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Front Matter of Journal of Undergraduate Research

Farley V. Ferrante

Southern Methodist University, smujour@smu.edu

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SMU JOURNAL OF
UNDERGRADUATE
RESEARCH

The SMU Journal of Undergraduate Research is dedicated to Dr. Robert Kehoe, Professor of Physics. Dr. Kehoe, guardian of academic integrity without whom this Journal would not have been possible, served as Director of Undergraduate Research from 2012 to 2018.

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Farley Ferrante

FACULTY FELLOW FOR UNDERGRADUATE RESEARCH PROGRAMS

David Son

POSTDOCTORAL FELLOW

Adam Neal

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LETTER FROM THE FACULTY FELLOW FOR UNDERGRADUATE RESEARCH PROGRAMS

Dear Members of the SMU Community:

It is my pleasure to introduce the next volume of the *SMU Journal of Undergraduate Research (JoUR)*. This volume continues the initiative of Professor Robert Kehoe, former Director of Undergraduate Research, and the Honors Research Association (HRA). The journal now operates through the Office of Engaged Learning (OEL), which plays a major role in providing support for undergraduate research at SMU.

The present volume includes ten articles, all written by SMU undergraduates and describing their research in the humanities and sciences. The increased number of articles compared to the previous volume (four articles) reflects a greater emphasis on undergraduate research at SMU, as outlined in the *2016-2025 SMU Strategic Plan* and recommended by the supporting document, *Continuing the Ascent: Recommendations for Enhancing the Quality and Stature of Southern Methodist University*, issued earlier this year by President R. Gerald Turner and Provost Steven Currall.

Submissions to the JoUR are subjected to a review process as is typical in any academic journal. Manuscripts are reviewed by at least one faculty reviewer, with comments and suggested revisions sent back to the author. Upon corrections, the manuscript is reviewed by the editors and copy-edited before final publication. Published articles now receive a unique digital object identifier number (DOI), which links directly to the online version of the articles. The online version of the journal continues to be hosted on the SMU Scholar platform within Central University Libraries (CUL). Manuscripts that receive final approval after publication of the print journal will be posted online.

It has been a pleasure working with editor-in-chief Melina Corriveau and her fellow student staff members. Furthermore, I am grateful to the faculty reviewers who have contributed their time to this effort. As you read the articles in this volume, I am confident you will share my optimism about undergraduate research at SMU. The future is bright!

Sincerely,



David Son, Ph.D.
Faculty Fellow, Undergraduate Research Faculty Steering Committee
Professor of Chemistry
dson@smu.edu

LETTER FROM THE EDITOR

Dear Reader,

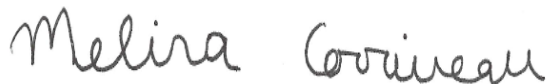
It is my great honor to present the fourth edition of the SMU Journal of Undergraduate Research (JoUR). During my first year as editor-in-chief, I have been inspired by the dedication and ingenuity of my fellow undergraduate researchers.

This publication cycle has focused on augmenting the JoUR's momentum. Building on our goals for the year, we not only increased liberal arts submissions, our team also significantly increased publication of articles across all disciplines. With this growth in publication came a corresponding expansion in our staff with the addition of an assistant editor and greater involvement from the Office of Engaged Learning of which Undergraduate Research is part. Finally, through a combination of several organizational platforms, we have improved our record-keeping capabilities allowing for enhanced streamlining and collaborative documentation.

Moving into the future, the JoUR's momentum will only continue to grow. One goal is to increase our affiliation with the Hilltop's various research programs such as Engaged Learning Fellowships, McNair Scholars, Hamilton Scholars, Mayer Undergraduate Fellows, and Undergraduate Research Assistantships. A second goal is improving our efforts to inform student researchers on the specifics of writing professional quality papers, a skill they can take beyond their time at SMU. A final goal for our team is to foster long-lasting relationships with both potential authors and future staff members.

In closing, I wish to thank the JoUR's undergraduate staff members for their passion and hard work. As well, a tremendous gratitude is owed to our Managing Editor, Farley Ferrante, who exemplifies dedication to the field of undergraduate research. Additionally, Dr. David Son's leadership as our Faculty Fellow has proved indispensable. Finally, the continued support of The Office of Engaged Learning and Central University Libraries has allowed JoUR to flourish.

Best,



Melina Corriveau
Editor-in-Chief
mcorriveau@smu.edu

The Hamilton Undergraduate Research Scholars Program enables Dedman College's most promising students to collaborate with top faculty researchers and contribute to the creation of knowledge in significant and meaningful ways. Each faculty/student team submits a competitive proposal for the project to the Program Director in response to a call for proposals in August of each academic year. A small number of Hamilton Undergraduate Research Scholar Awards are also made for the summer with a request for applications going out in late April. Awards are up to \$3000/semester with matching funds available from the University Undergraduate Research Program. www.smu.edu/Dedman/DCII/Programs/Hamilton

Robert Mayer Undergraduate Research Fellowships through the Dedman College Interdisciplinary Institute allow students to conduct research integrating two or more fields. Mayer Interdisciplinary Fellows will have access to \$1500 to use for research travel or for other expenses related to the development and completion of their research project. www.smu.edu/Dedman/DCII/Programs/Mayer

John G. Tower Center Student Fellowships provide a gateway for students to pursue work in politics and government. Undergraduate Fellows collaborate closely with faculty to develop research projects that either become published or presented for faculty or professional review. Fellows are accepted during the second semester of their sophomore year and serve as fellows during their junior and senior years. Selection is based on merit and determined by an application and interview process emphasizing ability and interest in research. Each fellow receives a stipend of \$750 per semester for a up to four consecutive semesters, a book allowance for documents related to the independent study project, and support for research expenses. www.smu.edu/TowerCenter/Students/TowerScholars

Maguire Public Service Interns are sponsored by the Maguire Center. The Maguire Center—with financial assistance from the Irby Family Foundation—awards summer internships to SMU students who wish to devote time to public service or research in the field of ethics. SMU Public Service Interns have volunteered in a vast number of diverse internship placements. Through such opportunities, students gain concrete information about others' needs, as well as differing perspectives on how to resolve them. Undergraduates receive a \$2000 grant for their internship. www.smu.edu/Provost/Ethics/Students/Fellowship

The Richter International Fellowship Program is funded by the Paul K. and Evelyn E. Cook Richter Memorial Funds and is awarded to members of the University Honors Program to conduct independent research, usually outside the United States. The project can cover any area of study, but should be international or multicultural in nature. SMU is one of only 12 schools offering Richter Fellowships, and only Honors students are eligible for the Fellowships. Richter Fellows receive funding for one to three months of research over winter or summer break, generally abroad. Upon returning, Fellows write and submit a scholarly article based on their research with intent to seek publication. www.smu.edu/UndergradResearch/Programs/RichterFellowship

The McNair Scholars Program is a federally funded TRIO program that serves a diverse group of undergraduate students at 151 universities across the nation. The program was designed to prepare students typically underrepresented in graduate education for doctoral attainment through involvement in intensive undergraduate research. McNair Scholars complete a funded summer research opportunity, where they work closely alongside a faculty mentor. Additionally, the program provides academic and career advising, faculty mentoring, and assistance with graduate school applications. www.smu.edu/simmons/Community/CollegeAccessPrograms/McNairScholars/Eligibility

The Office of Engaged Learning

Big iDeas is designed for entrepreneurs. Teams of students pitch their business and design business plans, helping students bring a value to society in viable and sustainable ways. Students can receive up to \$5000 in funding. www.smu.edu/Provost/BigiDeas

The Engaged Learning Fellowship (ELF) is an undergraduate student's SMU legacy work. The student engages in capstone-level scholarly research, community service or civic engagement, professional internship, or other creative project that moves learning beyond the classroom. SMU funds ELFs up to \$2000 per project and records ELF titles on student transcripts and commencement booklets. Students typically begin their fellowship sophomore or junior year and complete it the semester of their graduation. To complete a fellowship, students are required to bring their work to an end point, present their findings in a public forum, and turn in a final product of their accomplishment. www.smu.edu/Provost/EngagedLearning

Summer Research Assistantships (SRA) are an excellent way for a student researcher to make focused progress in a project, whether devising a new project or continuing one from the academic year. The write-up can be published in the SMU Journal of Undergraduate Research or other publications. SRAs allow students to earn up to \$4000 for the summer, providing matching funds to departmental or grant money, Engaged Learning, Hamilton, or McNair Scholars. www.smu.edu/UndergradResearch/Programs/SRA

Undergraduate Research Assistantships (URA) provide an opportunity to students to pursue research across all disciplines. By providing matching funds to another source of research funding, such as a department's, school's or individual faculty member's existing research funding, this program facilitates undergraduate involvement in the university's leading-edge research. Each assistantship involves a student working closely with a faculty member. Applications for URAs can be submitted at any time. During the academic year, support for up to 10 hours of research each week is provided. www.smu.edu/UndergradResearch/Programs/URA

Faculty Mentors

Dr. Weihua Geng, Assistant Professor of Mathematics, Dedman College of Humanities and Sciences.

faculty.smu.edu/wgeng/

Dr. Stephanie Langin-Hooper, Assistant Professor of Art History, Meadows School of the Arts, Karl Kilinski, II Endowed Chair in Hellenic Visual Culture.

www.smu.edu/Meadows/AreasOfStudy/ArtHistory/Faculty/Langin-HooperStephanie

Dr. MinJun Kim, Professor of Mechanical Engineering, Lyle School of Engineering, Robert C. Womack Chair in Engineering.

www.bastlabs.org

Dr. Lucas Kirkpatrick, Assistant Professor of Sociology, Dedman College of Humanities and Sciences.

www.smu.edu/Dedman/Academics/Departments/Sociology/People/FacultyandStaff/Kirkpatrick

Dr. Shira Lander, Senior Lecturer, Dedman College of Humanities and Sciences, Jewish Studies Director.

www.smu.edu/Dedman/Academics/Departments/ReligiousStudies/FacultyStaff/sLander

Dr. Stephanie Martin, Assistant Professor of Corporate Communications and Public Affairs, Meadows School of the Arts.

www.smu.edu/Meadows/AreasOfStudy/CCPA/Faculty/MartinStephanie

Dr. Adam Norris, Assistant Professor of Biology, Dedman College of Humanities and Sciences, Floyd B. James Trustee Professor.

blog.smu.edu/norrislab/people/

Dr. Karin Quiñones, Adjunct Professor of Management and Organizations, Cox School of Business.

www.smu.edu/cox/Our-People-and-Community/Faculty/Karin-D.-d.-Qui%C3%B1ones

Dr. Elizabeth Russ, Associate Professor of Spanish, Dedman College of Humanities and Sciences.

www.smu.edu/Dedman/Academics/Departments/WorldLanguages/Faculty/FacultyDirectory/RussElizabeth

Dr. Ahmet Can Sabuncu, Clinical Assistant Professor of Mechanical Engineering, Lyle School of Engineering, Hunt Institute Fellow.

blog.smu.edu/huntinstitute/2018/01/29/introducing-dr-ahmet-can-sabuncu-hunt-institute-fellow/

Dr. Steven Vik, Professor of Biological Sciences, Dedman College of Humanities and Sciences, Biochemistry Director.

www.smu.edu/Dedman/Academics/Departments/Biology/People/FacultyResearch/Steven-Vik

Dr. Bonnie Wheeler, Associate Professor of English, Dedman College of Humanities and Sciences, Director of Medieval Studies.

https://www.smu.edu/Dedman/Academics/Departments/English/People/DeptDirectory/Bonnie_Wheeler

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