

AMSEC AY 18/19 Annual Report

Advanced Materials Science
& Engineering Center

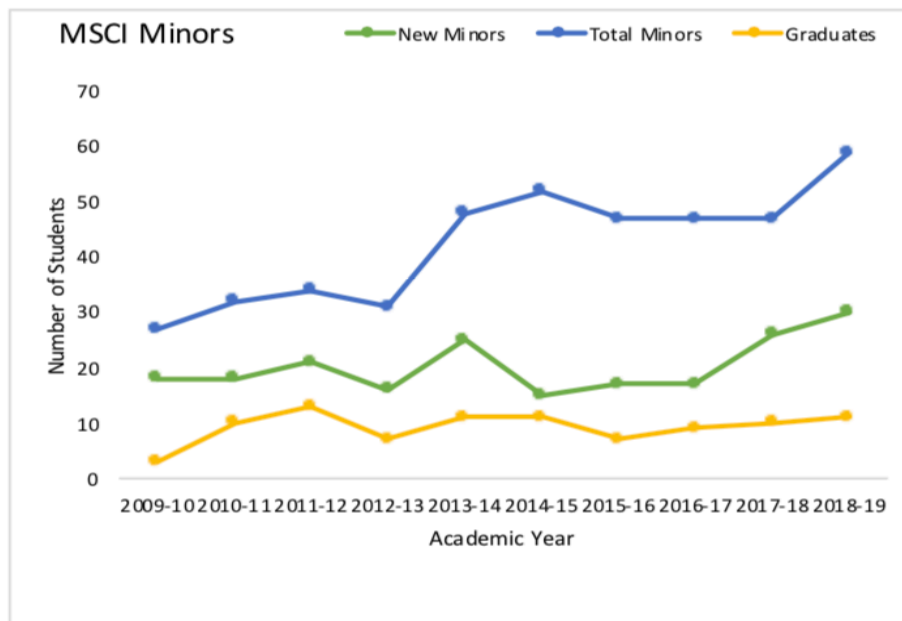
Summary

The 2018/19 academic year was another busy and exciting year for AMSEC. We've continued to carry out our ongoing programs (including the materials science minor and the AMSEC materials characterization laboratory) as described below, and we have rolled out several new and exciting initiatives. As the current director of AMSEC, I would like to first express my appreciation for Juliet Barnes and Kyle Mikkelsen, who continue to impress me with the quality of their work and their dedication to the program. I would also like to thank the many faculty members that devoted their time to serving on the committees that do important work for AMSEC. In particular, Sean Mulcahy, Mark Bussell, and Tim Kowalczyk and John Misasi served as Chairs of our Executive, Curriculum, and MAD committees, respectively. Below, I describe the highlights of our work in 2018/19 and summarize where AMSEC's many varied programs and initiatives stand as we enter 2019/20.

Materials Science Minor and Curriculum

The materials science (MSCI) minor is interdisciplinary in nature and draws students from nearly all of the CSE departments. The figure below shows the numbers of declared MSCI minors by academic year. As indicated by the enrollment data, the total number of declared MSCI minors has been steadily increasing since the first cohort in 2009/10, which reflects significant student interest in materials science. There are two primary concerns at present with the increase in numbers; first, it becomes difficult to schedule the 321/2/3 courses around the wildly different schedules of all of the students coming from different majors. Second, the cap on our capstone course is very low due to space restrictions, therefore a much larger increase in numbers would require a second section of MSCI 410.

Declared MSCI Minors and Grads



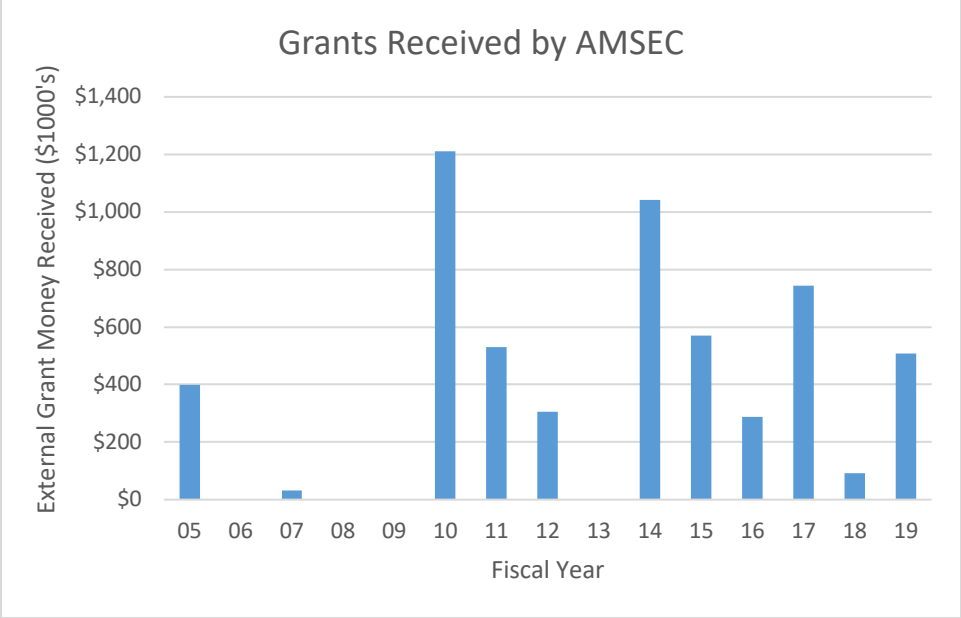
Scheduling course meeting times for students drawn from multiple STEM majors continues to be a barrier for the materials science minor despite Juliet's best efforts to satisfy the scheduling constraints of all MSCI minor students. A significant challenge is that currently, CSE departments do not consistently notify AMSEC when they are considering changing the timing of core courses, which impacts our ability to advocate for our programs.

This year we also offered two courses for the second time that serve both minors and non-minors. One was the SEM methods course (MSCI 497) taught by Mike Kraft and the other was a GUR (MSCI 101) taught by G McGrew. Both classes are on the books to be taught again in 2019/2020 and we look forward to seeing how the courses develop and how demand for the courses evolves over time. This year we also completed the important work of creating a list of learning goals for all of the core materials science courses, to help guide instructors and standardize the curriculum. Finally, this year we made some important changes to MSCI 410, to reduce the amount of overlap with courses required for the PCE major. This work will continue into next year, with the development this summer of a new lab synthesis and characterization of oxide nanoparticles by Mark Bussell and Mike Kraft.

Scholarship

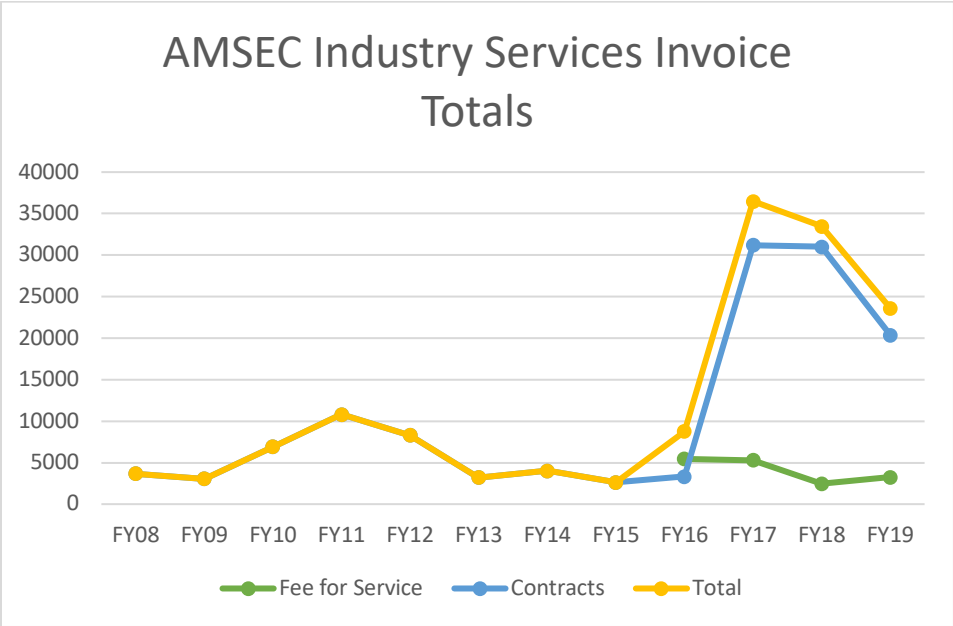
One of AMSEC's primary missions is to enable interdisciplinary scholarship in materials science at WWU. Supporting externally funded grants is therefore an important part of AMSECs operation and a significant source of funds via ICR. The table below lists all active external grants associated with AMSEC in 2018/19, and the plot gives dollar amounts over time. In contrast with last year, this year saw a decrease in the number of AMSEC grants submitted and received. However, this seems to be due to the unusually large number of ongoing grants such that overall the numbers in terms of active external grant dollars are holding fairly steady over time.

Faculty (name/role)	Agency	Amount
Bussell (PI), Mulcahy (co-PI)	JCDREAM	\$ 92,874
Bussell (PI), Patrick (co-PI)	JCDREAM	\$ 10,200
Kowalczyck (PI)	ACS-PRF	\$ 55,000
Kowalczyck (PI)	NSF	\$298,328
Kowalczyck (PI)	NSF (Career)	\$496,000
Leger (PI)	ACS-PRF	\$ 70,000
Murphy (PI), Leger (co-PI)	NSF	\$420,000
Rider (PI)	ACS	\$ 70,000
Patrick (PI), Bussell (co-PI)	Murdock	\$ 86,400
Patrick (PI), Gilbertson, Rider, McDowall	NSF	\$390,000
Patrick (PI), Johnson (co-PI)	NSF	\$320,000
Patrick (PI), McDowall	WRF	\$ 27,000



In addition to the standard research and equipment proposals that are included above, AMSEC has been pursuing larger-scale, center-level grant opportunities in accordance with our current six-year strategic plan. This continues to be high on our priority list moving forward and we encourage all AMSEC members to keep center-scale research opportunities on their radar for future efforts.

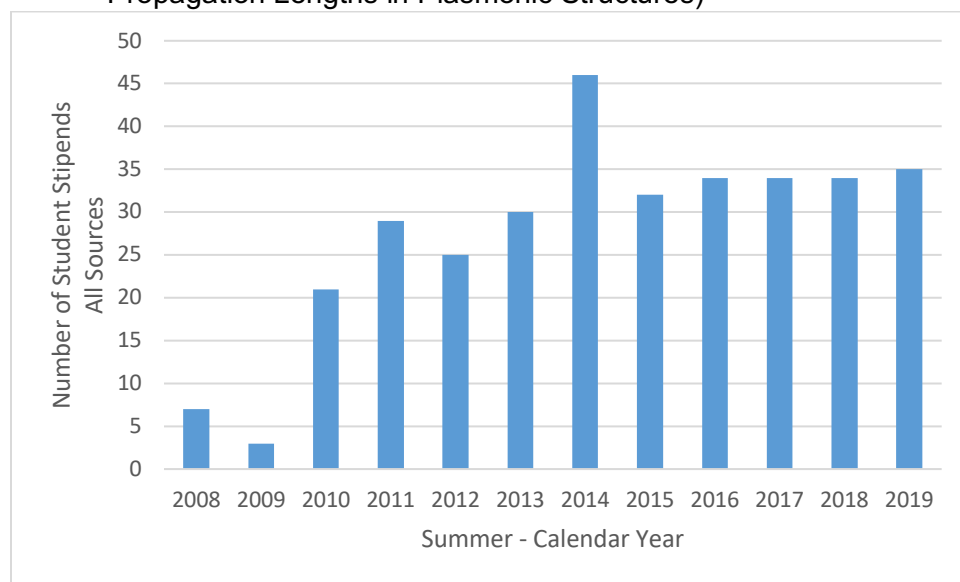
Finally, AMSEC does a significant amount of work to support industrial R&D efforts in the Pacific Northwest. Below is a plot showing the amount of industrial money coming into AMSEC over the years. There is a downturn this year, primarily due to a specific larger contract which recently ended. Overall, we are doing well in comparison with historical averages.



Student Support and Seed Grants

Four new SEED Grants were awarded this year (three from CSE, and one using AMSEC funds), including:

- **Bussell & O'Neil** (Catalytic Upgrading of Algal-Derived Oils for Sustainable Fuel Production)
- **Emory, Rider, & Montano** (Proxies for Environmental Risk Assessment)
- **Hoekstra & Misasi** (North American Ocean Plastics Project: WWU Feasibility Studies)
- **Leger, Larsen & Johnson** (Low-Refractive Index Coupling Layers for Improved Propagation Lengths in Plasmonic Structures)



The number of undergraduate research students supported over the summer with AMSEC funds and/or AMSEC grants continued its upward trajectory this year as seen in the graph above. Four of these summer projects came from AMSEC Seed Grants that were awarded this year.

Development

This year was the second annual “Give Day” campaign to support student-led initiatives, particularly those organized by the newly formed “Materials Science Club” (described below). This year, this campaign raised \$705 in one day for our program!

Last year we introduced the “AMSEC student membership”. This gives us, over time, a bank of alumni, students who have a connection to AMSEC but are not always materials science minors. Currently, we have 15 student members, three of which are also minor students. As Director, I have not done a sufficient job of articulating the benefits to the students of becoming a student member or of recruiting for the program. In future years it will be important to work recruitment and incentive structures into regular AMSEC activities for this program to be successful.

Specific fundraising priorities identified in our 6-year plan include:

- Summer seed grant program (undergraduate summer research stipends)
- MAD seminar series – funds for hosting speakers

- Student internships
- Scholarships, especially for underrepresented groups
- Instrumentation & laboratory operations

Seminars

AMSEC hosted two MAD seminar speakers in 2018/2019, Dwayne Arola (UW) and Robert Szilagyi (Montana State). We also continued the MAD Mixers series which is designed to provide the opportunity to build new collaborations, overcome research challenges, and get to know AMSEC research. These take place once per quarter, and the location rotates between departments. Treats and coffee are provided and the discussion can range from formal presentations, to informal discussions. Finally, AMSEC is collaborating with Whatcom Community College on the Materials Science Connections seminar series, which feature AMSEC faculty speakers sharing information about their own research as well as information about their own departments or programs, career choices in their field, or opportunities in STEM for students at WWU. Speakers this year included Nicole McGowan (Fall), Mark Bussell (Winter), and Amanda Murphy (Spring). Renewed attention to scheduling MAD seminars/mixers and other networking events will be critical for continuing in our mission to encourage cross-disciplinary collaborations as we move forward.

AMSEC Space

AMSEC's existing laboratory space is inadequate for current program needs, and presents a critical barrier to achieving important goals in our six-year plan. We continue to make AMSEC's needs clear with regard to space whenever the opportunity arises. AMSEC occupies high quality space, but the instrumentation is divided between two buildings, with some equipment located in space belonging to another academic program, and there is insufficient space for planned acquisition of new equipment, or consolidation of existing equipment. New contiguous space is needed to enable more efficient oversight, user-training, and improved access and safety. Some instrumentation, such as microscopes and x-ray photoelectron spectroscopy, would also benefit from being in closer proximity to closely-related equipment overseen by Scientific and Technical Services. In particular, AMSEC has needs for the following new spaces to alleviate current pressures:

- 1) Surface analysis & X-ray photoelectron spectroscopy (450 sf)
Rationale: The XPS is currently located in space borrowed from physics. This is unsustainable.
- 2) Thermal analysis & rheometry laboratory (250 sf)
Rationale: There is need for additional bench space in the current AMSEC lab (ES 129) which can be alleviated by moving the thermal analysis suite into another lab.

In addition to AMSEC's standing space needs, we have three additional considerations this year:

- AMSEC's activities, enrollment and instrumentation portfolio have continued to grow, therefore the standing space needs become more acute each year.
- The proposal (*Establishing Western Washington University as a Center of Excellence in the Science and Engineering of Sustainable Materials*) if funded will increase our space needs in the following way: *Office Space*: Office and research space will be needed for four new TT faculty members. *Research and Curriculum Space*. An additional 5,500 square feet

of lab space would be needed for the additional processing equipment and characterization instruments needed to support the courses and research.

- In the Spring 2019 AMSEC Advisory Board meeting, the board indicated the need for AMSEC to consolidate its instrumentation into a single facility.

AMSEC Faculty Membership

This year, we welcomed two new faculty members to our ranks, Greg O’Neil (Chemistry) and Mike Larsen (Chemistry). Greg and Mike are already contributing exciting new research projects and collaborations to AMSEC and we look forward to working with them in the future!

Materials Science Club

We are excited to announce that the new Materials Science club was in full swing starting in Fall 2019! This year the students had several events; first, they held an event called “Hello! My name is Materials Science” in which several faculty and students gave presentations about their work. This event was very well attended and was a great success. In winter, they held a smaller event for group members in which they made ice cream and planned future events. They also crafted the *Materials Science Undergraduate Research Grant* call for proposals. This competition was held in Spring 2019. The committee awarded \$350 each to Eli Doebler (Bao, Chemistry) and Matthew Scoggins (Rahmani, Physics) to support their research efforts. (AMSEC matched 1:1). Finally, the students together with Kyle Mikkelsen initiated an affiliation with E-NABLE the Future, a program that crowd-sources the creation of low-cost prosthetic devices for people in need via 3D printing. We anticipate that this will be an exciting and active program moving forward.

Establishment of the AMSEC Advisory Board

An important element of AMSEC’s six-year strategic plan is the establishment of an external advisory board. This year we had board meetings on *November 16, 2018* and *May 31, 2019* with our inaugural group of six board members. We were pleased to see widespread participation from faculty and students and look forward to future meetings. Lots of helpful input was generated, much of which was immediately actionable – one specific outcome of these meetings was that significant changes to our proposal for a new MS degree program (described below) were put into place that significantly strengthened the proposal, including the addition of two very strong letters of support. We will need to focus on continuing to expand the board with 5 or 6 additional members to ensure a full board meeting even when not all board members are available to attend.

Proposal for a Materials Science MS Degree Program

Another long-term strategic goal that we made significant headway on this year was the development of a proposal for the establishment of a Materials Science MS degree program at WWU. Thanks to the hard work and thoughtful contributions of the Executive Committee both last year and this year, the partnership with PCE (Nicole Hoekstra in particular), and critical input from the Advisory Board, a pre-decision package proposal went through the first round of internal feedback, with significant support and enthusiasm at all levels. The goal of this proposal is to establish WWU as a center of excellence in the development and application of sustainable materials. The proposed plan includes leveraging our already extensive faculty expertise in this area to address swelling student interest in these fields as well as the demands of regional industry for solutions to the ever-growing challenge of balancing technological development with environmental stewardship. Briefly, we proposed:

- To expand AMSEC’s current academic offerings to include a **Master of Science degree in Materials Science** encompassing three tracks: **(1) Sustainable Materials Engineering and Earth-**

Abundant Materials, (2) Additive Manufacturing of Advanced Materials, and (3) Computational Materials Science.

- To establish a new **Sustainable Materials Engineering concentration** to the existing B.S. program in PCE.
- To **develop broad course offerings** related to sustainable materials science and engineering for WWU students, including a GUR course, a Viking Launch course, and 5-6 core and elective courses to support the proposed academic programs.

We will continue to push this proposal through the internal processes in 2019/20 pending support by the Dean and luck at all levels!

Looking Forward

I am pleased to have had the opportunity to work with this fantastic group of staff, faculty and students for the past two years as AMSEC Director. I am also happy to be handing the controls to Steve McDowall, who will be bringing his leadership skills and fresh perspective to AMSEC's programs in September! One of the important initiatives coming up is a refreshing of AMSEC's six-year strategic goals document. I'm looking forward to continuing to work on that project as a member of the Executive Committee and am excited to continue to be a part of AMSEC's bright future!