



NATURAL AND APPLIED SCIENCES (NAS) SEPTEMBER 13, 2016

OVERVIEW

This report describes the recent initiatives, activities, and achievements by the Natural and Applied Sciences (NAS) division since the last meeting of the NAS Steering Board (NASSB) in October 2015. It provides an update about the NAS division today and seeks input as how could we best move the NAS division forward. NAS division progress over the past year consist of a positive growth trend, establishment of new programs, and implementation of innovative initiatives. The accomplishments of our students, alumni, and faculty reinforces the value of pursuing a technical degree at Loyola that is built based on the liberal arts and the Jesuit model of education. Feedback from our Steering Board will help us to be more intentional in planning for the future that is informed by the needs of the private and public organizations that will be employing our future graduates. In particular the input from NASSB members at this time is extremely important in view of the fact that Loyola university Maryland is in the midst of developing the next strategic plan for our institution.

Bahram Roughani

Quick Fact: NAS Profile

Departments:

- Biology
- Chemistry
- Computer Science
- Engineering
- Mathematics & Statistics
- Physics

Degree Programs:

- Biology (BS)
- Biochemistry (BS)
- Chemistry (BS)
- Computer Science (BS)
- Computer Science (BA)
- Data Science (MS)
- Engineering (BSE)
- Mathematics (BS)
- Physics (BS)
- Statistics (BS)

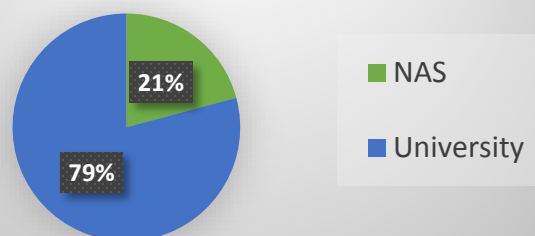
Interdisciplinary Majors:

- Biochemistry (BS)
- Biology – Psychology
- ...

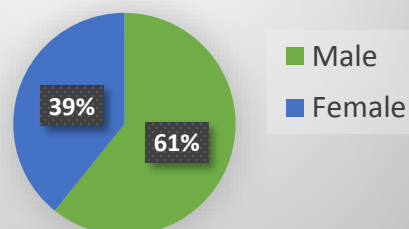
Interdisciplinary Minors:

- Forensic Studies
- Natural Science
- Biomedical Physics
- Environmental & Sustainability Studies

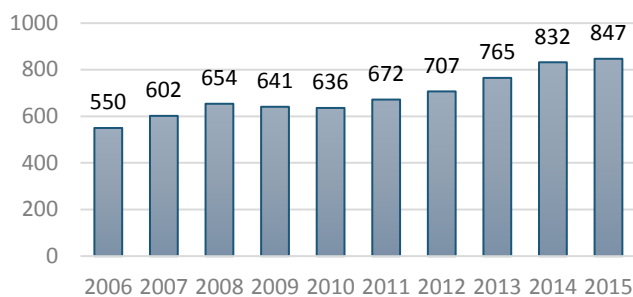
847 undergraduate majors



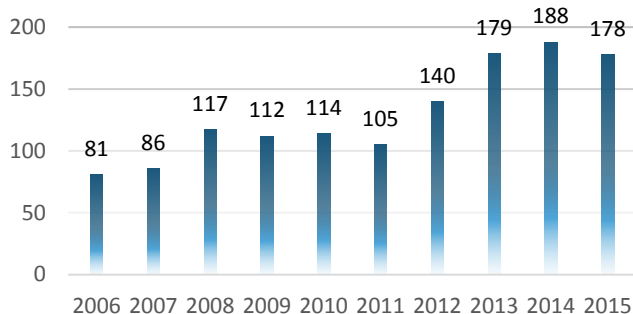
Fulltime Faculty Fall 2016



Degree Program Growth



Interdisciplinary Program Growth



CPaMS Faculty:

NSF supported S-STEM grant (\$565,000) is being implemented by a team of NAS faculty from three academic departments; Computer Science, Physics and Mathematics and Statistics listed below:

- Mili Shah, associate professor of Mathematics (PI),
- Dawn Lawrie, professor & chair: computer science (co-PI),
- Mary Lowe, professor of physics (co-PI),
- Lisa Oberbroeckling, associate professor of mathematics (co-PI).
- Other faculty involved in this grant are, Megan Olsen, assistant professor of computer science, Christopher Morrell, professor of statistics, and Roberta Sabin, professor emeritus of computer science.



CPaMS Collaborative Grant:

This collaborative NSF-funded (S-STEM program) is a need-based scholarship for academically qualified students that started in 2015. 'CPaMS' stands for three NAS academic departments involved in this collaborative effort; Computer science, Physics, - and Mathematics, and Statistics. The first cohort of CPaMS team of class of 2020 consist of seven students who have qualified to receive scholarship through S-STEM grant plus three additional students who have accepted the invitation to be part of the 2020 CPaMS cohort but without need-based S-STEM scholarship support. The recruitment efforts for 2021 CPaMS cohort is underway at this time.



2020 Cohort of CPaMS Fellows (7 of 10 cohort)



2020 Cohorts of CPaMS Fellows and Faculty involved in this NSF supported scholarship program.

CPaMS Page: <http://www.loyola.edu/join-us/stem-scholarships>

About Pathways

Pathways was created and is run by the National Center for Engineering Pathways to Innovation (Epicenter). Epicenter is funded by the National Science Foundation and directed by Stanford University and VentureWell. [Visit the Pathways homepage on Epicenter's site](#) for all the latest Pathways news, proposal information and downloads

VentureWell.org

Pathways to Innovation:

This collaborative initiative involving core team from Physics, Engineering, and Computer Science started in January 2015. Faculty involved in this initiative are;

- **Engineering Department:** Suzanne Keilson and Robert Pond
- **Computer Science Department:** Dawn Lawrie and M.S. Raunak
- **Physics Department:** Randall Jones, Mary Lowe, and Bahram Roughani.

Pathways to Innovation activities during 2015-16 included:

- A new course on “*Technical Innovation and Entrepreneurship*” cross-listed as (CS491 / EG491 / PH491) was developed and taught B. Roughani during spring semester 2016. 17 students participated in this course (class cap was set at 16). This interdisciplinary and cross listed course also eliminated the need for each department to offer a separate technical elective course, thus enhanced the efficiency in terms of course offerings.
- An interdisciplinary approach for capstone design projects was implemented for the first time during 2015-16 academic year, enabling CS and engineering students to work in joint senior design capstone projects. This has provided great opportunities for students to utilize their skills in completely new environments built by multidisciplinary teams.
- LUMEN (Loyola University Maryland Entrepreneurship Network): The idea for LUMEN was developed and it received university support. LUMEN will enter implementation phase during 2016-17 by creating a network of volunteer faculty, alumni, and advisory board member to nurture entrepreneurial and innovative efforts of Loyola students by providing advice, expertise, and support needed for successful technical ventures activities, from patent law, to financial, market, and technical aspects of such endeavor. We welcome ideas on how could we expand LUMEN's reach and heighten its impact.

PRESS RELEASE: 25 U.S. INSTITUTIONS SELECTED FOR PATHWAYS TO INNOVATION PROGRAM



25 U.S. Institutions Selected for Pathways to Innovation Program by NSF-Funded Epicenter

Sources of support for the Hauber Research Program

Endowed Hauber Fund consist of:

- The Edward Hauber, S.J. Endowed Scholarship Fund
- The Alexander M. Haig, Jr. Endowment Fund for Science, Faith and Culture: The Hon. Alexander M. Haig, Jr. and Mrs. Patricia F. Haig - Rev. Frank Haig, S.J.
- Gino J. Gemignani, Jr., '71 and Margaret Gemignani (The Hauber Scholars Fund in honor of Dr. Robert B. Pond, Jr.)
- Hauber Physics Fellowship - John R. Kane, '59

Current use Hauber Funds in 2016 was provided by:

- W.R. Grace & Co. (2016): Supported a Chemistry major
- Whiting Turner (2016): Supported an Engineering major
- Dr. Lisa Scheifele's NIH Grant (2016): Supported a Biology major
- Professor Mary Lowe & Dr. Lowe's Sister & Brother (2016 - 2019): Supporting one physics major each year (216-2019)

ABOUT Hauber Research Program:

Each summer, a select group of highly motivated, talented undergraduates work side-by-side with faculty mentors from the six natural and applied science departments at Loyola to conduct research in the students' area of interest. Hauber Fellows are selected by a committee, and each student receives \$5,000 for 10 weeks summer research. During the summer of 2016, 16 students participated in the Hauber summer research program.



16 Hauber fellows were supported during summer 2016, thanks to generous support by individual donors and organizations either using the endowed Hauber account or the current use accounts.

Hauber Summer Program Format and Deliverables:

The program runs for 10 weeks in the summer. Students gain valuable experience while engaged in research in their discipline whereas faculty obtain assistance with their work as well as mentoring students in scientific research methods and projects. Hauber Research Fellows gather together weekly for informative seminars regarding using library resources, research opportunities, regulations related to responsible conduct of research, graduate schools planning, writing CV and statement of purpose, and writing successful presentations, and presentation skills. Students then offer an overview of their research in a formal presentation which is open to students, faculty, staff and the greater Loyola community. At the end of the program, each Hauber Research Fellow is required to submit a written report and participate in a poster symposium in the fall semester, which provides the Loyola community with an opportunity to learn about the results of the on campus research work completed during the summer.

Seminars and Events



Dr. Bonnie Bassler



Dean Thomas presenting Alumni award to Austin Gallagher



Brother Guy Consolmagno, director of the Vatican Observatory, and Cosmos and Creation key note speaker

Some of the major NAS each year include

Grand Seminar:

The 2016 Grand Seminar talk by Dr. Bonnie Bassler was a great success, and it was received extremely well by large number of students, faculty and guests who attend the talk. Dr. Bassler in addition to being a highly accomplished and world renowned scientist, she is also an eloquent and engaging speaker. Furthermore, for NAS division it was the very first time hosting a women scientist as our Grand Seminar speaker, and Dr. Bassler was also the very first women scientist to receive the prestigious Shaw prize (2015 Shaw Prize). She is for sure a great inspiration for many of our students in particular women who are majoring in a field of math, sciences, or engineering.

Celebration of Science Week:

The celebration of Science was held during the same week as the Grand Seminar event. The inaugural celebration of Science week was in 2015 when we hosted Dr. Adam Reiss (2011 Nobel in Physics) as our Grand Seminar speaker. This year's Celebration of Science week included robot competition, films connection arts and science, as well as students and faculty meet and greet with Dr. Bassler, and NAS alumni award reception.

Alumni Award:

Austin Gallagher, (2008 Biology), PhD, who was named to the Forbes 30 Under 30 list in science in 2015 for his work as an ocean scientist was the recipient of the NAS Alumni award this year.

Cosmos and Creation:

The 2016 [Cosmos and Creation](#) conference was organized by Dr. Rob Pond (engineering) and Dr. Paul Richard Blum (Philosophy) as conference co-chairs. This annual conference began 34th years ago, and is held during the month of June. The keynote speaker this year was Brother Guy Consolmagno, S.J.; the [Director of the Vatican Observatory](#)

NAS faculty have developed new degree and relevant minor programs to address specific needs, including:

- Feasibility studies and/or planning for degree programs that is being pursued by NAS departments at this time include:

-

Data Science (MS):

[illegible]

Biomedical Physics: A new Biomedical Physics minor was approved, and 2016-17 academic year is the first year of [this interdisciplinary minor](#) offering that is led by Dr. Mary Lowe, professor of physics and Dr. Joe Ganem serves who is the minor coordinator. This minor was created primarily based on the NSF grant project that Dr. Lowe served as Loyola University grant PI. She also conducted a related workshop in our campus in January 2016 that attracted number of faculty from across the country.

Environmental and Sustainability Studies: The official implementation of a new interdisciplinary minor in Environmental and Sustainability Studies has been very successful based on the number of students joining this minor during 2015-16 at a rate faster than what was originally anticipated. This minor is led by Dr. Bernadette Roche, associated professor of Biology.

Environmental and Sustainability



Loyola University Maryland recognizes that sustainability is a multi-faceted commitment. Within a university this may involve energy conservation, green building, academics, food service, grounds maintenance, and other areas. However, to ensure our students are well informed about environmental and sustainability issues, we need faculty who are knowledgeable and passionate about this issue to be engaged and lead efforts as shown by the example of their recent initiatives.



Examples of recent initiatives by NAS faculty related to Environmental and sustainability:

No Impact week was coordinated and led by Elizabeth Dahl with support from other faculty interested in environment and sustainability. This will continue during [2016-17 academic year](#).

Baltimore Environmental Film Series: This new [film series program](#) was organized by Elizabeth Dahl (Chemistry), and will continue for 2016-17 year.

Baltimore Environmental Exchange (BEE): Loyola University in coordination with joint-recipients MADE CLEAR grant from Goucher College and Stevenson University, created the newly formed **Baltimore Environmental Exchange (BEE)**. This include offering a one-day workshop on October 14, 2016, at Loyola University that will include best practices for climate education across the curriculum and integration with co-curricular initiatives, with special emphasis on integration of science and societal approaches to understanding climate change. Professor Bernadette Roche (Biology) and Elizabeth Dahl (Chemistry) are leading this project.

About MADE CLEAR: The Maryland and Delaware Climate Change Education, Assessment and Research (MADE-CLEAR) program is supported by a Phase II Climate Change Education Partnership (CCEP) grant awarded to the [University System of Maryland \(USM\)](#) by the [National Science Foundation](#). MADE CLEAR supports Baltimore Environmental Exchange (BEE) program, mentioned above.

Solving the E-Waste Problem: Loyola University Maryland hosted four engineering students from Brazil on campus this summer through the [Brazil Scientific Mobility Program \(BSMP\)](#). Dr. Suzanne Keilson (Engineering) helped create the e-waste and e-recycling project for the four Brazilian students.



Program Reviews & Accreditation

Loyola University has restated a program review for all academic programs based on a rotation that includes few program reviewed each year. This program review is conducted by a team typically consist of two external reviewers from other universities and at least one internal reviewer. Usually background of the external reviewers are the same as the program being reviewed and the internal reviewer is selected from a program that has some level of overlap with the program under review. In addition to the internal program reviews, we have two ABET accredited programs, Computer Science & Engineering, in addition to Chemistry being certified by the American Chemical Society.



Program Reviews

Mathematics and Statistics: The first department completed a program review process during 2014-15 IS Math & Statistics. Currently department is working on implementing the recommendations they received after the program review.

Computer Science & Engineering: both Computer Science and Engineering will go through the program review during the 2016-17 academic year.



ABET Accreditation: Both Computer Science and Engineering programs will complete the 6-year periodic ABET reaccreditation process including fall 2017 campus visit. Program reviews results done in fall semester 2016 will

be used in developing more complete ABET self-study reports, both of which are due June 2017.

American Chemical Society certification: Chemistry program was recertified based on the submission of periodic report by the department. The next 6 year periodic report is due 2020, and the internal Chemistry program review is scheduled for 2019.

Co-Curricular and Outreach Programs:

CampBalti Code: This new two-week summer camp for 7th and 8th grade girls was organized and led by Dr. Megan Olsen (CS) with assistance from Dr. Roger Eastman (CS) and Raenita Fenner (Engineering), and was offered during June 11-22.

Engineering Innovation (EI) summer program for the first time was led by Dr. Suzanne Keilson as an on campus program during June-Jul 2016 in Donnelley Science building. 15 high school students from US and even outside US attended this four-week program.

Diversity of Science Seminar series was organized by "Women of STEM" led by Drs. Dahl, Roche, and Shah who organized 6 talks by external speakers to introduce students to various career paths, in industry, business, and government agencies.

NAS Grant Activities

NAS faculty have been very active in grant writing activities, with notable success since the last meeting of NASSB meeting in October 2015.



Grants & Grant Applications:

- Lisa Scheifele (PI - Biology); "Development of a Sustainable Synthetic Biology Workshop and Public Lecture at a Community Laboratory" - December 2015 – supported by the Society for Biochemistry and Molecular Biology (\$2,000).
- Megan Olsen (PI - CS); "developing and presenting Camp BaltiCode Summer STEM Camp" - June 2016 – supported by the Family League of Baltimore (\$6,500).
- Theresa Geiman (PI – Biology); "Nathan Schnaper Summer Intern Program in Cancer Research" - February 2016 – supported by NIH (\$32,175)
- Mili Shah (PI–Mathematics and Statistics); "The Development of Sensor Registration Algorithms" -May 2016 – supported by the National Institute of Standards and Technology (\$26,095).
- Bernadette Roche (PI) and Elizabeth Dahl (co-PI), "Increasing Capacity for Climate Change Across the Curriculum at Loyola University Maryland)" – May 2016 – supported by MADE CLEAR Climate Change Education (collaborative effort with Gaucher, and Stevenson) (\$5,000 each institution plus \$1,250 matching fund).
- Megan Olsen (PI / CS), Brigit Albrecht (Co-PI / Chemistry), David Binkley (Co-PI / CS), and Jeremy Schwartz (co-PI / SSBM), "MRI: Acquisition of a Computing Cluster to Enable Transformative Research across Disciplines" -July 2016 – supported by Major Research Instrument (MRI), NSF (\$280,120).
- David Rivers (PI/ Biology)" RCN-UBE Incubator: The Mid-Atlantic Biology Research and Career Network: Innovations in Biology Undergraduate Education" - June 2016 – supported by NSF (\$50,000).
- Bahram Roughani (PI / Physics) and Randal Jones (Co-PI / Physics), "The PIPELINE Network: Supporting the Development of Physics Innovation and Entrepreneurship Education through Institutional Engagement" in collaboration with American Physical Society and six other universities – August 2016 - NSF (Loyola's award \$80,977 - total collaborative grant award \$595,000).

Impact of Capital Equipment Funds:

CAPITAL EQUIPMENT FUNDS:

NAS departments have been able to secure many of the major equipment needed for teaching and research using two capital equipment funds; one account being an endowed account and the second account being an account that is budgeted each year by the university. These two accounts are:

- Endowed Capital Equipment account supporting the capital equipment needs of three academic departments; Engineering, Computer Science, and Physics.
- Current Use Capital Equipment account supporting the capital equipment needs of three academic departments; Biology, Chemistry, and Mathematics and Statistics.

Capital Equipment Projects:

Support for enhancing major laboratory equipment, research infrastructure, and machine shop are provided through capital equipment funds associated with NAS programs, in addition to external grants.



A new Atomic Force Microscope (AFM) for surface analysis of materials.

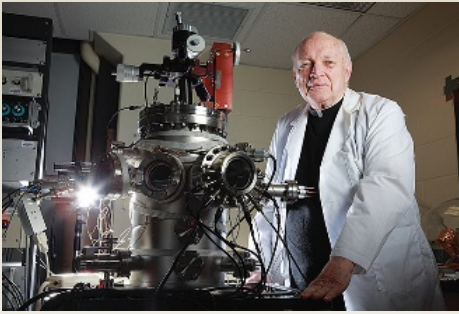


6 new microtomes were purchased for *state-of-the-art neuroscience techniques* for biological sample sectioning.



A new laser cutter- 24"x48" work area -156W power laser, metal cutting capabilities

Faculty Achievements



Rev. Frank R. Haig, S.J., professor emeritus of physics received [lifetime achievement award](#) from Washington Academy of Sciences in an event in May 19, 2016. Rev. Frank R. Haig, S.J., is a strong supporter of the Hauber Summer Research program and undergraduate research at Loyola.

Faculty Achievements & Awards:

- A 2006 joint paper by David Binkley, Dawn Lawrie, Christopher Morrell, and Henry Feild (student), “What’s in a Name” was declared [the most influential paper over the last 10 years](#) by the International Conference on Program Comprehension. This paper has 130 citations so far.
- Dr. Lawrie was awarded the 2015 Best Reviewer award by the IEEE International Conference on Source Code Analysis and Manipulation.
- Dr. Thompson (Biology) won the Student Choice AFFIRM award, indicative of the strong commitment to our students.
- Mathematics instructor (per course affiliate) Amanda Lattimore, won the NCWIT [Aspirations in Computing Educator Award](#) and gave a [TEDx talk](#).
- Greg Derry (Physics) published a paper with two Hauber fellows as co-authors.
- Math and statistics faculty had at least 8 articles accepted for publication over the past year, and an additional 3 submitted.
- CS faculty published two journal articles and twelve conference papers (this is often more challenging than publishing journal articles).
- Two of the engineering department faculty (Drs. Hoe and Elban) published two peer reviewed conference papers and three peer reviewed journal papers.
- Biology faculty had six peer reviewed research publications, one book chapter, and seven papers/posters were presented at national meetings, most of which had student co-authors. Furthermore, Biology faculty have two research papers in review and one book in the copy editing stage.
- Dr. Binkley (CS) WAS a Fulbright scholar this year based on Fulbright, NSF awards he received to support collaborative research project in Norway.

Students Achievements



EXAMPLES OF STUDENTS ACHIEVEMENTS:

Three Loyola students awarded [STEM scholarships](#) for summer study in Germany.

- Emily Chambers, (engineering major, '17) was awarded a scholarship through the Undergraduate Research Opportunities Program (UROP) at RWTH Aachen University for her project, "Functionalization of Thermoplastic Polymers for Sensor Applications."
- Sarah Trent (Biology, '18) won a scholarship from The German Academic Exchange Service (DAAD)/Research Internships in Science and Engineering (RISE) to study her project, "Development of a Sensor and Expert Model Based Training Device for Advanced Minimally Invasive Surgical Tasks," at the Heidelberg University Hospital.
- Jonathan Deegan (Chemistry, '17) was awarded a scholarship with The German Academic Exchange Service (DAAD)/Research Internships in Science and Engineering (RISE) to study his project, "Natural Product Synthesis and Method Development in Heterocyclic Chemistry" at Freie Universität, Germany.
- Jamie Surgent-Nahay (Biology '17), [win Gilman Scholarships for study abroad](#) in will be studying in Newcastle, England.
- Brianna Banerjee, '17, wins [Gilman Scholarship for study abroad in Denmark](#).
- Student technical and service clubs have grown in kind. Last year a makers club (engineering) was established with Dr. Kranov as mentor. This joins the recently formed [robotics club](#), which Dr. Hoe mentors with Dr. Eastman in CS. Dr. Fenner continues strong engagement with the Society of Women Engineers (SWE) club, and Dr. Pond mentors the engineering club.
- Zahara Kazmi (CS major) won a scholarship to attend the Grace Hopper Celebration of Women in Computing in the fall.



Looking Ahead

Some of the main points for the Natural and Applied Sciences division for the foreseeable future are those listed in this page. This is not a comprehensive list, but helps to keep in mind some of the significant issues that we need to pay attention to at least during this academic year.

Near future projects that could have positive impacting on NAS:

- Launching the new Data Science (MS) program
(The first class offered in spring 2017).
- Strategic Planning for LCAS and NAS (Spring 2017)
(After the University strategic plan is approved.)
- Inclusive Excellence,
 - Submission of HHMI pre-proposal (December 2016)
 - Submission of INCLUDES proposal
 - Building on the work of PKAL
- Exploring options for new and relevant degree options
- Collaboration with industry, business, and government
- Pathways to Innovation related efforts including;
 - LUMEN (Loyola University Maryland Entrepreneurship Network,
 - University Innovation Fellows (UIF),
 - Expanding joint capstone (CS & engineering),
 - Technical Innovation and Entrepreneurship course,
 - Working on PIPELINE project (modeled after Pathways for Physics),
 - Engage the rest of NAS and the University,
 - Pop up courses.
- Enhancing Alumni connections and engagement through
 - Possible new Alumni Speaker Series
 - LinkedIn affinity group for NAS

OTHER ISSUES THAT COULD BE CONSIDERED:

- How to increase the Yield rate of admitted students
- Balancing growth with space and physical facilities limitations
- Optimizing full time faculty course coverages
- Enhancing efficiency as a liberal arts institution
- Effective program assessment and continuous improvement.