within the Notre Dame campus. Warren researchers filed 27 US patents in 2022, whereas 3 US patents were issued and inventors had 16 new inventions to accelerate the drug discovery process. In addition, Warren researchers have requested more than $50,644,959 million in federal grant support through 49 proposals, of which 39 were awarded.

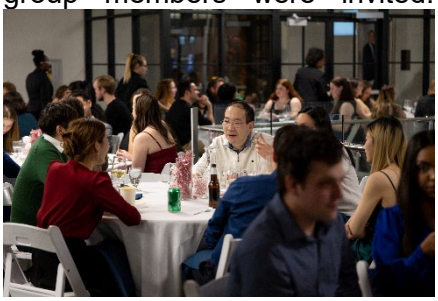
Warren Center Lecture Like A Champion Today

The Warren Center is introducing the Warren Center lecture series on the first Thursday of each month during the academic year. These talks will showcase two PI's from the university. Each speaker will have 20 minutes to present and ~ 5-10 minutes for Q & A. There will be a beer and wine reception for about 30 minutes before and about 30 minutes after both presentations. We hope these lecturers will increase our knowledge and lead to new collaborative opportunities.

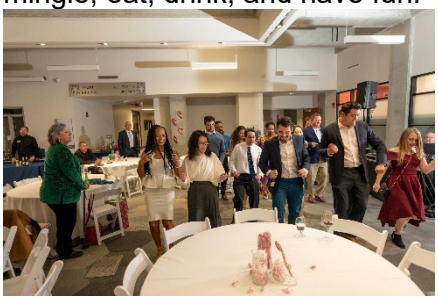
Warren Christmas Party

The Warren Center Christmas party was held on Saturday, December 3, 2022 in McCourtney Hall.

Members of the Warren Center and significant others were able to celebrate the holiday season and look back on their accomplishments during the past few years. All PI's and their group members were invited.



Guests were able to celebrate the Christmas season with music provided by a DJ while dancing the night away. All were able to mingle, eat, drink, and have fun.



Leahy–Filipi Graduate Fellowship

David Gazzo, a graduate student in the Zartman lab, is the recipient of the 2023 Leahy-Filipi Family Endowment for Excellence in Neuroscience Research. The Leahy-Filipi endowment was established in 2019 by Rev Jody Leahy Filipi and Dr. David H. Filipi, who was diagnosed with a rare neurological disease. The endowment was created with the ultimate goal of improving the quality of life for those afflicted by neurological diseases through the funding of cutting-edge neurological research. One of the most common neurodegenerative disorders found in our population is Parkinson's. Parkinson's disease (PD) is a result of cell loss in the substantia nigra region of our brain. Because the substantia nigra is, in part, responsible for motor control, cell loss in this area results in the classic symptoms that are associated with PD like tremors, poster instability, and irregular walking gait. Recently, the disruption of calcium, an important cellular signaling messenger, has been linked to the progression of PD. In accordance, David's project centers around the interruption of these signaling events, highlighting ionic channels that facilitate much of calcium's cellular dynamics. As the role of calcium is beginning to be reviled, the generosity of the Leahy-Filipi Family Endowment will continue to help elucidate its connection to PD through funding David's work, which intends to determine how the mechanisms that affect calcium signaling can be controlled to fix any disruptions of it. Congratulations David!

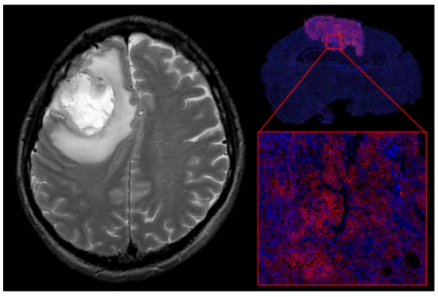
Featured Faculty – Meenal Datta

Meenal Datta, PhD is an assistant professor in the Department of Aerospace and Mechanical Engineering at the

University of Notre Dame, and a graduate student mentor in

Bioengineering and Materials Science and Engineering PhD programs. Prof. Datta received her Ph.D. in chemical and biological engineering from Tufts University in 2018, after which she completed a postdoctoral fellowship at Harvard Medical School and Massachusetts General Hospital. Her research focuses on deciphering the atypical tumor microenvironment that drives disease progression and treatment resistance in incurable cancers. By understanding and overcoming the biological, chemical, electrical, and mechanical abnormalities found in solid tumors, new therapeutic approaches can be discovered.

Prof. Datta specializes in multidisciplinary and mechanism-based preclinical research that has the potential to be rapidly translated to improve treatment approaches in the clinic. She has spent her time as a researcher deciphering and reprogramming abnormal tissue microenvironments that present in a variety of diseases ranging from virulent tuberculosis to benign schwannoma to deadly glioblastoma that, surprisingly, share unifying features: abnormal blood vessels, abundant extracellular matrix, immunosuppression, and mechanopathologies. During her Ph.D., Prof. Datta normalized the aberrant blood vasculature found in pulmonary tuberculosis granulomas to improve drug delivery. In her postdoctoral training, Prof. Datta re-engineered the immunosuppressive brain tumor microenvironment to improve glioblastoma response to immunotherapy.



Prof. Datta joined the Notre Dame faculty in fall 2021. As the director of the Tumor Immune Microenvironment & Mechanics Lab at Notre Dame (TIME Lab, https://timelab.nd.edu), Prof.

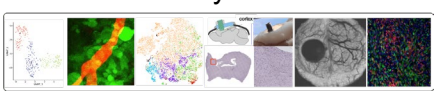
Datta's research group is applying engineering fundamentals and problem-solving approaches to explore "immunomechanics" in the tumor microenvironment and discover novel biophysical targets of interest. The TIME Lab is currently focused on exploring and exploiting the interplay between tumor mechanics and immunology in difficult to treat cancers including glioblastoma and triple-negative breast cancer. State-of-the-art research techniques in the TIME Lab utilized at multiple scales (in silico, in vitro, ex vivo, in vivo) include clinically relevant animal and organotypic models, intravital imaging, single-cell multi-omics, and high-throughput mechanical assays and drug screening platforms.

Prof. Datta has received numerous awards in support of her research including a National

Institutes of Health predoctoral fellowship, a single-recipient postdoctoral fellowship from the

American Association of Cancer Research, a National Cancer Institute career transition award,

and an Oak Ridge Associated Universities early career award.



ND/Purdue University Graduate Symposium

The first annual ND/Purdue University Graduate Symposium in Medicinal Chemistry and Chemical Biology was held from October 28 – 29, 2022 at the Morris Inn at the University of Notre Dame. This was a two-day student-organized symposium that will rotate annually between participating schools. The graduate students from the host university organized and moderated the entire meeting. The event brought together ~ 150 graduate students, post-doctoral fellows, and faculty members in the field of medicinal chemistry and drug discovery from the two Universities. This event allowed graduate students the opportunity to present their research to both peers and experienced researchers. Friday night included dinner and a presentation by keynote speaker, Dr. Dale Boger, from the Scripps Research Institute. Friday night concluded with a poster session presented by 30 graduate students and post-doctoral fellows from the two universities. Saturday events included a continental breakfast followed by eight oral presentations from both graduate students and post-doctoral fellows. Awards were given for both poster and oral presentations. Organizers from the University of Notre Dame were Hao Xu form the Blagg Lab and Amy Sorge from the

Melander Lab. The event will be held from October 20 - 21, 2023 at Purdue University, West Lafayette, IN.

Featured Faculty – Pinar Zorlutuna

Dr. Pinar Zorlutuna is the Roth-Gibson Professor of Bioengineering. Born and raised in Turkey, she received her B.S. in Molecular Biology and Biotechnology from Ankara University. She then went on to study tissue engineering at Middle East Technical University, where she received her M.S. and Ph.D. under the supervision of Dr. Vasif Hasirci, co-advised by Dr. Pankaj Vadgama.

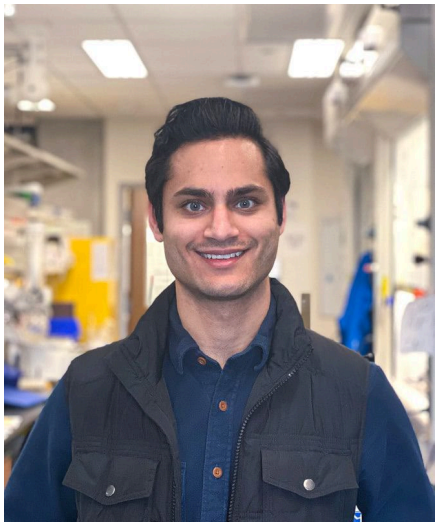
Here she focused on biomimetic tissue engineering towards fabricating a functional blood vessel tissue through 3D tubular co-culture of vascular cell types using nanopatterned scaffolds. She then moved to the United States to work as a post-doctorate researcher at the University of Illinois at Urbana-Champaign, under Dr. Rashid Bashir. Her work there involved the utilization of stereolithography for engineering microfabricated 3D neuro-muscular tissue as a first step towards engineering cell-based soft robots or "Bio-bots". From there, she took another post-doctorate position at the Harvard-MIT Center for Biomedical Engineering, working with Dr. Ali Khademhosseini at the Brigham and Women's Hospital and Harvard Medical School. Her teaching career started as an assistant professor at the University of Connecticut. Finally, she found her home at the University of Notre Dame in 2014.

Dr. Zorlutuna's research focuses on two main areas: tissue-engineered disease models and biocomputing. She explores new methodologies to investigate and develop micro and nanoscale approaches to study the cell-cell and cell-matrix interactions to address important health problems such as cancer, heart disease and aging and to engineer bio-inspired systems. Much of her recent work focuses on studying tumor-tumor microenvironment interactions, which are crucial to understand tumor growth and metastasis. In vivo animal models often fail to provide a platform for designing experiments to study multiple TME parameters simultaneously (such as matrix biophysics and biochemistry, neighboring cells, etc.) in a controlled fashion due to the heterogeneity and complexity of this microenvironment, while conventional two-dimensional (2D) studies fail to recapitulate it. Her research utilizes a newly developing field, namely biomimetic three-dimensional (3D) engineered tissue models.

Her other research area, biocomputing, is the intersection of biology and computer science. As modern computing advances, more and more energy is needed to run these computers and store data. Dr. Zorlutuna was inspired by the efficiency and multi-tasking capabilities of the human heart and brain, and aimed to solve computing problems using human cell-based biocomputers. In a recent study, she created a cardiac muscle-based coupled oscillator network to solve computationally hard problems, such as the Vertex Coloring Problem. This system has significant advantages over traditional computing platforms, such as its ultralow energy requirements and inherent scalability.

Dr. Zorlutuna has received many honors awards throughout her career, including the Biomedical Engineering Society "Rising Star" Award in 2016, an NSF CAREER award in 2017, the Presidential Early Career Award for Scientists and Engineers in 2019, the University of Notre Dame All-Team Faculty Award in 2021, and her appointment as a National Academy of Sciences Kavli Fellow in 2022. She also serves as the Director of Diversity, Equity, and Inclusion in the Aerospace and Mechanical Engineering department, and was the Acting Associate Dean for Diversity and Faculty Development.

Welter Family Graduate Fellowship in Science – Avraz Anwar

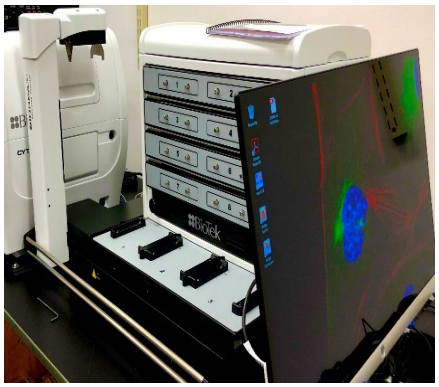


Avraz Anwar, a graduate student in Juan Del Valle's lab, is this year's recipient of the Welter Family Graduate Fellowship in Science for research on Cystic Fibrosis. The Welter Family Fellowship in Science provides

financial support to conduct research during the 2022-2023 academic year. This fellowship is focused on facilitating discoveries in cystic fibrosis research, which can include mechanistic studies, drug development, and/or related diseases that affect those with cystic fibrosis (e.g., infections of the lung). Avraz's proposal was entitled, "Targeted Optimization of Pseudouridimycin Antibiotics." Congratulations Avraz!

The Biological Screening And Development Core

The Biological Screening and Development Core (BSD) is a state-of-the-art shared research facility established in the Warren Drug Discovery Center to offer multidisciplinary cutting-edge drug discovery and translational biomedical research services for Notre Dame Investigators and external users. The goal of the BSD is to assist its user scientists and provide both expertise and advanced technologies and assays in biomedical and drug discovery research. Using advanced equipment and automation services, we provide a full range of high-throughput pre-clinical screening (ADMET assays) for small molecule development; these assays include: Plasma Stability, Microsomal Stability, Hepatocyte Stability, Caco-2 Permeability and transport, PAMPA, Blood-Brain Barrier Permeability, Plasma protein binding, Protein-protein interaction, ligand-protein interaction, Primary Hepatocyte Toxicity, hERG Interaction, CYP Inhibition, CYP Induction and AMES Mutagenicity Test. The laboratory also offers a number of assays and equipment for biomedical research that include cell culture facilities for both mammalian and bacterial cells, western blotting, qRT-PCR, DNA and RNA gel electrophoresis, ELISA, AlphaLISA, plasmid development, and cellular metabolic phenotype assays. Furthermore, the core is capable of generating and purifying recombinant proteins for in vitro assays. More excitingly, *BSD offers free testing of small molecule compounds against 5 different cancer cell lines. We are asking for 5 mg of each compound. 1 mg for testing, and 4 mg to be placed into the Notre Dame small molecule library for subsequent testing in other assays.* The program will facilitate collaborations with the Warren Center. We also have a live cell imaging automated



High-throughput Imaging - BioTek Cytation5 microplate imaging system integrated with automated BioSpa cell culture incubator. System has three channel fluorescent filters and brightfield capabilities. System has 4x, 10x, and 20x objectives.

platform featuring an automated BioSpa cell culture incubator (can hold 8 plates at a time) integrated with a Cytation5 microscopy system capable of imaging 96-well plates with three-channel fluorescence as well as bright field. This technology can be used on both 2D and 3D culture systems. With the combination of a hybrid plate reader and advanced microscopy mode, the Cytation5 can be used for a wide range of assays, including label- free cell counting, calcium kinetics, time-lapse cell imaging, cell proliferation assays, cell viability/toxicity, cell migration, transfection efficiency, confluence, cytoplasm analysis, intracellular analysis, subpopulation analysis, signal translocation and much more.

Our Nanotemper Monolith and Tycho instrument, utilizing microscale thermophoresis, will quantitatively measure any type of biomolecular interaction (ligand-protein or protein-protein) in an easy, rapid, and accurate manner. Thermophoresis (or thermo-migration) of bound or unbound molecules are detected and quantified using either covalently attached dyes, fluorescent fusion proteins, or intrinsic fluorescence.

The Monolith instrument provides a flexible, robust, and highly versatile platform to measure molecular interactions. It can quantitate a dynamic range (nM to mM) of Kd values in a small volume of sample (4µL).

Tycho is an automatic protein analyzer that can reveal protein quality – presence, purity, concentration, functionality and similarity –in one experiment in and within 3 minutes using microliters of sample (10µl). It occurs by measuring the protein's structural integrity or foldedness in a label-free way.

Our most robust and high-throughput instrument is the Biomek i7 Robotic Dual-Arm and 45 Deck Positions Liquid Handling Automation Platform integrated with Cytomat2 cell culture incubator and Cytation5 multimode microplate reader with fluorescence, absorbance, luminescence and AlphaScreen detection capabilities setting is a versatile platform for library screening, ADMET studies, as well as biomedical research

applications.

Seahorse XFe96 Analyzer

The Agilent Seahorse XFe96 Analyzer measures real time kinetics of media flux in the live cellular environment to determine in vitro oxygen consumption rate (OCR), and extracellular acidification rate (ECAR) or proton efflux rate (PER), in order to assess cellular metabolic functions such as oxidative phosphorylation, glycolysis, fatty acid oxidation and mitochondrial function. The XFe plate accommodates 96 individual wells, and up to 4 different test compounds (for example, Oligomycin, 2-DG, FCCP, Rotenone) can be injected separately into each well for real time kinetic experiments. XFe assays can apply to all fields of biomedical research including drug discovery, cancer, immunology, obesity/diabetes and neurodegenerative diseases.

We also have a Bio-Rad Connect Real Time PCR system that is computer controlled Real-Time PCR Detection System and offers 1) easy startup – obtain great results right away with factory-calibrated dyes, quick setup, and intuitive software, 2) effortless optimization – optimizing assays in a single run using the thermal gradient, 3) powerful data analysis tools- quickly and accurately validate and analyze data with the advanced analysis modules of CFX Manager™ Software.

Our AKTA pure is a versatile automated high performance liquid chromatography system for the fast purification of proteins, enzymes, nucleic acids, and other macromolecules. The system supports a broad range of chromatography techniques, allowing separation based on size, shape, charge, hydrophobicity, and non-covalent interaction.

The Agilent 6460 Triple Quad LC-MS/MS with 1290 autosampler is the gold standard for pharmacokinetic (PK), pharmacodynamic (PD), and bio-distribution studies for lead compound development. Other equipment include GE's AKTA FPLC for protein purification, BioRad ChemiDoc imaging and analyzing gel and western blots, AB StepOne real-time PCR system, BioRad C1000 thermocycler, several low and high speed centrifuges, digital sonicator, etc.

In summary, the BSD is a state-of-the-art shared research facility within the Warren Center to deliver reliable data in a timely and cost-effective manner in the field of drug discovery and biomedical research. We encourage the research community to bring your compounds for screening in our facility.

For more information, please contact:

Professor Aktar Ali
Department of Chemistry and Biochemistry
University of Notre Dame
305B McCourtney Hall
Notre Dame, IN 46556
E-mail: aali4@nd.edu
Tel: (574) 631-2363

You may also contact Sarah Gabadi-Randall by email: sgabadir@nd.edu

The Chemical Synthesis Core

The Chemical Synthesis and Drug Discovery (CSDD) Facility that is overseen by Professor Brandon Ashfeld supports translational biomedical research by providing expertise that enables the preparation of small molecules for use in hit verification, lead development, and midsize scale up. In addition, the core prepares biological probes (affinity or fluorescently tagged), active pharmaceutical agents as experimental controls, and small chemical libraries for structure-activity relationships as well as the optimization of pharmacological properties. The CSDD coordinates the organizational oversight of compounds from past, current, and future chemical synthesis endeavors that comprise the Notre Dame Chemical Compound Collection, which currently contains ~5000 unique chemical entities. The CSDD is staffed with PhD level scientists (research scientists and postdoctoral research associates) with expertise in multi-step organic synthesis, medicinal chemistry, parallel development, and purification an d isolation of small molecules. Services that are offered include, but are not limited to:

- Parallel synthesis of small molecule libraries
- Single compound preparation (10 mg to 20 g)
- Synthesis of biological probe molecule s
- Peptides Synthesis

- Purification of complex mixtures
- Sample plating and distribution
- Project development with a special emphasis on therapeutics development
- Consultation

For more information, please contact:
Professor Brandon L. Ashfeld
Department of Chemistry and Biochemistry
University of Notre Dame
305D McCourtney Hall
Notre Dame, IN 46556
E-mail: bashfeld@nd.edu
Tel: (574) 631-1727

The Computational Core

The Notre Dame Computer Aided Molecular Design (CAMD) Core Facility of the Warren Family Research Center for Drug Discovery and Development provides the full range of computational chemistry support, from atomistic modeling to assistance in proposal writing, for drug discovery and related areas to all groups on campus. CAMD computational scientists have extensive expertise in virtual screening for inhibitor design, including docking, scoring, MM/PBSA calculations, library design and cheminformatics. CAMD expertise in molecular dynamics extends from standard MD to advanced methods, such as Long Timestep Molecular Dynamics (LTMD), to Free Energy Free Energy Perturbation and Nudged Elastic Band simulations. In the area of electronic structure calculations, the CAMD uses density functional theory (DFT), correlated quantum mechanics (QM) and hybrid quantum/classical calculations (QM/MM) methods. In addition to utilizing existing methodology, CAMD is actively developing new methods, such as Q2MM and Ensemble Rescoring. CAMD expertise extends to pharmacokinetics and predictive modeling, encompassing quantitative structure-activity relationships (QSAR), cheminformatics, library and ligand-based design, and network analysis. For more information, please contact:
Professor Olaf Wiest
Department of Chemistry and Biochemistry
University of Notre Dame
305E McCourtney Hall
Notre Dame IN 46556
E-mail: owiest@nd.edu
Tel: 574-631-5876

Researchers Awarded Grants to expedite Drug Discovery

The Warren Center for Drug Discovery and Development is a state-of-the-art resource for drug discovery researchers who have an interest in the development of molecular probes, drugs, chemicals tools, biological screens or metabolomic assessments to study neurological and central nervous systems disorders, infectious disease, cancer, rare diseases or other issues of human health. An RFA had been established to expand its interactions and collaborations on campus by providing resources within the core to support new and existing collaboration that utilizes the core's strength and expertise. Each researcher was awarded funds/services to cover the cost of research performed within the Warren Center.
Funding has been awarded to:

- **Laurie Littlepage** from Chemistry and Biochemistry to work with Brandon Ashfeld in Chemical Synthesis and Drug Discovery Core Facility.
- **Margaret Schwarz** from Chemistry and Biochemistry to work with Professor Brandon Ashfeld in the Chemical Synthesis and Drug Discovery Core Facility.
- **Donny Hanjaya-Putra** from Aerospace and Mechanical Engineering to work with Professor Aktar Ali in the Biological Screening and Development Core Facility.
- **Aktar Ali** from Chemistry and Biochemistry to work with Professor Brian Blagg from the Warren Center.

Congratulations! Another request for applications will be announced during the fall of 2023 and will encourage utilization of the three cores.

NSF Center for Computer Assisted Synthesis (C-CAS)

The Center for Computer Assisted Synthesis (C-CAS) is a newly awarded NSF Center for Chemical Innovation (CCI) dedicated to changing the way chemical synthesis is done by developing machine learning tools that help predict and understand chemical reactivity. The tools, workflows and datasets are disseminated to the scientific community, including 14 of the world's largest pharmaceutical and chemical companies that are partners of C-CAS. In a recent paper published in *Nature*, C-CAS

scientists demonstrated that machine learning can outperform more traditional reaction optimization by humans. Online training material developed in C-CAS makes these tools available to scientists everywhere and a variety of activities are targeted towards increasing the participation of underrepresented groups in science and to engage the broader community in a discussion of the opportunities and dangers of artificial intelligence in science. C-CAS is the first CCI at Notre Dame and is directed by Prof. Olaf Wiest at the University of Notre Dame, but also involves data scientists and computational & organic chemists from Colorado State University, Princeton, Utah and UC Berkeley. Further information on C-CAS can be found at the center website at ccas.nd.edu.

Instruments for Use by Warren Center Researchers

AKTA Pure FPLC – Protein purification system

- Fast purification of proteins,

CFX96 Connect Real Time PCR - microtiter plate-based qPCR system

enzymes, nucleic acids, and other macromolecules
- Supports a broad range of chromatography techniques

- Factory –calibrated dyes, quick setup, and intuitive software
- Optimizing assays in a single run using the thermal gradient
- Quickly and accurately validate and analyze data with the advanced analysis modules of CFX Manager™ Software

EASY MAX

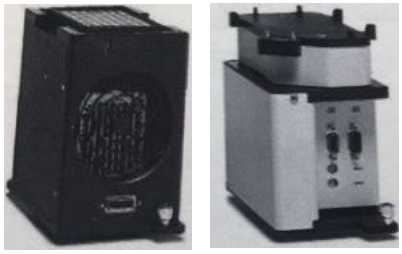
- Perform experiments at temperatures ranging from -90 to 80°C without the use of cumbersome oil and ice baths, or bulky cryostats

BIORAD TRANS-BLOT TURBO TRANSFER SYSTEM

- Rapid transfer of mini or midi gels in as little as 3 min
- High throughput transfer 1–4 mini or 1–2 midi gels in a single run
- Higher transfer efficiency compared to other transfer methods
- Allows user to customize transfer conditions and is compatible with traditional semi-dry consumables

Non-CO2 Incubator

- For use with Seahorse related assays.
- Perform XF assays more accurately and precisely



Heating/Cooling Peltier (L) and Shaking Peltier (R)

- Added to Biomek system to significantly increase its capacity of doing a wide range of assays

Hypoxic Chambers and gas

- Increase experimental procedures in cancer research

Warren Lecture Series/ Seminar Speakers?

The Warren Center has established the Warren Lecture Series to invite guest lecturers to share discoveries and scientific expertise with the Warren community. The Warren Center had two guest lecturers, this past year.

Professor Dennis Liotta from Emory University. Professor Liotta's research has focused on the discovery and development of antiviral, anticancer, and anti-inflammatory therapeutic agents. Professor Liotta has helped transform HIV/AIDS from a death sentence to a chronic infection in which patients can live active and productive lives.

Professor Philip Low from Purdue University. Professor Low's research focuses on reprograming the immune system, cancer therapeutics, bone and soft tissue regeneration, therapies for infectious diseases, fluorescence guided surgery for cancer, and treatment of erythrocyte diseases.

Dennis Liotta presented a talk about *"Novel Therapeutics for Treating Viral Diseases, Cancers and Neurological Disorders."* Phil Low presented a talk about *"A New Generation of Targeted Therapies for Cancer, Autoimmune, and Infectious Diseases."*

Dennis Liotta gathered with faculty members after his presentation.

Phil Low and faculty members after his presentation.

We look forward to welcoming more Lecturers this fall. *You can nominate a guest lecturer with strong expertise in drug discovery via email to* wrcadmin@nd.edu *or website at* https://drugdiscovery.nd.edu/ *seminars.*

Warren Center Calendar

April 1st Leahy –Filipi Family Endowment for Excellence in Neuroscience Research application due date.

August 15th Welter Family Graduate Fellowship Research on Cystic Fibrous application due date.

November 3rd- 4th Purdue University/ND Graduate Symposium. West Lafayette, IN.

November 15th Warren Center RFA due date.

Warren Center Lecture Like A Champion Today

Speakers will be presenting from 4:30 pm to 5:30 pm. Refreshments and ligh hors d'oeuvres from 4 pm to 6 pm. Talks will be in B01 McCourtney Hall.

September 7th
October 5th
November 2nd
December 7th
February 1st
March 7th
April 4th

December 2023
Warren Center Christmas Celebration. Date to be announced.

Watch for these and other events happening via the Warren Center.