



Graduate programs in  
**MECHANICAL ENGINEERING**



**MARQUETTE**  
UNIVERSITY

Be The Difference.



## ABOUT MARQUETTE

**Our programs.** Marquette offers 50 doctoral and master's degree and more than 30 graduate certificate programs, and a School of Dentistry and Law School. And we have a variety of specializations to help you tailor the curriculum to your needs — an opportunity not offered by all universities.

**Our students.** We enroll approximately 3,700 graduate and professional students from diverse cultural and educational backgrounds and 68 countries all over the world.

**Our faculty.** Marquette's almost 700 full-time faculty represent renowned scholars and industry experts. As a student, you'll also benefit from established collaborations within the local business and nonprofit communities, as well as other nationally renowned institutions within the region, including the Clinical and Translational Science Institute, Medical College of Wisconsin, Milwaukee School of Engineering, University of Wisconsin system, and others.

**Our research.** Graduate students can participate in important research alongside our renowned faculty members — making you a contributing member of our research team, not just a face in the crowd like at some other universities. Marquette's overall research award volume in fiscal year 2010 reached a record high, with faculty receiving more than \$28 million. Federal award dollars increased by 81 percent, and the average award size rose by 45 percent. Federal, state, foundation and corporation research awards all increased in fiscal year 2009, and corporate research dollars increased more than 50 percent from the previous fiscal year.

**Our commitment.** Class sizes are small and are usually taught by regular faculty members who are conducting cutting edge research. Your teaching will be informed by current research, and you will often have the opportunity to participate in research.

**Our network.** As a graduate of Marquette, you'll become part of our alumni family of 110,000 around the world — creating a professional network that spans from right next door to across the globe.

**Our values-based education.** As a Jesuit institution of higher education, Marquette continues a centuries-old tradition of academic excellence, development of the whole person and research that addresses societal needs.

# Why graduate studies in Mechanical Engineering at Marquette?

You'll appreciate being part of a program that has a long-standing tradition of excellence. The Accreditation Board of Engineering Technology has accredited our program since its inception in 1936. It is also the largest Jesuit mechanical engineering program in the United States. You'll have access to everything you need to earn your degree and succeed in your career — experienced faculty, research variety with interaction among areas and departments, a collaborative peer environment, and strong industry connections, alumni networks and job opportunities. And you'll have a mechanical engineering graduate degree, not just a concentration in the field.

**Be noticed.** Class sizes are small, and faculty members are readily available and accessible, ensuring a high level of attention to your needs and interests.

**Be a contributor.** Our faculty pursue industry-leading field research in a wide range of areas, including shock physics, ergonomics, cryobiology, mechatronics, stress analysis and neuromuscular functions. You'll work alongside them and independently, developing the research skills you'll need to make your own lasting contributions to the field.

**Be specialized.** We offer an abundance of specialization possibilities, giving you great flexibility when it comes time to finding a career. From energy systems to manufacturing systems to mechanical systems, the choice is yours.

**Be mentored.** Our renowned faculty members come from varied backgrounds — from working in industry to government laboratories to academia — so you'll gain from their insight.

**Be supported.** Generous benefits are available to new students every year in the form of fellowships, research assistantships or teaching assistantships with tuition credits, a competitive stipend and health care benefits.

## Mechanical engineering graduate programs:

Doctorate

Master of science

## YOUR JOURNEY

A mechanical engineering graduate degree from Marquette can help open the door to job placement in industry, government-run national laboratories or academia. It can also help you achieve greater career success or salary increase if you're already working in the field.

According to the 2010-11 Bureau of Labor and Statistics' *Occupational Handbook*, new job opportunities will be created because of emerging technologies, including biotechnology and materials science. Are you prepared to take advantage of these opportunities?

### Doctorate

**Specializations:** energy systems, manufacturing systems, mechanical systems

#### Course work:

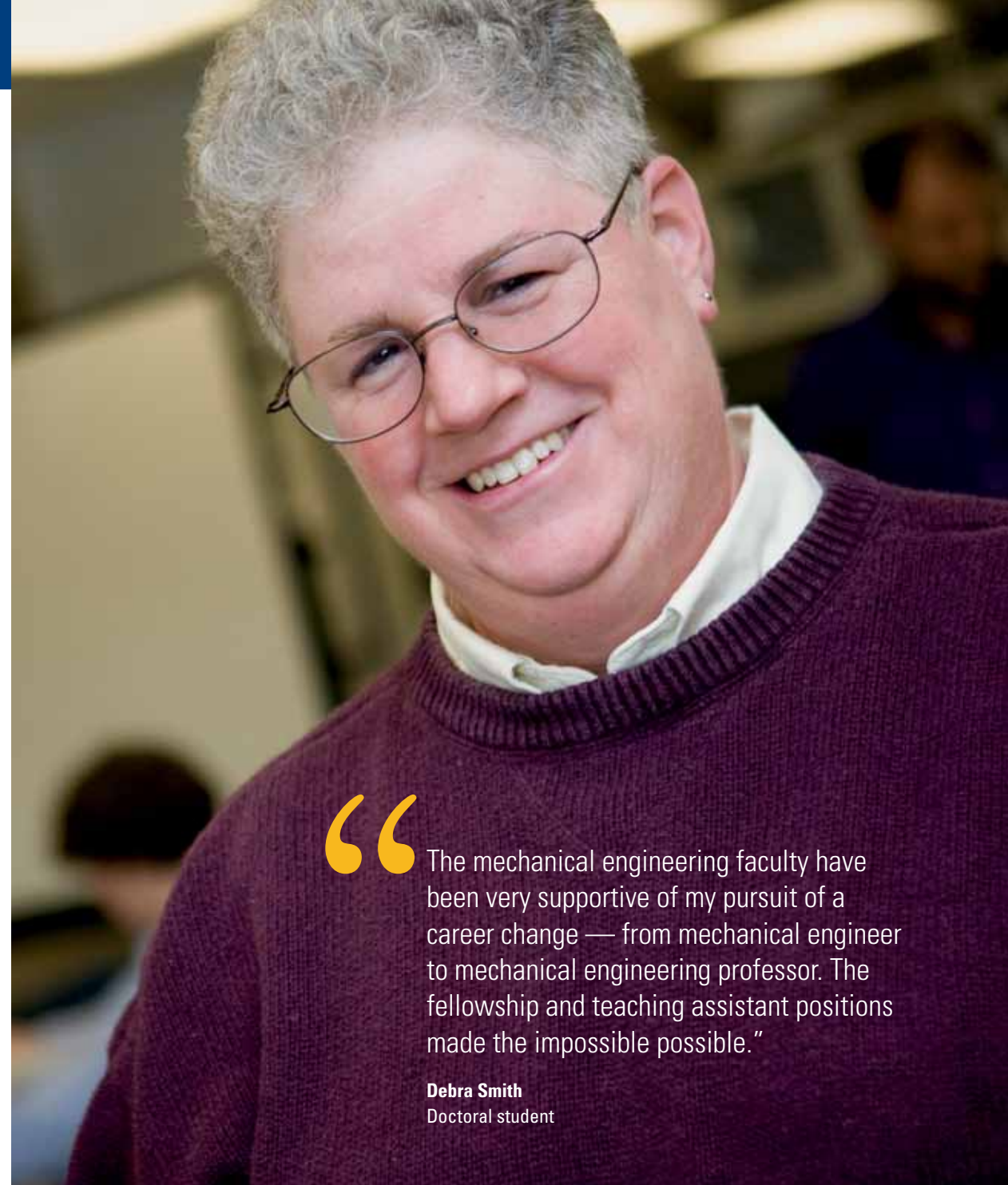
- Students must complete a minimum of 48 post-baccalaureate credit hours (16 classes), plus 12 dissertation credits, pass a proficiency exam, pass a doctoral-qualifying exam, and submit and successfully defend a dissertation.
- Full-time students typically enroll in 12 credit hours (four classes) per semester to complete their degree work in four to five years.
- Part-time students typically enroll in three to six credit hours (one to two classes) per semester to complete their degree work in six years.
- Early in the program, students each week spend an average of nine hours in class, 20-25 hours on course work and 10-15 hours on research.
- Later in the program, students each week spend a few hours on course work and up to 40-60 hours on research.

#### Residency requirements:

- Students must complete nine credit hours (three classes) or their equivalent per term for two terms within an 18-month period or complete at least six credit hours (two classes) or their equivalent per term for three terms within an 18-month period.

#### Exam requirements:

- All students must complete a proficiency exam during their first year before completing their residency requirement.
- All students are required to pass a doctoral-qualifying exam and successfully defend a dissertation.



“The mechanical engineering faculty have been very supportive of my pursuit of a career change — from mechanical engineer to mechanical engineering professor. The fellowship and teaching assistant positions made the impossible possible.”

**Debra Smith**  
Doctoral student

#### Research and seminar opportunities:

- Students conduct original research and attend weekly departmental seminars.
- Each student has a customized research plan formulated with his or her adviser.
- Graduate assistants support undergraduate student laboratory experiences.
- Students attend and present at the department's annual poster conference.

#### Scheduling:

- Courses are offered in the late afternoons and evenings.

For more program details, including requirements and course descriptions, see the *Graduate Bulletin* at [marquette.edu/grad](http://marquette.edu/grad).



Refine your teaching skills, participate in university committee work, present scholarly lectures and papers, and learn how to conduct a successful job search through our Preparing Future Faculty program. Marquette is one of only 17 U.S. universities to have received funding for this program. For more information, visit [marquette.edu/pff](http://marquette.edu/pff).

## Master of science

### Course work:

#### Non-thesis program

- Students must complete a minimum of 33 credit hours (11 classes).
- Part-time students taking three credit hours (one class) per semester typically complete their degree in as few as four years.
- Full-time students taking nine credit hours (three classes) per semester typically complete their degree in two years.

#### Thesis program

- Students must complete a minimum of 24 credit hours (eight classes), plus six credit hours of thesis work, submit an approved thesis and pass a final comprehensive oral exam.
- Full-time students taking nine credit hours (three classes) per semester typically complete their degree in two years.

### Research and seminar opportunities:

- Students participate in guided research with a faculty adviser every week.
- Research and graduate assistants can spend time in the laboratory conducting or assisting with original research.
- Students attend weekly departmental seminars and participate in the department's annual poster conference.

### Scheduling:

- Courses are offered in the late afternoons and evenings.

For more program details, including requirements and course descriptions, see the *Graduate Bulletin* at [marquette.edu/grad](http://marquette.edu/grad).



Marquette's program prepares graduates by equipping them with the best problem-solving skills through in-depth education and hands-on experience."

**Hector Sanchez, Eng '06, Grad '07**  
 Supply management global process leader  
 Service parts supply  
 GE Healthcare — Global Products  
 and Repair Solutions



Marquette offers two graduate engineering certificates in engineering innovation and new product and process development for practicing engineers wishing to update or expand their knowledge without pursuing a master's degree. For more information, visit [marquette.edu/engineering/certificates](http://marquette.edu/engineering/certificates).

## YOUR FACULTY MENTORS



For more information about the department's faculty, including research, affiliated, adjunct and emeriti members and their research interests, visit [marquette.edu/engineering/mechanical/facstaff](http://marquette.edu/engineering/mechanical/facstaff).

**Dr. John Borg, P.E.**, associate professor

*Shock physics, hydrodynamic stability and turbulence, fluid dynamics and aerodynamics*

**Dr. Vikram Cariapa, P.E.**, associate professor

*Rapid prototyping, flexible manufacturing systems, process controls, neural networks, mass finishing, design of experiments*

**Dr. Kevin Craig**, professor and Greenheck Chair in Engineering Design

*Mechatronic system design; modeling, analysis and control of dynamic physical systems*

**Dr. Joseph Domblesky**, associate professor

*Process simulation, metal forming, materials joining technology*

**Dr. Raymond Fournelle, P.E.**, Fellow A.S.M.E. and professor, associate chair and director of graduate studies

*Mount technology, phase transformations, grain boundary migration, electron microscopy, surface*

**Dr. Scott Goldsborough**, assistant professor

*Sustainable energy development, IC engines, alternative power systems (human, solar, biomass, etc.), societal/environmental impacts of engineering*

**Dr. Gerald Harris**, joint appointed professor

*Assessment of neuromuscular function, human motion analysis*

**Dr. Stephen Heinrich**, joint appointed professor

*Structural mechanics, electronic packaging*

**Dr. Jon Jensen**, joint appointed professor

*Solid and geometric modeling, computer graphics*

**Dr. Kyuil Kim, P.E.**, professor and department chair

*Computer-aided manufacturing, industrial automation, precision engineering, accuracy analysis of multi-axis machine tools, machining dynamics and on-line control of machining processes, sculptured surface machining, flexible inspection systems*

**Dr. Jon Koch**, assistant professor

*Gas dynamics, heat transfer, fluid flow, photophysical properties of attractive fuel and flow tracers, LIF techniques for measuring properties of flow fields*

**Dr. Chung Hoon Lee**, joint appointed professor

*Micro/nano scale device fabrication, characterization and analysis; ultrasonic/bio MEMS; microfluidics; thermal analysis of bio/chemical molecules; molecular electronics; thermoelectric material design, fabrication and analysis; near-field scanning optical microscopy; atomic force microscopy probe developments; bio/chemical sensors*

**Dr. Richard Marklin**, professor

*Ergonomics, human factors, biomechanics of the workplace, musculoskeletal disorders*

**Dr. Mark Nagurka, P.E.**, associate professor

*Mechatronic systems, modeling measurement, controls and design of mechanical and electronic systems, dynamics and control of vehicles, rail, mag-lev, automotive, motorcycle and human-machine interactions*

**Dr. James Rice**, associate professor and director of graduate studies

*Manufacturing process modeling and systems simulation, process signature analysis, particulate processing, metal matrix composites*

**Dr. Joseph Schimmels**, professor

*Dynamic systems and control, robotics, automated assembly, optimal design robotics*

**Dr. Barbara Silver-Thorn**, joint appointed professor

*Prosthetic limbs, soft tissue mechanics, rehabilitation engineering*

**Dr. Robert Stango**, professor

*Composite materials, polymeric materials, deburring and surface finishing processes, computer-aided engineering*

**Dr. Philip Voglewede**, assistant professor

*General area of dynamics and controls, theoretical kinematics applied to robotics and prostheses, polynomial chaos theory applied to controls, industrial automation and fixturing*

**Dr. Robert Weber**, associate professor

*Creativity in engineering design, biomechanics, mechanical systems design*

**Dr. G.E.O. Widera**, Fellow A.S.M.E. and professor

*Stress analysis, modeling of manufacturing processes, plates and shells, structural, plastics and pressure vessels*

## FACULTY RESEARCH

Our faculty members have financial support from numerous government and private agencies, including the National Science Foundation, NASA, the U.S. departments of Energy, Interior and Defense, and the Gas Research Institute. Their research has been recognized with many national and international awards. A few departmental research focus areas include:

### Shock physics, hydrodynamic stability and turbulence, fluid dynamics and aerodynamics

**Dr. John Borg, P.E.** — Research involves building an understanding of the response of materials to dynamic loading events. This includes a vast array of possible applications, from materials experience of rapid loading from ballistic impact and seismic events to combustion and explosion. Marquette has a rapid loading facility and several computational analysis tools to analyze and explore these types of events.

### Optical diagnostics for energy and chemical processes

**Dr. Jon Koch** — Research focuses on the development and application of techniques like laser absorption; laser-induced fluorescence imaging; and particle imaging velocimetry for harsh environments, including thermometry and gas concentration measurements during explosions, and in situ flow field characterization in combustion chambers.

For more information about the department's faculty, including research, affiliated, adjunct and emeriti members and their research interests, visit [marquette.edu/engineering/mechanical/facstaff](http://marquette.edu/engineering/mechanical/facstaff).

## YOUR RESOURCES

As a graduate student in mechanical engineering at Marquette, you'll have access to:

- a fully staffed and functional machine shop.
- an electron microscope and optical microscopy laboratory.
- a variety of engineering design software, including computer-aided design, computational fluid dynamics and finite element mechanics.
- state-of-the-art hardware and software for mathematical modeling, including MATLAB, dSpace and LabView.
- a 100-core computer cluster for high throughput computational modeling.
- the College of Engineering's new state-of-the-art Discovery Learning Complex, which has rapid prototyping and fully automated CAD/CAM systems.
- research laboratories in ergonomics, engines, lasers and mechatronics, as well as analysis equipment for thermo-fluid sciences.
- a program that in 2010 was ranked in the top 100 of tier-one universities by *U.S. News & World Report*.
- a program fully accredited by the Accreditation Board of Engineering Technology, North Central Association of Colleges and Schools Commission on Institutes of Higher Education.

Our graduate programs also provide excellent resources beyond the classrooms. Thanks to our location in downtown Milwaukee and community-connected faculty, you'll enjoy an urban setting with access to a vibrant arts scene, professional sports, restaurants and nightlife.

### Marquette University

- Access to networking, career counseling, and job searching counselors and seminars through our free Career Services Center
- More than 20 academic centers and institutes that foster research in end-of-life care, ethics, neuroscience, rehabilitation engineering, transnational justice, water quality, sports law and others
- Access to more than 1.7 million volumes of books and bound journals, 22,000 journals and other serials in digital format, laptops for checkout, and extensive special collections (Raynor Memorial Libraries are open evenings and weekends)
- Access to a secure high-speed wireless network (54Mbps) for laptops and other devices
- Remote computer access to campus-only resources through our VPN
- Student Health Service, Counseling Center and Campus Ministry
- Sports recreation and fitness facilities
- Big East Conference sports, including men's basketball, which has 27 NCAA appearances, 14 Sweet Sixteen appearances, three Final Four appearances and one NCAA championship (1977) and plays in front of 18,000 fans at the Bradley Center

### Milwaukee

- The Milwaukee metropolitan area has approximately 1.7 million people, ranking among the top cities in the United States by population
- Home to 9 Fortune 500 company headquarters, including Harley-Davidson, Johnson Controls, Northwestern Mutual and Rockwell Automation
- Milwaukee offers many art and cultural opportunities, including a repertory theatre, a symphony orchestra, two opera companies, a ballet company, diverse art galleries, a public museum, the Milwaukee County Zoo and the Milwaukee Art Museum
- Professional sports include baseball (Brewers), basketball (Bucks), hockey (Admirals), soccer (Wave), a PGA tournament and skating exhibitions at the Pettit National Ice Center (an Olympic training facility)
- Known as the city of festivals, Milwaukee has abundant celebrations throughout the year honoring the city's diverse heritage, including Summerfest — the world's largest outdoor music festival
- More than 10 miles of lakefront, 1,500 restaurants and 15,000 acres of parks



## YOUR INVESTMENT

Furthering your education is an investment you can count on. Financial aid — in several forms — can help meet the costs of your graduate education at Marquette.

### Tuition\*

#### For full-time students:

Nine credits per semester at \$945 per credit = \$8,505 per semester

#### For part-time students:

Three to six credits per semester at \$945 per credit = \$2,835 to \$5,670 per semester

A minimum of 48 credit hours plus 12 dissertation credits (post-baccalaureate) is required to complete the doctoral program.

A minimum of 33 credit hours is required to complete the non-thesis master's program.

A minimum of 30 credit hours plus six thesis credits is required to complete the thesis master's program.

\*Figures provided are based on average credit hours taken per semester and exclude service fees and/or continuous enrollment/continuation course fees. Per-credit cost valid until May 2012.

### Merit-based aid

Students with promising credentials have an opportunity to receive generous amounts of aid in the form of fellowships and research and teaching assistantships.

Fellowships provide financial aid from agencies outside the department and, in most instances, outside the university. As such, students must apply to each fellowship individually. Marquette's Funding Information Center can help you find these opportunities. For more information, visit [marquette.edu/library/services/fic](http://marquette.edu/library/services/fic).

Research assistantships are generated by individual or collections of faculty members who obtained research grants to fund students. A partial list of faculty grant information can be found at [marquette.edu/orsp](http://marquette.edu/orsp).

The availability of teaching assistantships varies from year to year, but, in general, there are 10 mechanical engineering positions. The current teaching assistant package includes 18 hours of tuition, approximately \$14,000 in stipend money and health insurance. More information can be found at [marquette.edu/grad/finaid\\_teachingasst](http://marquette.edu/grad/finaid_teachingasst).

### Need-based aid

Enroll as a half- or full-time student in a degree program (at least four credit hours, usually two or more classes a semester), and you may be eligible for loans distributed through the Office of Student Financial Aid. Most student loans have competitive interest rates and do not require repayment until after you complete your course of study.

To apply, file the Free Application for Federal Student Aid each year between January 1 and mid-February. It's available from the Office of Student Financial Aid or at [fafsa.ed.gov](http://fafsa.ed.gov). Once you have been admitted to your program and completed your financial aid paperwork, we will determine your eligibility and send you a notice explaining what financial aid you are eligible to receive from the university.



### Additional resources

- Marquette offers a convenient payment plan that divides tuition costs into monthly installments. For more information, visit [marquette.edu/mucentral](http://marquette.edu/mucentral) or contact Marquette Central at (414) 288-4000.
- Employment assistance is available.
- Private lenders feature special educational loans.
- Your employer may offer a tuition-remission plan.
- Some private foundations offer financial aid for graduate study.
- Tax credits can be claimed for work-related educational expenses.

## YOUR OPPORTUNITIES

Where could a graduate degree in mechanical engineering lead you?  
You'll find our recent graduates ...

#### working for a variety of laboratories and companies, including:

- Argonne National Laboratory
- Caterpillar
- CD-adapco
- GE Aircraft Engines
- Harley-Davidson
- Modine Manufacturing Co.
- Pratt and Whitney

#### pursuing doctoral degrees at other tier-one universities and holding faculty positions at:

- Marquette University
- Milwaukee School of Engineering

## YOUR FIRST STEP

**We invite you to apply.**

### **Application requirement checklist:**

- Online application at [marquette.edu/grad](http://marquette.edu/grad) (must be submitted online before any additional admission materials)
- Application fee
- Official transcripts from all current and previous colleges/universities except Marquette
- Three letters of recommendation
- (Doctoral applicants only) A brief statement of purpose and copies of any published work, including master's theses and essays
- GRE (general test only) scores; waived if your undergraduate degree was from Marquette with a GPA of 3.0 or higher.
- (International applicants only) TOEFL score or other acceptable proof of English proficiency
- If necessary, submit any additional hard-copy materials in one envelope to:

Marquette University Graduate School  
P.O. Box 1881  
Milwaukee, WI 53201-1881



**We invite you to speak with a faculty member.**

Dr. James Rice  
Associate professor and director of graduate studies  
Haggerty Engineering, Room 227  
P.O. Box 1881  
Milwaukee, WI 53201-1881  
Phone: (414) 288-5405  
Fax: (414) 288-7790  
E-mail: [james.rice@marquette.edu](mailto:james.rice@marquette.edu)





**MARQUETTE**  
UNIVERSITY

---

**Be The Difference.**

**Marquette University Graduate School**

Phone: (414) 288-7137 or (800) 793-6450, ext. 7

E-mail: [mugs@marquette.edu](mailto:mugs@marquette.edu)

1324 West Wisconsin Avenue | Holthusen Hall, Room 305 | P.O. Box 1881

Milwaukee, Wisconsin 53201-1881

[marquette.edu/grad](http://marquette.edu/grad)