College of Osteopathic Medicine
MICHIGAN STATE UNIVERSITY

Research and Scholarly Activity: Present State and Strategic Initiatives

Updated May 2021

Research and Scholarly Activity: Mission and Vision

Introduction: Michigan State University ranks as one of the top 100 research universities in the world. MSU research excellence has been recognized through institutional membership in the American Association of Universities (AAU) since 1961. The university attracts and welcomes an international community of outstanding graduate and medical students, postdoctoral associates, and faculty visitors to a broad range of highly ranked graduate programs, research centers, and interdisciplinary collaborations. As the nation's pioneer land-grant institution, MSU serves the people of Michigan, the United States, and the world, creating and applying knowledge to develop sustainable solutions to humanity's most challenging problems.

The Michigan State University College of Osteopathic Medicine (MSUCOM) Research and Scholarly Activities Present State and Strategic Initiatives are founded upon the long-standing investment the College has made, and continues to make, in advancing the research and scholarly activities of the affiliated faculty and students of the College, and derives from the tenets outlined in the College's overall Strategic Plan.

Overall Mission: Provide research administrative infrastructures, resources, professional development and training opportunities across MSUCOM campuses, state-wide campus system, and international research networks to foster research and scholarly activity of COM faculty and students in each of the following domains:

A. Research in basic science, education, translational science, patient care or population health.
B. Quality improvements and/or patient safety initiatives
C. Systematic reviews, meta-analyses, review articles or chapters in textbooks or case reports
D. Submission of Peer reviewed grants
E. Creation of curricula, evaluation tools, didactic educational activities or electronic educational materials
F. Innovations in education
G. Dissemination of scholarly activity
H. Contribute to professional committees, educational organizations or editorial boards

Overall Vision: Successful achievement of the MSUCOM Research and Scholarly Activity goals via the MSUCOM Research and Scholarly Activity Strategic Plan will result in COM faculty and students having:

- increased opportunities to participate in and share meaningful research experiences at MSUCOM campuses, in the state of Michigan, nationally and internationally
- increased numbers of publications and presentations, as well other opportunities to broadly share their scholarly outputs nationally and internationally
- increased opportunities and access to faculty development programs, workshops, and resources that foster increased research and scholarly activities

- increased and more diverse sources of intramural funding, supporting successful achievement of extramural funding to expand the domains of our research mission well into the future
- demonstrate improved health outcomes of the state, nation, and internationally based upon the research and scholarly activities undertaken by MSUCOM affiliated faculty and students.

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Overview/Background:

A strong track record for supporting research and scholarly activities at MSUCOM

COM Faculty and Research/Scholarly Activity Portfolio:

A large number of MSUCOM-supported faculty members have exceptional research programs that have garnered widespread attention and respect through the years, resulted in thousands of publications and symposium abstracts, posters and presentations, as well as tens of millions of dollars in extramural funding support, a substantial portion of which derives from the National Institutes of Health. In absolute terms, MSUCOM currently supports approximately 245 faculty, who, as part of their faculty appointment in the college, are ***all*** expected to participate in research and scholarly activities, in addition to their educational, outreach, and/or clinical efforts. Metrics of success are numerous, and we note that since 2015, MSUCOM affiliated faculty had thousands of instances of authorship on publications or meeting abstracts, and applied for hundreds of grants, resulting in millions of dollars of total external grant award support. As a result, MSUCOM students have also expanded their participation in many of these scholarly activities, as noted in recent analyses prepared in conjunction with the college's upcoming COCA accreditation self-study documents. Together, these activities place MSUCOM in the top tier of osteopathic medical colleges nationwide in regard to overall evidence of research and scholarly activity output.

MSUCOM Students: Current training and participation in Research and Scholarly Activity:

It is the policy of MSUCOM that each student in the D.O. program will have instruction in principles of research and scholarship, scientific and research methods, interpretation of evidence, and communication to patients in the delivery of evidence-based care. These principles are presented through required coursework, research and scholarly activity electives, and the mandatory co-curricular program in the Responsible Conduct of Research. While osteopathic medical students are not required to complete scholarly activity as a component of the D.O. curriculum, the college provides its students with an array of opportunities to engage in this work if they so choose.

Immediately upon matriculation, ***all*** MSUCOM medical students are obligated to participate in OST598: Evidence-based Health Sciences, an introductory course to the practice of Evidence Based Medicine that is structured on the principles of Epidemiology, Biostatistics, Research Methods, Preventive Medicine and Public Health. This course provides a foundation knowledge for a scholarly approach to basic and clinical sciences presented in years one and two of the curriculum.

Thereafter, a number of research related course offerings can further enrich research training and experiences of all DO students in COM, including OST 591-730: Medical Case Study Elective in which students present case reports while clinical faculty present patient-based cases which they use to guide

students through the case study process; OST 593: Scholarly Activity Seminar: a 1-credit hour course that develops the student's ability to design and implement a scholarly project, using a workshop format, and focuses on building the student's capacity to engage in scholarship in practical and pragmatic ways; and OST 597: Biomedical Research Structure and Methods, a 2-credit course where students are introduced to a wide variety of research types and methods, via lectures, workshops and large group case discussions.

In years 1 and 2, students may enroll in the OST 599: Preclinical Biomedical Research elective to earn credit for active participation in a research project in a clinically or laboratory based project or patient chart review. In the clerkship years, OST 615: Clinical Biomedical Research: is a 6-credit elective that enables medical students to test and compare different theories and approaches, and explore different methods to determine better modalities for patient care and therapy. Students are enrolled in 6 credits, representing 40 hours' research per week for 4 weeks, up to a maximum of 18 credits.

All OST 599 or OST 615 research must have prior approval from the College of Osteopathic Medicine's Research Office. After formalizing an agreement with a research mentor, the student must provide a research proposal. The research proposal must include: Study Title; Principal Investigator/Research Mentor; Significance and/or clinical impact of the research; Background and hypothesis; Approach/ Study Design; Sample size, if applicable. Inclusion of power analysis or alternatively a statement that the study is a pilot study; Aim(s); Methods; Anticipated Results; and Statistical analysis, if applicable; with each section being approximately 200 words. Prior approval by the MSU Institutional Review Board is expected for human subjects research; animal research requires approval of the MSU Animal Use Form. After completing the project, the student must provide a narrative report of one to two pages indicating what was accomplished in qualitative and quantitative terms, the relevance of these findings to the hypothesis tested, and what in their opinion is the next step(s) in the research project. Student's must have their research mentor review, and approve their final report before submitting it. The research mentor must provide a student evaluation as well.

For those COM medical students seeking a deeper immersion and recognition for their additional research and scholarly activity efforts, options include a Masters in Public Health, a Masters in Global Health, and the long standing MSUCOM DO/PhD training programs. The DO/PhD training program in particular, has a current contingent of approximately 45 DO/PhD trainees, (as well over 60 alumni). Since 1979, trainees in the DO-PhD Physician Scientist Training Program spend seven to eight years in education and training to become physician-scientists. Graduates find careers in biomedical research or academic medicine. Their training enables them to be physician-scientists working on basic science or disease-related problems.

Responsible Conduct of Research, or RCR, training is also required for all students in the MSU College of Osteopathic Medicine. RCR topics address the responsibilities of students in both basic biomedical and clinical research during the four year curriculum. Face-to-face instruction developed by College of Osteopathic Medicine basic research, clinical research, administrative and support faculty/staff are harnessed to foster commitment to RCR, (something that is furthered in our SCS educational modules for residents as well). These efforts are complemented by the MSU Institutional Review Board training

and Collaborative Institutional Training Initiative online modules. Completion of the required training and online modules is tracked for each student by the College of Osteopathic Medicine Office of the Registrar.

Dissemination and Recognition of MSUCOM DO Student Research and Scholarly Activities:

MSUCOM students regularly present at a number of local and national venues, such as the Michigan Osteopathic Association (MOA) Spring and Fall Research Conferences, and the annual Osteopathic Medical Education (OMED) meetings. In addition, MSUCOM provides for and supports a variety of additional venues allowing students the opportunity to present their own RSA, as well learn from other students, across the spectrum of research activities of the college. Examples include:

MSUCOM SCS Research Poster Day: The MSU College of Osteopathic Medicine Statewide Campus System (SCS) has sponsored an Annual Scholarly Activity Poster Day. Poster abstract submissions concerning the results of research, quality improvement (QI) and other types of scholarly work projects are presented by MSUCOM Medical Students, SCS-affiliated Residents and Fellows, as well MSUCOM Faculty.

MSUCOM DO/PhD Training Program Research Retreat: The MSUCOM DO/PhD training program sponsors an annual retreat and research presentation meeting, providing a venue for trainees to present and share their research efforts with other students and faculty mentors.

Detroit Medical Center GME QuESST Research competition: The Research Day is a multidisciplinary event that seeks to highlight the scholarly activities of medical students, physician assistants, nurses, pharmacists, and residents from various specialties, via a forum where trainees are showcase their research and quality improvement projects in the form of oral or poster presentations.

These venues for dissemination of student RSA outputs are further enhanced by a number of research presentation venues provided by each of the MSUCOM foundational sciences departments, as well mentoring expertise and guidance provided to MSUCOM research mentors and students by the MSU Graduate School. Please see the MSUCOM student awards website for a listing of recent research recognition awards our medical students have received at these and other conferences.

MSUCOM SCS Spartan Medical Research Journal (SMRJ): The college provides a number of opportunities to support publication of research outputs of our students, including via the SMRJ. The primary purpose of this peer-reviewed journal is to provide a formal publication option for research completed by MSUCOM students, residents and faculty. SMRJ's mission is to advance medicine and medical education through the timely publication of peer-reviewed clinically-oriented research, clinically-relevant basic science research, healthcare quality research, and medical education research from the MSUCOM community, with the ultimate goal of improving patient care and the education of patients and care providers. SMRJ is a free on-line journal, open to all viewers. Importantly, the SMRJ

has been recently accepted for indexing in PMC. This means that all published articles going forward will receive a Pubmed Central ID number (PMCID). In addition, all past SMRJ articles will be retrospectively assigned a PMCID. Together, these efforts have afforded an increased number of research and scholarly activities being undertaken by the COM student body, as assessed most recently by the COM 2021 COCA Self-study summaries.

COM Research Areas of Strength At a Glance:

Osteopathic/Neuromusculoskeletal

Clarence Nicodemus is Director of Osteopathic Manipulative Medicine Clinical Research. He co-authored Chapter 8 on Biomechanics for the 4th edition of Foundations of Osteopathic Medicine and contributed to the 5th edition of Greenman's Principles of Manual Medicine. His research focus in understanding the role of sacroiliac (SI) joint dysfunction in the mechanics of lumbosacropelvic motion as a major cause of Chronic Low Back Pain. This research includes 3D motion capture with EMG measurement, cadaver dissection, 3D modeling and FEA from cadaver CT scans, SI ligament strength testing.

John Michael Popovich has a multi-disciplinary approach to investigating the mechanics, control and function of the spine has received post-doctoral funding from the NIH and funding from prestigious spine-related societies, including an Exploratory Research Grant from the Scoliosis Research Society and a Young Investigator award from the North American Spine Society.

Roger C. Haut is a University Distinguished Professor and Director of Orthopedic Biomechanics Laboratories at MSU. His research has been funded by grants from the Centers for Disease Control and Prevention, National Center for Injury Prevention and Control for research on blunt knee insults causing post-traumatic osteoarthrosis.

Jacek Cholewicki is a Professor in spinal biomechanics and is Director of the Michigan State University Center for Orthopedic Research (MSUCOR). His research has been funded by NIH to investigate the areas of lumbar and cervical spine function, spine injury mechanisms, tissue loading, and biomechanical modeling, including one of the largest "U" grants from NIH ever awarded to MSU, focused upon clinical evaluation of OMT interventions.

Feng Wei is the Assistant Director of Orthopedic Biomechanics Laboratories and his research interests are human musculoskeletal system modeling, sports injury prevention and rehabilitation, pattern classification and recognition, imaging, lower extremity electromyography (EMG) in pathological gait, mechanotransduction in articular cartilage, and locomotor adaptation.

Richard C. Hallgren's research is focused upon investigating the effects of whiplash-type injuries upon the rectus capitis posterior (RCP) muscles. He is developing a biomechanical model that characterizes

the functional relationship between RCP muscles and structures of the upper cervical spine such as the atlas and the spinal dura.

Christopher Kuenze has as a research interest around the impact of ACL reconstruction on physical activity participation and quadriceps neuromuscular function with the goals of reducing ACL re-injury risk and promoting positive long-term patient outcomes. In addition, Kuenze is working to develop low-cost technologies to assist in the promotion of physical activity participation following knee joint injury.

Autoimmunity

Andrea Amalfitano and Yasser Aldhamen have explored genetic associations with autoimmune diseases to unravel the regulation of the innate and adaptive immune systems.

Julia Busik studies the molecular and immunological mechanisms underlying several forms of diabetes, in particular as they relate to diabetic retinopathy.

Laura McCabe explores how inflammatory bowel diseases result in bone loss, and how the gut microbiome influences immunity as well skeletal biology.

Richard Neubig has investigated the molecular underpinnings of the autoimmune disease scleroderma.

Cancer

Andrea Doseff investigates the effect of diet on immune cell fate in cancer models.

Karen Liby studies the role of inflammation in cancer and seeks to develop and test new drugs for the prevention or treatment of cancer and other chronic diseases.

Andrea Amalfitano studies how cancer vaccines can be developed against solid tumors to treat existing cancer, or prevent cancer.

Yasser Aldhamen studies how inhibitors of the SLAM signaling pathway can be targeted to prevent solid tumor avoidance of immune mediated detection and destruction.

Richard Neubig's lab focuses on the molecular mechanisms of GPCR (G-Protein Coupled Receptor) signaling and discovered: a series of compounds that inhibit the MRTF/SRF signaling axis with potential therapeutic benefits in melanoma and fibrosis; and involvement of TGF-beta in pulmonary arterial hypertension.

Jetze J. Tepe's research includes studies attempting to improve inhibition of the proteasome, a clinically validated treatment of multiple myeloma, however nearly all patients relapse after some time. Tepe's natural product inspired scaffolds elicit a unique mechanism of inhibition of this large protease that

overcomes resistance to current cancer therapies as one of several approaches to treat cancer and a variety of other diseases using natural product inspired therapeutics.

Drug Discovery

The MSU Drug Discovery Program, also led by Richard Neubig, works towards the discovery and development of drugs and chemical technologies with applications for human health, animal health and agricultural use.

> Christopher Waters's lab studies bacterial signaling in Vibrio Cholerae and inhibition of bacterial biofilm formation with the development of new antibiotic adjuvants as lead development for drug discovery.
>
> Stephanie Watts' lab focuses on 5-hydroxytryptamine or 5-HT, perivascular adipose tissue (PVAT), peptide chemerin, and their contribution to hypertension, obesity and obesity associated hypertension. The development of a 5HT7r agonist is currently in as lead development in the drug discovery program.
>
> Min-Hao Kuo's lab has been funded by NSF and NIH to study the cellular lifespan regulation by intracellular triacylglycerol and Alzheimer's disease drug discovery.

Health Services and Preventive Medicine Research

Paul Stein and Mary Jo Hughes are globally renowned researchers on venous thromboembolic disease and pulmonary embolism.

Alla Sikorskii is a methodologist and statistician, and has built a program of research in symptom management and patient-reported outcomes (PROs) and design and evaluation of interventions to improve these outcomes among people with chronic conditions, especially in cancer patients. She has designed numerous randomized controlled trials (RCTs) including the sequential multiple assignment randomized trial (SMART) allows to build the evidence base for multi-staged interventions. She has authored or co-authored nearly 200 peer-reviewed publications with 3536 citations and has been a principal or co-investigator on numerous NIH RO1 grants.

Furqan Irfan is a physician-scientist and has carried out Population health and Preventive Medicine studies across a broad spectrum of diseases including cardiovascular diseases (cardiac arrest/stroke) and cancer. He has been externally funded for work with colleagues at the Veteran Affairs Healthcare system, the largest integrated healthcare system, in the US, on improving clinical outcomes in veterans. He has also developed machine learning clinical predictive outcome systems, most recently on predicting mortality in COVID-19 patients.

Clare Luz is a nationally recognized gerontologist and founding director of AgeAlive program, and the principal investigator for the HRSA-funded Building Training…Building Quality ™ (BTBQ™) project, a

comprehensive personal care aides training program, and Integrated Model for Personal Assistant Research and Training (IMPART), funded by the Michigan Health Endowment Fund.

Imaging Research

Erik Shapiro heads the Molecular and Cellular Imaging Laboratory (MCIL) that is focused on magnetic resonance imaging (MRI) and x-ray computed tomography (CT) for molecular and cellular imaging of biological phenomena, regenerative medicine, and early detection of disease. Working at the intersection of chemistry, physics and biology, Dr. Shapiro's laboratory has three main cores: developing novel nanoparticle contrast agents for MRI and CT; using molecular and cellular imaging for monitoring cell migration, such as after stem cell transplant; and using targeted contrast agents to detect specific molecular epitopes, such as in cancer.

Jill McMahon has been NIH funded to investigate the effects of exercise on reversing diabetic peripheral neuropathy and the effects of statin medications on muscle function using MRI to examine muscle size and muscle damage and Magnetic resonance spectroscopy to examine phosphorus metabolites. She also explores the influence of age and exercise on vascular function using MRI to examine microvascular function with fMRI, MRI CINE PC and ultrasound to examine blood flow in the leg artery and veins.

Chunqi Qian's research is focused on the development of advanced detection technologies for MRI and biosensing, and the development of multi-physical theragnostic methods to study vasculature diseases related to kidney, heart and brain.

Infectious Diseases

Andrea Amalfitano has spent a career studying Adenoviruses, primarily as a gene transfer vector for use in the potential treatment of a variety of infectious (malaria, C. difficile, HIV) and genetic diseases.

Eric Benbow is studying how complex communities (e.g., aquatic insects or microbes) change, are distributed and how this knowledge can be used in various applications in medicine, disease and environmental management.

Brett Etchebarne focuses on rapid identification of deadly pathogens with appropriate antimicrobial treatments to fight sepsis, a condition that kills many and often leaves survivors with persistent debilitating medical problems.

Terrie Taylor, is an internationally recognized scientist and physician who has waged a 33-year battle against malaria. Her research, published in the New England Journal of Medicine, determined swelling of the brain and pressure on the respiratory center as the cause of death in pediatric patients. She has authored or co-authored well over 200 peer-reviewed publications and has received over $35 million in grant awards.

Yong-Hui Zheng studying the cellular innate immune responses to HIV infection, including impact of cytidine deaminases in host antiviral defense in HIV, and how environmental agents, including cannabis exposure, might impact these responses.

Peter Gulick is a clinician-scientist collaborator fostering translational capacity for each of the projects outlined above, with a particular focus on clinical management of HIV patients.

A. Leonel Mendoza studies the molecular and immunological aspects of infections caused by the Stramenopilan Oomycete pathogen Pythium insidiosum.

Andrew Olive and Robert Abramovitch together working on tuberculosis pathogenesis and immune interactions

Victor Dirita and Chris Waters collaborate on Cholera pathogenesis as well as many other pathogens that represent threats to human health.

Psychiatry and Neurodevelopment

The THRIVE Always neuropsychiatry research division led by Michael Boivin, is comprised of leading experts, Alla Sikorskii, Amara Ezeamama, Itziar Familiar-Lopez, and Horacio Ruisenor Escudero, in neuropsychiatric research pertaining to interventions and outcomes assessment in low- and middle-income countries (LMICs).

Neurology/Neuropathology

Charles Lee Cox research interests are in the cellular mechanisms underlying behavioral plasticity. His research is particularly concentrated on the neurophysiology and pharmacology of neocortical and thalamic neurons in the mammalian central nervous system.

John Goudreau is a clinician-scientist who studies the molecular mechanisms, as well conducts clinical trials to improve the treatment of Parkinson's patients, alongside several clinicians with additional large MS patient cohorts.

Michelle Kvalsund, is a global health neurologist and has received an NIH grant for her work in Zambia, identifying potential causes of Distal Symmetric Polyneuropathy, which is prevalent among certain clinical populations in the region.

Neuro-Vascular Biology

Anne Dorrance's research has noted that the brain is exquisitely sensitive to changes in blood flow, with even small reductions in flow resulting in neuronal injury and stroke. Milder reductions in blood flow can result in the development of cognitive impairments that lead to dementia development. In the Dorrance lab, we study how cerebral arteries regulate blood flow and how conditions like obesity and

hypertension impair this process. By doing this we may identify treatments to slow or prevent the development of dementia and improve the outcome of a stroke.

Gregory Fink's research concerns the causes of systemic arterial hypertension, a major world-wide risk factor for cardiovascular disease morbidity and mortality.

William F. Jackson's laboratory seeks to understand how arterioles in the microcirculation sense their environment and how changes in the environment alter the contractile function of vascular muscle cells in the walls of these microvessels to lead to changes in blood flow and blood pressure.

Nathan Tykocki's research focuses on urinary bladder physiology, with specific emphasis on the mechanisms responsible for the sensation of bladder fullness, to understand how the bladder muscle, nerves, vasculature and urothelium communicate to impact bladder function.

Stephanie Watts' laboratory focuses on vascular smooth muscle pharmacology, physiology and function and is dedicated towards understanding the mechanisms by which the vasculature contributes to hypertension, obesity and obesity associated hypertension.

Toxicology

Neera Tawari-Singh's research focus is on understanding mechanisms of toxicity and inflammation from mainly dermal and ocular exposures to chemical agents employing state-of-the-art molecular techniques and systems toxicology approaches.

MSUCOM Research Facilities and Administrative support:

Research facilities and administrative support units dedicated to various aspects of research and scholarly activity of MSUCOM faculty and students are extensive and fully available, and include not only COM specific areas of support, but also access to the research infrastructures present at Michigan State University, a top 100 research university in the world.

COM Research Office: The Office for Research, under the direction of John Goudreau DO, Ph.D, encourages and supports biomedical research at the college's East Lansing, Macomb University Center and Detroit Medical Center sites, and throughout the Statewide Campus System of affiliated hospitals. The office promotes improved health outcomes, quality and safety in healthcare through research and scholarly activity, and facilitates research-related activities between the college and university central administration, and between the College of Osteopathic Medicine and other MSU colleges. It also provides assistance to college-affiliated physicians and scientists working to develop successful research programs and assists College of Osteopathic Medicine students seeking research experience. A source for information and documents, including information regarding the responsible conduct of research, the office also provides information regarding potential funding sources for research and scholarly activity, both within the college and university, as well external funding sources. The DO/PhD training program is also administered through this office, in coordination with a number of Ph.D granting departments within, and beyond the College of Osteopathic Medicine.

SCS/Virtual Scholarly Activity Consult Program: Consult "visits" are provided to COM affiliated programs, and is a program that also allows residency programs at MSUCOM affiliated clerkship and SCS affiliated sites to sign up for partial or whole-day scholarly activity (SA) consultation visits in addition to individual faculty/resident project services. These visits for individual or multiple residency QI and research programs are implemented to expand current SA project levels and dissemination products.

Consults include:

-One or more 30-60 minute virtual interactive learning modules regarding SCS SA services, project topic conceptualization and design principles, IRB application strategies, selection of project planning tools, etc. from a menu of presentation options;
-Individual project-specific planning sessions with faculty/fellow/resident project teams; and
-Ongoing online SA modules and resources.

Health Colleges Research Services/ Support Offices: or HCRS, provides pre-award support and additional information to the faculty in departments of the College of Osteopathic Medicine.

CSTAT: The Center for Statistical Training and Consulting (CSTAT) provides staffing and expertise to MSUCOM faculty and students as a means to collaborate on research projects and provide statistical support. CSTAT offers training and education in data management, statistical methods, and responsible conduct of research. For example, CSTAT provides expertise and guidance on study design, statistical methods, interpretation of results, and conduct statistical analyses participate in grant proposal

applications with design and methods considerations and sample size determination provide research data management services collaborate on manuscripts and serve as co-authors.

Clinical and Translational Sciences Institute (MSU-CTSI): is composed of the MSU Office of Clinical Research Support Core (CRSC) and the Biomedical Research Informatics Core (BRIC). The goal of the MSU-CTSI is to develop clinical and translational research infrastructure to the benefit of the communities and investigators in the MSU network, and ideally to expand this network by linking with additional research communities across the nation.

CRSC: The mission of the CRSC is to assist researchers across the different colleges with development, implementation, management, and completion of government and industry-funded clinical research (i.e., clinical trials, investigator-initiated research, etc.) conducted through MSU and its community partners, to expedite the research administration process, and to facilitate research compliance. CRSC is staffed by seasoned clinical research professionals representing the University's investment in clinical research and trials management, who have extensive knowledge in the intricacies of both internal and external clinical research processes and requirements for both federally and industry-sponsored research projects.

BRIC: BRIC Services include Pre-Award Planning, customized data management plans and providing supporting material for the Human Subjects Protection and Resource/Facilities sections of grant proposals. Databases are constructed to organize and integrate information from multiple data sources while BRIC data managers can create custom databases, while providing valuable expertise in the use of best practice parameters for defining variables. Data management also includes training database users, managing access to data, importing data from other sources, data cleaning, storage and security. BRIC senior staff are available to participate as a co-investigator for select studies. CTSI is directed by Dr. John Goudreau, DO, Ph.D; he reports directly to the MSU Office of Vice President for Research and Innovation, who reports directly to the MSU President's office.

The Macromolecular Structure, Sequencing, and Synthesis Facility

This facility provides assistance with purification and sequence analysis of proteins, peptides and carbohydrates. Oligonucleotide synthesis is available with standard bases, modified bases, or with fluorescent or biotin labels. The MSSSF also provides assistance with oligonucleotide design prior to synthesis.

Investigative Histopathology Laboratory

This facility provides histology processing and staining, automated immunohistochemical staining, and tissue preparation for antigen retrieval and nucleic acid extraction. Equipment includes Leica AutoStainer XL and CV5030 Robotic coverslipper, microtomes, Shandon Cryotome Thermo Crostat and Excelsior tissue processor, VIP Tissue Tissue Processor, Dako Autostainer Universal Staining System (Immuo), Fisher MicroProbe and Shandon Histocentre Tissue Embedding System. Much of the service to faculty and trainees involves customizing procedures for specific study purposes. The transmission electron microscopy service is employed for research and teaching.

Center for Advanced Microscopy

Many microscopy and other imaging capabilities exist in the laboratories of MSU investigators and their Departments. In addition, the Center for Advanced Microscopy (CAM) is a campus-wide microscopy resource. It provides MSU researchers and their trainees with formal, graduate level instruction and 24-hour/day access to scanning electron microscopes, transmission electron microscopes and confocal laser scanning microscopes. There are two Scanning Electron Microscopes at the Center for Advanced Microscopy, a JEOL 6400V (Japan Electron Optics Laboratories) with a LaB6 emitter (Noran EDS) and a

JEOL 6300F with field emission (Oxford EDS). These provide capabilities for secondary electron imaging, backscattered electron imaging, digital or analog imaging and energy dispersive X-ray microanalysis. A JEOL100 CXII transmission electron microscope with two ultramicrotomes with a CR-X cryosectioning unit for cryo-ultramicrotomy and diamond knives are available for users. There are three confocal laser scanning microscopes at the CAM, a Zeiss LSM Pascal, a Zeiss 510 Meta ConfoCor3 LSM , an Olympus FluoView 1000 LSM as well as a Meridian InSIGHT. Services offered include confocal imaging and extended focus imaging in reflection and fluorescence modes, multi-channnel confocal imaging, time series imaging and transmitted imaging (brightfield, darkfield, phase contrast, polarized light, DIC). (For details see http://www.ceo.msu.edu/index.html)

Research Technology Support Facility (RTSF)

The RTSF is a campus-wide service facility supported by the MSU Office of the Vice President for Research and Innovation, the mission of which is to provide the analytical research tools and bioinformatics resources for Genomic, Proteomic, Mass Spectrometric, Genetic and Structural Biological research at MSU. The facility operates as a series of service cores, but there is a significant component of collaborative research as well as training. Training for faculty, postdocs and graduate students is a major activity of the RTSF, both to assist users with the design and completion of projects and in many cases to allow direct user access to instrumentation. Full information about the facility and its resources can be obtained at: http://genomics.msu.edu.

Genomics Core: The Genomics Core provides small scale to genome size, high throughput DNA sequencing. The Core also provides custom spotted microarrays and has full resources for Affymetrix gene chip analysis.

Macromolecular Core: The Macromolecular Core contains equipment to analyze proteins, peptides, DNA, carbohydrates and small molecules. Peptide and DNA synthesis is available. Oligonucleotides can be synthesized using standard, modified, fluorescently labeled or biotinylated bases.

Proteomics Core: The Proteomics Core has at its disposal three state of the art mass spectrometers (LC-MS) two Thermo linear ion-trap (LTQ) mass spectrometers and one Thermo Fourier Transform Ion cyclotron resonance linear ion-trap (LTQ-FT) mass spectrometer capable of parts per billion resolutions. These UPLCs provide enhanced peptide separation which allows processing of much more complex mixtures of proteins. There is a full complement of 1 and 2D gel boxes specifically for the separation of protein samples to be analyzed by LC- MS, as well as a BioRad Proteome Works spot cutter robot/BX Proplus Imaging System for cutting out gel slices. A 20 processor computer cluster aids in processing large proteomic datasets. The programs Sequest, Mascot, and X! Tandem are available to match spectra to peptide sequences, and the program Scaffold is available to provide additional statistical validation of the data as well as allow users to access their data in an efficient manner.

Mass Spectrometry Facility: The Mass Spectrometry Facility is an open access resource where researchers and facility staff perform small molecule and metabolomic analyses using 11 mass spectrometers. Analyses typically involve compound identification or quantitative analysis. Students and other researchers are encouraged to become certified users of the instruments, and the facility staff offers frequent training in the theory and operation of facility instruments.

Flow Cytometry Core: This facility has available multiple flow cytometers, and provide sinvestigators with cell sorting services and access to cutting-edge analytical flow cytometry instrumentation, as well as training and experimental consultation.

Bioinformatics Core: This core has a staff of Bioinformatics specialists who support the work of the other Cores and distribute and maintain bioinformatics and sequence analysis software. These individuals are also available on a fee for service basis for computation analysis, design and maintenance of relational databases, websites, and program development.

Institute for Global Health (IGH): The IGH seeks to actively engage MSUCOM students and faculty in medical programs abroad clinically, culturally and through research helps to develop a humanitarian mindset that addresses our diverse society. To meet this vision, MSU established the Institute over thirty years ago, and it is currently led by MSUCOM. IGH's mission is to build sustainable partnerships globally through education, research and capacity building. Additionally, IGH offers MSUCOM faculty researchers and students the opportunity to address health disparities thru clinical and research experiences in distinctly different cultures. IGH also helped establish the Education and Research Consortium of the Americas (ERCA) in 2019. ERCA includes six institutions from Latin America and South America united in the goal of promoting multinational research that addresses vexing world health problems. The IGH faculty has mentored students globally over the past ten years, generating publications, abstracts, meeting and poster presentations resulting in numerous awards and recognitiions. The IGH also supports the sharing of MSUCOM educational and didactic expertise world-wide, in particular in collaboration with medical schools in Africa.

MSU Office of Research and Innovation: In concert with the Provost, the Office of Research & Innovation, under the leadership of Douglas Gage, is responsible for recruiting outstanding faculty through MSU's Global Impact Initiative, and maintaining synergy between research and creative scholarship and the education of graduate students through The Graduate School. The Office also promotes excellence in research at Michigan State University by providing many types of support to all MSUCOM faculty, such as seed funding for promising research and creative activity coordination and support of the research grant proposal process the latest research training, facilities and infrastructure proactive opportunities for sponsored research protection and licensing of intellectual property support for scale-up and commercialization of ideas, and recognition of research excellence in faculty recruitment, retention, and career development oversees the ethical conduct of research, including conflict of interest issues implements university policies relevant to research and creative activities enhances the safety of researchers and research subjects assures compliance with state and federal regulations regarding research seeks ways to contribute to the state's economic development by leveraging the university's intellectual capital. The Office of Research & Innovation strongly encourages student research opportunities and creative activities at the undergraduate and the graduate level, as well as entrepreneurship opportunities for all students.

MSU Research Centers: Michigan State University has nearly 100 active research centers and institutes on campus, as well as field research sites throughout the state of Michigan. Most are interdisciplinary and several are joint initiatives between Michigan State University and other universities around the world. Examples of these research collaborations include:

-The Facility for Rare Isotope Beams (FRIB), a new national user facility for nuclear science, funded by the Department of Energy Office of Science (DOE-SC), Michigan State University (MSU), and the State of Michigan. Located on-campus and operated by MSU, FRIB will provide intense beams of rare isotopes, that is, short-lived nuclei not normally found on Earth.

-The National Science Foundation Science and Technology Center for the Study of Evolution in Action (BEACON), a consortium, led by Michigan State University and including North Carolina A&T State University, University of Idaho, the University of Texas at Austin and University of Washington, which is exploring evolution in both natural and digital settings.

-The Great Lakes Bioenergy Research Center (GLBRC), funded by the U.S. Department of Energy and led by the University of Wisconsin-Madison, to conduct transformational biofuels research.

-The 4.1m Southern Astrophysical Research Telescope (SOAR) in Cerro Pachon, Chile, operated by a consortium including Michigan State University, the University of North Carolina at Chapel Hill, the National Optical Astronomy Observatory, and the country of Brazil.

MSUCOM Research and Scholarly Activity (RSA) Strategic Plan

Vision, Mission and Desired Outcomes

MSUCOM RSA Strategic Plan Vision: Provide ***expanded*** research administrative infrastructures, resources, professional development and training opportunities across MSUCOM campuses, state-wide campus system, and international research networks to foster ***increased*** research and scholarly activity of COM faculty and students by strategically planning to expand MSUCOM efforts in the following key RSA ***domains***:

RSA Domains

A. Expanded research in basic science, education, translational science, patient care or population health to:
   - increase publications, presentation, systematic reviews, meta-analyses, review articles, chapters in textbooks or case reports.
   - Contribute to professional committees, educational organizations, or editorial boards
B. Increased Quality improvement and/or patient safety initiatives
C. Increased Submission of Peer reviewed grants
D. Creation of new curricula, evaluation tools, didactic educational activities or electronic educational materials
E. Development or Implementation of Innovations in education
F. Improved dissemination of scholarly activity

MSUCOM RSA Strategic Plan Desired Outcomes: The College's Research and Scholarly Activity Strategic Plan continuously strives for expanded support of all research and scholarly activities of the college's faculty and their collaborators, in a manner that will capitalize upon existing strengths, and will maximally increase scholarly output (and as an indirect metric of success, increased NIH research funding) with a goal to improve the health outcomes of those we serve. Inclusion of understanding as to how diversity, equity and inclusion variances across populations impacts health outcomes will also be imparted as an important priority for these efforts. Successful pursuit of each of the MSUCOM Research and Scholarly Activity Mission Domains will not only foster successful achievement of our vision, but will also address a major pragmatic concern for the College, the need for a larger percentage of our students having increasing access to meaningful research activities and projects. Our vision can only be achieved via a clearly defined, college wide research and scholarly activity strategic plan. Given our goals and vision, the following strategies will be pursued and implemented to address the six domains of RSA over the coming years, as listed below.

RSA Domain A

Expand Research in basic science, education, translational science, patient care or population health to foster increased evidence of scholarly outputs **(publications, meetings, participation in scholarly societies):**

Successful achievement of each of the MSUCOM RSA Domain A-F strategic goal initiatives will eventuate in increased scholarly output from both MSUCOM faculty and students, inclusive of peer reviewed publications and meeting presentations. As a natural consequence of these necessary scholarly foundations, the generation of systematic reviews, meta-analyses, review articles, chapters and/or textbooks will be fostered. To expedite this anticipated outcome, MSUCOM faculty and staff will benefit from expanded provision of a number of capacities available at MSU.

RSA Domain A: Strategic Plan #1. Expanding Osteopathic Principles and Practice Research, via establishment of the MSUCOM Center for Neuromusculoskeletal Clinical Research: The mission of The MSUCOM Center for Neuromusculoskeletal Clinical Research (CNCR) will be to combine research interests in distinct areas of neuromusculoskeletal medicine, including the clinical specialties of Osteopathic Manipulative Medicine, Orthopedic Surgery, Physical Medicine and Rehabilitation, Neurology, Psychiatry, Sports Medicine, Pediatrics, and Physical Therapy as well as the foundational sciences such as Physiology, Anatomy, Biochemistry, and Microbiology and Molecular Genetics. Current faculty, as well to be hired faculty, (including Patenge Endowed Chair designation of appropriate candidate), will expand these centers scope to include impact of osteopathic principles and practices of clinical medicine improve specific health outcomes promote and overall health. These goals will be accomplished by three main strategies.

(1) CNCR will partner existing MSUCOM neuromusculoskeletal research expertise and laboratory resources with clinical faculty, residents, students and facilities in the development of and participation in research projects.

(2) CNCR will serve as a hub for a campus-wide collaboration with other MSU clinics, departments, centers, laboratories and units, enabling application of multidisciplinary research in neuromusculoskeletal disorders.

(3) CNCR will establish cooperative, multidisciplinary research projects with outside entities like the Veterans Affairs (VA) Hospitals, the Henry Ford/MSU research initiative, and Michigan Department of Health and Human Services (MDHHS), where current research ventures have already begun.

The mission and activities of the CNCR align perfectly with the five areas of focus outlined in the MSUCOM 2020-2023 Strategic Plan with concentration on OPP, diversity, retention, scholarly activities and impact on community. Additionally, the planned engagement of osteopathic medical students and trainees will enrich the medical school experience and help cultivate the next generation of leaders in the osteopathic profession.

Key activities of the CNCR: The CNCR will develop research activities related to clinical diagnoses and treatments for neuromusculoskeletal disorders. These activities focus on: 1) understanding the underlying causes of chronic disorders, especially chronic low back pain, and others that are ubiquitous in patient populations and 2) study techniques and procedures commonly used in

the treatment of chronic neuromusculoskeletal disorders to learn and document mechanisms of action, 3) reduce the use of opioid use and addiction, 4) lower the cost of care in these areas, 5) decrease the burden of disease in patients from these conditions, 6) promulgate findings nationally and internationally to enhance the profession, 7) seek extramural funding through federal and private organizations and through donations, and 8) seek funding from other MSU colleges and departments in fee for use of testing equipment and facilities. The group will seek MSU Center designation, that will foster expanded recognition and support by the greater university. MSU Development teams, and MSUCOM Development officers are together appraised of these efforts, and will secure philanthropic support to foster more rapid expansion of these research activities.

RSA Domain A: Strategic Goal #2: Expanding Applied Immunology Research (the MSUCOM AICER program): We recognize that a number of research efforts already underway in the College focus on the interactions of the immune system with numerous body systems as well pathogens and other environmental influences. These efforts are being pursued alongside our goals to develop deeper understanding as to how the human immune system impacts upon a number of diseases, including cancer; auto-immune, infectious, & neurological diseases.

Given these strengths, we now desire to create within MSUCOM a national center of research excellence fostering the development of immunological therapeutics entitled the "Applied Immunology Center for Education and Research (AICER)". AICER will serve to not only capitalize upon expanding our understanding of the human immune system, but to foster improved interventions that will dramatically improve health outcomes across the spectrum of human disease in real time. Students in MSUCOM will become partners in these efforts as part of their scholarly activities. As part of this holistic research venture, we will also continue to foster improved collaborations with non-medical Colleges at MSU, such as Natural Sciences, Engineering, and the Institute of Quantitative Health Science and Engineering to maximize innovation and partnerships on these areas of focus.

A cluster hiring of multiple mid-career research active faculty will be developed and undertaken, augmented by potential linking at least three of these hires to Patenge Chair endowment designation, furthering the stature of the applicants ultimately hired by the college. MSU-COM has identified the following translational research topical areas, and their associated faculty, for strategic AICER support as well.

MSUCOM is committed to supporting the mission and vision of AICER, with the goal of developing multi-PI, program project and center grants, that also foster advanced training opportunities for all AICER participants. The group will seek MSU Center designation that will foster expanded recognition and support by the greater university. MSU Development teams, and MSUCOM Development officers are together appraised of these efforts, and will secure philanthropic support to foster more rapid expansion of these research activities. Please click on the respective AICER participating faculty member's name in the table below to learn more.

Autoimmune/Genetics Immunology	Cancer Immunology	Environmental Immunology	Infectious Disease Immunology	Neuro-Immunology
Aldhamen	Amalfitano	Comstock	Abramovitch	Aldhamen
Amalfitano	Bernard	Copple	Amalfitano	Brundin
Busik	Contag	Doseff	DiRita	Gordon
Gulbransen	Das	Gardner	Gulick	Goudreau
Harkema	Doseff	Gangur	Mansfield	Gulbransen
K.S.Lee	Gallo	Gulbransen	Mias	Kaminski
Luyendyk	K.S.Lee	Harkema	Olive	Moeser
Mansfield	Liby	Kaminski	Parameswaaren	B. Smith
McCabe	Martinez-Hackert	K.S.Lee	Pestka	Strauss
Meek	Pyeon	Mansfield	Pyeon	Ward
Mohr	Schwartz	McCabe	Waters	
Neubig	B. Smith	Moeser	Xi	
Pestka	Waters	Olive	Zheng	
Petroff		Parameswaaren		
Root-Bernstein		Pestka		
Spence		Rockwell		
Subramanian		Schwartz		
Yu		Subramanian		
		J. Wagner		

RSA Domain A: Strategic Goal #3: Expand Neurocognitive Research of MSUCOM: The MSUCOM Global Neuropsychiatry Research Group is comprised of leading experts in neuropsychiatric research pertaining to interventions and outcomes assessment in low- and middle-income countries (LMICs). The team is united by a shared commitment and passion for research, interventions, and education within global neuropsychiatry. With a mission to develop and validate innovative and significant strategies within neuropsychiatric science in an attempt to enhance healing and wholeness in the face of human affliction and brokenness in individuals, families, and communities, the group's commitment is driven by a shared vision for alleviating human suffering in the context of global mental health, and a passion to contribute at the leading edge of a scientific and evidence-based framework. MSUCOM has committed increased support to hire research faculty in the Dept. of Psychiatry, and will continue that support in the efforts of the Global Neuropsychiatry Research Group. This expansion will support advancing pilot funds and" bridging support" as the group expands its research and scholarly activities to foster an NIH/PO1 Center Designation and funding. The group will also seek MSU Center designation that will foster expanded recognition and support by the greater university. MSU Development teams, and MSUCOM Development officers are together appraised of these efforts, and will secure philanthropic support to foster more rapid expansion of these research activities.

RSA Domain A: Strategic Goal #4: Create a state-wide MSUCOM/SCS Translational Research Network- The MSUCOM strategies to continually improve research and scholarly output have been, and continues to be based upon a focus on translational biomedical research, that has at its heart, a desire to improve the health of those seeking out osteopathic medical caregivers at our campuses, state-wide, nationally and internationally. MSUCOM, via a coordinated effort between the Office for Research and the MSUCOM State-wide campus system (SCS) research teams, will foster and expand research and scholarly activity collaborations between our foundational science and clinical faculty expertise, with the expertise and clinical reach that our nearly 4,000 adjunct clinical faculty represent in the over 40 COM affiliated hospitals, systems and networks affiliated with the MSUCOM SCS.

Once achieved, these interactions will create a Statewide MSU-COM Translational Research Network fostering research and scholarly activity throughout the communities we serve, addressing community based health problems that may ONLY be approachable by large networks of research faculty and staff working together on common themes. The success of the Network to promote expanded research and scholarly activity at our community sites, will become nationally recognized as groundbreaking and potentially viable as part of an MSU NIH/CTSA designated "hub" to foster MSU becoming a NIH/NCATS Clinical and Translational Science Awardee. The MSUCOM Translational Research Network will also work to integrate activities with similar network strategies underway at other Osteopathic Medical Colleges, fostering a national capacity of the nation's osteopathic medical schools to better compete for, and garner NIH funding to support these nationally important research endeavors.

The Statewide Campus System of MSUCOM will lead the efforts of the network, and provide expanded services and innovation with excellence for community based graduate medical education training in competency-based curriculum, professional development, educational technology, osteopathic curriculum, and scholarly activity, while nurturing strong community partnerships within the SCS network, and with MSUCOM faculty and students at the 3 campus sites. These strategies will be achieved by:

- Maximizing online access to scholarly activity(SA) learning resources by SCS-affiliated faculty;
- Increasing the number of onsite SA consultation services for affiliated programs and systems;
- Integrating SA activities into other key SCS service lines; and
- Enhancing both the volume and quality of SA dissemination products

RSA Domain A: Strategic Goal #5: Expand International RSA and collaborations: The Institute for Global Health (IGH) research efforts established the Education and Research Consortium of the Americas (ERCA) in 2019 with the goal of promoting multinational research and addressing the most vexing world health problems. Recently, the consortium of MSU, Latin and South American Research partners decided upon current challenges in health that four Institutes of expertise will address: Psychosocial Determinants of Disease, Tropical Medicine/Infectious Diseases, Water Quality/Waste Management and Ecology and Human Well-Being. As a result, students from MSUCOM, Latin and South America will have expanded opportunities to participate in research with international faculty. Among the projects to be initiated will be: Early Detection and Prediction of Viral Outbreaks through Wastewater Analysis; One Health/Global Health Modelling, Forest Conservation and Cultivation as Therapy- Restoring Human-

Forest Mutualisms in the Yucatán; and Examination of Predictive Influence of Toxoplasmosis Levels and Other Patient Characteristics on Acute Mental Health Hospitalizations. Increased support to hire research faculty with appointments in IGH and affiliated COM foundational and/or clinical departments will further expand the research activities of COM faculty and students.

RSA Domain A: Strategic Goal #6: Expanding research collaborations of MSUCOM faculty via the Dell Fellowship Program: MSUCOM seeks to attract and train a diverse and promising group of early career post-doctoral investigators by financially supporting their training as they conduct studies related to current college research priorities and areas of emphasis. In doing so, the college will simultaneously support the initiation of new, collaborative research efforts involving MSUCOM faculty with other MSUCOM faculty and/or or other research faculty throughout the MSU network. The college will support foundational, as well applied studies, non-clinical or clinical. The amount of funding is up to $50,000 for a single year of support. The COM-Dell Postdoctoral Research Fellowship Program will be initially supported in part through an endowment established by the Phyllis K. and Walter P. Dell research endowment to the MSU College of Osteopathic Medicine. The college will provide these postdoctoral research funds to support the research efforts of promising, early career (4 years or less since graduate degree conferral), post-graduate (DO, MD, PhD) candidates undertaking a program of training that will also foster expanded, collaborative efforts of the trainee's mentors (one of which must be a College of Osteopathic Medicine faculty member active in research) on current college research priorities and areas of emphasis. Goals of the fellowship program include supporting the post-doctoral trainee's ability to rapidly apply for future NIH career grants, such as the NIH F32 award while simultaneously supporting the mentors' ability to rapidly apply for future external grants, such as NIH Center or Program Project grants by demonstrating pre-existing and substantial collaborations.

RSA Domain A: Strategic Goal #7: Expand number of MSUCOM students participating in research *via the* SpartanDO Research Accelerator: Engaging COM students in all research and scholarly activities underway at MSUCOM is a top priority, and one in which the college continues to make important strides. As part of this strategic goal, we will add dedicated research faculty (DO, Ph.D) and administrative expertise to the COM Office for Research, whose efforts will focus upon supporting and expediting expansion of the number of OST 599 and OST 615 research credit experiences. To increase the number of mentors available to COM students, MSUCOM will implement, and then expand the "SpartanDO Research Accelerator". The accelerator is a funding mechanism, in which the research advisor (principal investigator) of a COM student enrolled in OST 599 is eligible to receive funding of $1,000. The funding is specific for a single project per student for as long as the student is enrolled for research credits and is working on the project. The funding will be sent to the Research advisor (principal investigator) after the student research has been approved by the Research Office and credits have been awarded. The research advisor (principal investigator) can receive maximum funding of $3,000 for advising three or more students, per academic year. Expansion of this to the OST 615 research electives and/or increased funding per project is planned going forward to further increase student RSA experiences throughout the 4 year curriculum.

RSA Domain A: Strategic Goal #8: Expanding statistical support to MSUCOM Faculty and students via CSTAT. The Center for Statistical Training and Consulting (CSTAT) provides staffing and expertise to MSUCOM as a means to collaborate on research projects and provide statistical support to MSUCOM scholars and off-campus clients. MSUCOM will secure increased amounts of dedicated, funding so as to expand availability to MSUCOM students seeking to conduct any variety of RSA. This expansion of dedicated support will foster improved RSA outcomes and output for MSUCOM students, as CSTAT will provide expanded expertise and guidance on study design, statistical methods, interpretation of results, and conduct statistical analyses, as well participate in student RSA project design and methods considerations and sample size determinations.

RSA Domain A: Strategic Goal #9: Achieving NIH-MSTP Designation of the MSUCOM DO/PhD training program: We will continue the expansion of the MSU-COM DO/PhD program, and craft a Medical Scientist Training Program NIH grant proposal to allow for expansion of numbers of students supported by the program, as well raise the stature of the program nationally, being the first Osteopathic Medical School achieving MSTP/NIH designation.

RSA Domain A: Strategic Goal #10: Expanding number of case report and other publications: Efforts to support these types of important scholarly activities include expansion of established MSUCOM/SCS opportunities such as the "Emergency Medicine Case Report Poster Day"; the "NMM/OMM research day"; "Obstetrics and Gynecology - George W. Russian Memorial Research Day"; the "Orthopedic Surgery - Senior Paper Day, the "Otolaryngology and Facial Plastic Surgery - Annual ENT Research Day: Essential Skills for Research program" with a goal for addition of new venues for case report presentations. The goal will be to integrate these opportunities for development into case report or other publications via the MSUCOM SCS research support and editorial teams, with a particular emphasis on supporting publication of these case reports via the Spartan Medical Research Journal (SMRJ).

RSA Domain A: Strategic Goal #11: Expand Faculty and student participation in professional committees, educational organizations or editorial boards: MSUCOM recognizes that the success of one's research and scholarly activities can and should be recognized externally, and this recognition many times is evidenced by inclusion in professional committees, educational organizations, and/or editorial boards. Successful achievement of Domain A strategic goals #1-8 will simultaneously increase the visibility and stature of all faculty and staff research and scholarly activities. To further capitalize upon the increased scholarly outputs of our faculty, MSUCOM will implement a faculty mentoring program that will seek to partner early career faculty with later career faculty so as to foster a progressively stronger faculty composed of members who meet continuously higher standards and are competitive nationally and internationally. Formalized mentoring programs have also been shown to foster improved participation in leadership and professional activities, recognition with honors and awards, contracts and grants, and/or teaching, as compared to non-participant faculty. Newly appointed junior faculty (assistant professor: tenure stream, or health profession (HP)) will be provided the MSUCOM Faculty Mentoring Program description upon initial hire and will also be expected to attend the MSU's Survive and Thrive Symposia, the MSU New Employee Welcome Presentation, and the

MSU New Faculty Orientation, a program that the Office of the Provost arranges annually to assist new faculty in learning more about the academic community at MSU, and how to utilize those resources to foster professional standing nationally and internationally. The COM Mentoring Program and policies are specifically designed to also address the special circumstances of women and minorities, since women and minorities in some units and colleges do not share in the informal professional network(s) enjoyed by majority men when particicpating in professional committees, educational organizations, or editorial boards. Additional resources available to COM Mentors and mentees include: The COM Office for Diversity and Campus Inclusion; The COM FEA support services; and COM Health and Wellness guidance. These strategies will also increase Faculty participation in MSU Professional Development opportunities.

MSUCOM students will also be made aware of research focused educational organization and committees they can participate in as part of a revised onboarding orientation program upon matriculation. Additional advice on how research can foster career goals, via expanding provision of couneling and expertise in the MSUCOM Academic and Career Advising arm of the Dept. of Medical Education. These opportunities will be highlighted and expanded via increased communication from the Student Life offices (using web-based as well additional social communications strategies) and information sharing via 30 MSUCOM student organizations. These nodes of communications will work to increase knowledge of, and participation of students not only in RSA, but also in local, state and national opportunities for student participation in RSA committees and educational organizations.

RSA Domain B. Increase Quality Improvement (QI) and/or patient safety initiatives:

RSA Domain B. Strategic Goal #1: Expand QI efforts: MSUCOM, via the SCS, will offer an expanding series of MSUCOM/SCS Quality Improvement/Patient Safety (QIPS) learning modules for students, residents and faculty planning to develop scholarly activity projects that are more program/healthcare system-oriented. This series will be hosted in MSU's Desire2Learn (D2L) learning management system.

RSA Domain B. Strategic Goal #2: Expand Scholarly Activity in QI via Teaching for Quality program: In addition, MSUCOM/SCS will develop, and expand participation in the "Teaching for Quality" initiative, to foster interactions between clinically active students, residents, and faculty, with MSUCOM faculty who are ready, able, and willing to engage in and lead education in quality improvement, patient safety, and the reduction of excess healthcare costs. To accomplish this goal, the AAMC developed a multi-faceted certificate program that equips clinical faculty with the ability to lead, design, and evaluate effective learning in QI/PS across the continuum of health professional development. MSUCOM/SCS will initiate and implement availability of this program throughout the MSUCOM networks. At the completion of the program, increasing numbers of participants will be able to:

- Address an identified gap in the education of residents and/or practicing clinicians regarding quality improvement and patient safety, focused within one of the following

CLER “Pathways to Excellence” components that include Patient Safety (PS), Health Care Quality (HQ), Care Transitions (CT), Duty Hours/Fatigue Management & Mitigation (DM); Supervision (S); and Professionalism (P).

- Design an educational innovation to fill that gap (with the assistance of an SCS Faculty Coach)
- Implement and assess the impact of the innovation (with assistance of an SCS Faculty Coach)

RSA Domain B. Strategic Goal #3: Expand RSA relative to patient safety via the MSU-LAC: The MSU-Learning and Assessment Center (LAC) is an MSU facility that encourages and supports research efforts of faculty, students and MSUCOMmunity. The LAC is a collaborative simulation center with partner colleges including Nursing, Human Medicine, Osteopathic Medicine and Veterinary Medicine. The LAC recognizes that assessment, research and interdisciplinary healthcare education is critical for achieving optimal patient outcomes and improving the overall healthcare system. The LAC will assist and expand its capacities in the preparation of MSUCOM students, MSUCOM/SCS medical residents and practicing clinicians develop and demonstrate competence through immersive experiential activities. The LAC will as part of this conduct RSA focused on the critical evaluation as to the efficacy of simulation and related educational strategies. This will include ongoing QI with regard to standardized patient programs, so as to monitor validity and reliability of assessments performed by Standardized Patients, educators and those external to the Program. LAC will also expand efforts to quantify and analyze effectiveness of modalities used at MSUCOM, and compare/contrast with those prominent in the field of simulation nationally. These efforts will support expanded NIH grant submissions, including IPE research assessing for example, implicit bias of providers towards under represented minorities. These efforts will be shared in publication formats as well national forums, for example at the annual Society for Healthcare Simulation and Association of Standardized Patient Educators.

RSA Domain C. Foster submission of Peer reviewed grants

RSA Domain C. Strategic Goal #1: Expand administrative support to foster increased numbers of grant submissions: MSUCOM will provide continued and enhanced support for our faculty as to the administrative support, development, and submission of external grant applications to various types of granting agencies or foundations. In particular, MSUCOM will continue to participate in, and expand, the efforts of the Health Colleges Research Services (HCRS) office, a shared service group that supports pre-award grant activities within the Colleges of Osteopathic Medicine, Human Medicine and Nursing at Michigan State University. The HCRS research administrators serve as the primary liaison between faculty and the central Office of Sponsored Programs. HCRS provides grant compliance services, budget development and proposal preparation to faculty in 18 units across three colleges. As a result, the HCRS office will foster an increased number of grant proposals from MSUCOM faculty, including small foundation grants, large program projects, center proposals, and many federal grants.

RSA Domain C. Strategic Goal #2: **Expand notification of grant opportunities**: The MSUCOM research office will provide regular updates to MSUCOM faculty as new grant opportunities become available, highlighting those opportunities that align best with current MSUCOM Faculty expertise in particular.

The Associate Dean for Research will be available for consult regarding grant development support opportunities for chairpersons and individual faculty. These notifications and supports will foster, expand, and align with MSU Office of the Vice President for Research and Innovations also available to all MSUCOM faculty, including additional resources for locating grant support, as well provision of grantsmanship experts to faculty submitting external grants.

RSA Domain C. Strategic Goal #3: Expand opportunities for sharing information and improved grantsmanship: Several departments will provide expanded opportunities for faculty to present research proposals for critique by faculty, (ie: the MMG dept "Grant Studio" initiatives); coupled with expanded support by MSUCOM to provide support for outside speakers to come to MSU and participate in expert seminars, as well foster increased collaboration via faculty roundtables, and journal clubs, initially via expansion focused on the MSUCOM AICER initiatives.

RSA Domain D. Support faculty in creation of new curricula, evaluation tools, didactic educational activities or electronic educational materials:

RSA Domain D. Strategic Goal #1: Faculty development: MSUCOM has a robust menu of faculty development resources available thru the University resources listed. MSUCOM will also implement and expand a COM mentoring program in which junior faculty will be mentored by their Chairperson and/or designee to foster academic success, and recognition in all tiers of their activities, inclusive of their research and scholarly activities, coupled with MSU resources available to all MSU.

RSA Domain D. Strategic Goal #2: Expand SCS didactic educational training opportunities: MSUCOM SCS sponsored MedEd E-forums and workshops, and research consultations whose topics of focus will include educational improvement will be expanded to all MSUCOM Faculty, including adjunct faculty and core faculty in the SCS residency training programs.

RSA Domain D. Strategic Goal #3: Expand MSUCOM assistance with creation of educational materials, activities, tools and materials to foster domestic and international, educationally focused outreach and engagement: IGH efforts will seek to expand and initiate new opportunities to bring MSUCOM educational expertise to our international partners. This will include the ability to enhance medical school training for students in the Middle East, and African continent, and in particular, in Egypt. By coupling these efforts with an eye to foster expansion of the diversity of students being trained to be physicians in these same venues, MSUCOM will foster DEI efforts abroad, while improving health outcomes of those to be served by these future physicians.

RSA Domain D. Strategic Goal #4: Expand the PEAK Program for COM Student success: The MSUCOM PEAK Program for Healthy Cognitive Living and Academic Success promotes cognitive health by emphasizing principles of learning and the use of internal controls to help balance emotional and cognitive demands, resulting in efficiency and maximization of learning potential. The PEAK program will continue to provide, and expand the number of guidebooks for Self-Directed Learning for a variety of COM courses, with expanded vetting by MSUCOM faculty expertise specific to the topic of each guidebook. The PEAK program will expand its innovative educational capacities to enhance Academic Performance generally, such as in collaboration with the Drew Scholars program at MSU.

RSA Domain E. Develop or implement Innovations in education:

RSA Domain E. Strategic Goal #1: Expand Provision of Technology Resources: As the osteopathic curriculum required adaptation to the limitations imposed by the COVID-19 pandemic, the college worked across disciplines to assist faculty in this challenge. This has evolved into resources and support to promote the development of high quality, evergreen instructional products for use in the DO program.
Physical resources included the provision of "studios" at each site for the broadcast of synchronous content or recording of asynchronous content. Faculty support for use of the students will be expanded to create new educational materials and lectures that foster improved delivery of didactic materials to all MSUCOM students. These will also serve to ensure a high level of compliance with MSU Web Accessibility Policies; in brief, the policy requires that all multimedia posted for students to be close captioned, and all digital documents be properly formatted for screen reader use.

While not all lectures or other academic events are intended to be broadcast or recorded, those sessions that are may be viewable as a livestream as they occur. These capacities and plans will benefit from Desire 2 Learn (D2L), an MSU-supported online learning management system. All required courses in the curriculum will utilize D2L for posting electronic course packs, course schedules, and other materials. MediaSpace expands the ability to view lectures, either by streaming live or previously recorded lectures on-demand, is made available on a course-by-course basis, determined by the course coordinator, and will be made available after accessibility requirements for the recordings have been met. MSUCOM will foster and expand MSU IT's Digital Classroom Services unit works to provide a consistent viewing experience in the MediaSpace service. Each Class will also have access to a Google Calendar, located on the MSUCOM website. The google calendar is a composition of course schedules, allowing students the ability to conveniently see dates and times of learning events.

The preclerkship curriculum also makes use of polling technologies for in-class sessions. These include : iClicker Cloud, previously known as Reef Polling, which allows students to associate an electronic device (e.g. smartphone, laptop or tablet) with their account. This replaces the need to purchase or rent an iClicker device. This technology may be used to provide practice with concepts and principles, to stimulate discussion, to take attendance and/or administer assessments. Questions may be posed at any time during the class session.

RSA Domain E: Strategic Goal #2: Develop and expand international didactic educational activities, tools and educational materials as innovative opportunities for collaboration: **The Institute for Global Health (IGH)** IGH will develop pre- and post-departure surveys that will assist faculty participating in IGH RSA efforts in assessing the psychosocial changes that result from immersing students participating in care and research efforts amongst the world's most vulnerable populations. Additionally, the ERCA institutes will create a series of educational webinars to expand knowledge among junior researchers and graduate students amongst the institutions using advanced IT strategies, the internet, and other technologies to maximize participation.

The PEAK Program for Healthy Cognitive Living and Academic Success promotes cognitive health by emphasizing principles of learning and the use of internal controls to help balance emotional and cognitive demands, resulting in efficiency and maximization of learning potential. The PEAK program will expand its innovative educational capacities internationally, and include research activities to foster Research Training Programs in HIV specifically (Fogarty/NIH D43 training program), and to enhance Academic Performance generally, such as in collaboration with the Drew Scholars program at MSU.

RSA Domain F: Expand the dissemination of scholarly activity:

RSA Domain F. Strategic Goal#1: **Increase impact and scope of the Spartan Medical Research Journal (SMRJ)**: In 2016, the Michigan State University College of Osteopathic Medicine (MSUCOM) established the Spartan Medical Research Journal (SMRJ) to provide a publication venue for MSUCOM and Statewide Campus System (SCS) affiliated medical students, residents, post-residency fellows and faculty. As of January 2021, the SMRJ is a campus-based PubMed Central (PMC)-indexed scholarly medical journal, with a total of 99 online scholarly articles published online. SMRJ continues to invite submissions concerning scholarly activity (SA) projects, (e g., literature reviews, medical education, clinical practice and clinical reviews, quality improvement & patient safety (QI/PS) case reports and opinion paper manuscripts. The MSUCOM and SCS strategic goals for SMRJ includes: complete full PubMed Central Indexing of ongoing Spartan Medical Research Journal issues; expansion of the size of the SMRJ Editorial Office team; expansion of the number of Research specialists; updating of the SMRJ manuscript informational materials for potential authors as well reviewers; implementation of SCS website author networking group/discussion forums; expansion of the number of expert reviewers alongside reviewer templates to facilitate reviewer feedback to authors; and strategies to improve SMRJ visibility nationally. With these strategies implemented, we will achieve multiple outcomes, including, but not limited to:

- Attaining approval for retrospective PubMedCentral (PMC) indexing
- Growing submission volumes overall, as well from currently non-affiliated authors.
- Expanding development of editorial team instructional modules.
- Capitalizing on increasing service efficiencies from Scholastica programming.
- Increasing journal marketing at GME conferences, journal advertisements.
- Enhanced promotion of SMRJ publication opportunities to SCS Physician Advisory Councils (PACs) and other MSUCOM groups.
- Facilitation of multi-system SA projects leading to higher-quality submissions.

RSA Domain F. Strategic Goal #2: Increase venues for presentation of scholarly activities by MSUCOM students. The MSUCOM SCS will foster increasing numbers of opportunities for all students (UME and GME) and their faculty to present their current research in poster days and meeting venues that are available and accessibly by all RSA faculty and students within the MSU systems statewide. Currently the SCS provides an annual research poster day in which resident and medical school student research projects are provided an annual day to acknowledge their efforts. These efforts will be expanded, to include keynote speakers as well oral platform opportunities for resident and student researchers to

share the results of their RSA efforts. We also envision that accepted abstracts can be published in the SMRJ as a Meeting summary supplement

These efforts to support and expand important sharing of scholarly activities include expansion of ongoing MSUCOM/SCS opportunities such as the “Emergency Medicine Case Report Poster Day”; the “NMM/OMM research day”; “Obstetrics and Gynecology - George W. Russian Memorial Research Day”; the “Orthopedic Surgery - Senior Paper Day, the “Otolaryngology and Facial Plastic Surgery - Annual ENT Research Day: Essential Skills for Research program” with a goal for addition of new venues for case report presentations. The goal will be to integrate these opportunities for development into publications via the MSUCOM SCS research support and editorial teams, with a particular emphasis on supporting publication of these case reports via the Spartan Medical Research Journal (SMRJ) Synergizing with these GME efforts, the MSUCOM Research Offices will provide expanded venues for MSUCOM student researcher presentations that build upon current opportunities in the foundational sciences departments of MSUCOM, and by building upon its current expertise in developing a DO/PhD Research focused Retreat for DO/PhD trainees, to allow greater numbers of MSUCOM DO students to present their latest research efforts.

RSA Domain F. Strategic Goal#3: Increase financial support for student generated research and scholarly activity participating in regional and national research sharing events: The Student life offices will provide expanded financial resources and financial support to MSUCOM students successfully submitting abstracts for meeting presentation, and/or manuscripts for publication to offset costs of travel, purchase of materials, as well publication costs to maximize distribution of student derive RSA’s.