

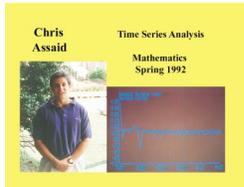
# THE MCSP TIMES

## Wall of Fame

Plans are underway for a new science center, with open areas and glass replacing the bland cinder block corridors of Trexler. One of the few aspects of Trexler that we want to carry over to the new facility is the Wall of Fame on the second floor, which reached two milestones this year: 25 years of existence and 175 student projects commemorated.

The Wall started as a public relations ploy to increase student research – and it worked! In the 1980s independent studies were rarely done by MCSP students; most of our majors did not consider research a possibility. After some intrepid students did projects and had frames put up on the second floor, students started asking when they could do their project. Gotcha! New faculty hires were encouraged to work with students on research, and now it's an integral part of the MCSP culture.

Each research project in MCSP is illustrated with an 8x10 image showing the student's name and picture, project title, and an image that is relevant to the project (see them all at [webapps.roanoke.edu/mcsp/minton/IndStudies.html](http://webapps.roanoke.edu/mcsp/minton/IndStudies.html)). The first three frames were for Chris Assaid, Erica Thompson, and Chris Hylton.



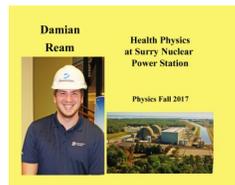
The Chrises worked together learning time series analysis and applying it to economic data. Erica studied recursive dynamics leading to fractals. These early frames featured pictures developed from film at K-Mart (they were in color, at least), taped to yellow paper. Screen images had to be exposed for several seconds to eliminate ugly screen-refreshing lines. Technology has progressed!

In the first five years, the Wall collected 18 frames. As the research momentum built, we decided to limit production to two frames per student. Scotty Smith, Jessica Young, Mason Vines, Jake Bennett and others would have broken our picture frame budget!

Unfortunately, this meant that Scotty's infinite regress idea would have to stop at iteration two. In the last five years, we have produced 77 frames, with several students running into the two-frame ceiling. This is a great level of student research!



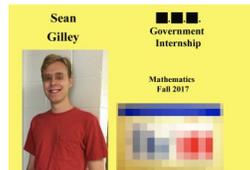
Damian Ream is a senior Physics major, having maxed out with frames for physics research and a physics internship. He says that the Wall shows the large scope of possible research projects, many of which are not represented in classes offered at Roanoke.



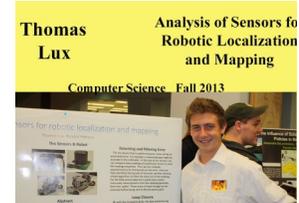
Drew Luther is a junior Computer Science major who enjoys seeing pictures of friends and past students and the work they have done. While Drew is not especially thrilled with seeing his own face on the wall (and he doesn't know that putting the frames up is known as "nailing the students to the wall"), he and others like this small reward for the hard work they have done.



Sean Gilley is a senior Mathematics major who did an internship with the FBI. Since his work was not for public consumption, we had some fun pixelating parts of his frame. Sean had noticed the Wall as a freshman and wanted to do similar work to leave his mark on Roanoke College.



Along with Scotty's and Sean's, other whimsical frames include Hampton Smith's Captain Morgan pose, Thomas Lux on fire, and Marc Sandoval's pose (see if you can figure what is odd about this).



The range of titles represented by MCSP research is impressive if not bewildering. Some of the mathematics research titles include "Is It a Knot or Not?", "Analysis of Food Deserts in the Roanoke Valley", "Assessment of Water Quality in the Chesapeake Bay", "Gothic Cathedrals and Sacred Ratios", and "Is Streak Shooting a Cognitive Illusion?" Physics titles include "Spectroscopic Investigation of Gusev Crater, Mars", "Classic Neural Models for Small Cell Effects", and "Growth and Characterization of Carbon Nanotubes". Computer science titles include "Presence in an Immersive Environment", "Maximal Snakes in Hypercubes", and "Recursive Median Blob Detection". As our students have discovered, MCSP research possibilities are endless!

We are proud of the excellent work our students do and value the Wall of Fame as a visible thank you for that work.

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## An Indie Production

Rama Balasubramanian describes her wedding as a Bollywood-type story. But it's her strong independent spirit that brought her to the United States and has made her a highly successful teacher and researcher.

Rama was born and raised in southern India in the big cities of Bangalore and Chennai. She was a precocious student, skipping grades, and ranking first in her class at almost all stages of school. She describes herself as being a "notorious" student in college who pestered teachers with questions both relevant and irrelevant. A professor with whom she has a long-standing friendship once told her that she hoped Rama would become a professor and have to deal with students like herself. Rama just smiled when asked which Roanoke students have qualified.

Rama chose to come to the United States for graduate school, another expression of her independence. The third of four sisters, she was the first in her family to come to the United States. Her graduate studies would relate to materials science, a favorite subject from spending time at work with her father, a metallurgical engineer. Other requirements for schools included warmth (she had heard that places like Chicago could be unbearably cold) and a full scholarship. Old Dominion University in Norfolk fit the bill, although Norfolk felt like a small town to her.

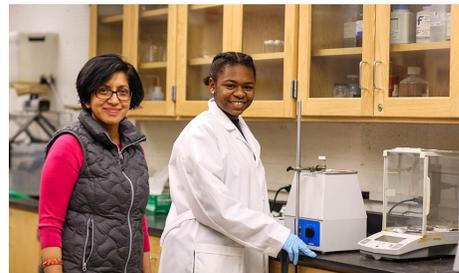
An important career decision followed her Ph.D., when she had to choose between a teaching position at James Madison and a postdoc in Germany. A love of working with students won out, but she maintained contact with the German research group. That connection has allowed multiple Roanoke College students the opportunity to work with data from the Mars rovers! JMU led to Georgetown University and then to Roanoke College in 2005.



But let's get to the Bollywood story. Rama and her husband-to-be Nav had been good friends at the University of Madras. While he worked for the Indian Navy, she was pursuing her Ph.D in the USA. Meanwhile, Rama's father was trying hard to find her a husband. Nav later moved to the states for his graduate work in management. Unknown to her father, their friendship blossomed into love over time. In 2004, both Rama and Nav came back to India to visit. Nav went to visit Rama's family and made a good impression on Rama's father. Her father had stage four cancer and saw a last opportunity to fulfill his duty to arrange a marriage for Rama. This was more than fine with Nav and Rama. They were married within 48 hours in the untraditional wedding that Rama wanted, a small affair in their living room as opposed to a traditional three-day wedding event. A marriage of love for Rama and an arranged marriage for her father, who passed away a month and a half later.

Rama and Nav have two daughters, Kriti (age 11) and Ritu (age 6). Their shared hobbies include classical Indian music. Rama has revived an interest in Carnatic music (whose "capital" is Chennai), teaching a class on weekends. Befitting their names, her girls are talented singers and perform in Diwali and other festivals. Rama enjoys the mathematical nature of Carnatic music, which explores some 34,000 scales or ragas in compositions known as kritis.

At Roanoke College, Rama often teaches courses with substantial mathematical content. But she is best known for her research in nanoscience, a rapidly developing field focusing on engineering tiny structures that can improve materials and life. Many students have grown carbon nanotubes in lab, an amazing experience at a liberal arts college. Rama counts 45 student projects in her 22 semesters at Roanoke College. Helping students explore the different aspects of nanomaterial interactions is her favorite part of her job. She has taken her students with her to international conferences to present their research. Other highlights include opportunities to teach summer classes at Stanford and Harvard.



Rama is looking forward to the new science building, with better research facilities and plans for a pod of offices for faculty exploring small (e.g., nanoscale) particles. As her girls get more independent, she will phase out of her taxicab driver tasks and tackle challenges such as running a half marathon. She will continue to grow and model strong independent learning for her students.

## Making Her Way

In many large cities, traffic laws are really just suggestions. Course prerequisites are similar, being wise recommendations that we sometimes waive to help students navigate their way through a major. A late decision to become a math major made it important for us to waive prerequisites twice for Sooyeon Chun. She worked hard and cruised through those courses with high marks. But none of this is unusual for her.

Sooyeon Chun was born and raised in Korea, the daughter of a Presbyterian minister. When Sooyeon was middle school age, the family moved to Thailand as missionaries. The effect on Sooyeon's education was profound: international schools were too expensive, and the language barrier too difficult for public school. So she was home schooled, though with her parents hyper-busy with their work this mostly meant staying home and teaching herself. Watching American movies helped with English skills, but mostly it was reading and learning on her own.

A turning point was when an uncle and aunt, who live in Roanoke, brought her to the United States to attend classes at Roanoke Catholic High School for about a month. This experience made her "kind of desperate" to go back to school, to interact with students and teachers and great ideas. She returned to Korea to get GED-like diplomas for middle school and high school, and then back to the U.S. and enrollment at Roanoke College.



Finding a good major is a struggle for many students. You can imagine that Sooyeon would want to try out a number of majors, out of curiosity and unfamiliarity with the American system. As she describes journey, the phrase "Try it, it might work out" recurs at multiple times and in multiple contexts. Psy-

chology was an early front runner, but eventually Adam Childers' INQ 240 got her pointed at mathematics, which had not originally been on her radar. While she says that she doesn't really think she's good at math (we professors know that she is), she enjoyed the classes and saw the usefulness of math in careers that would allow her to stay in the United States.

For many students and parents, graduating in four years is important. This is especially true for international students whose visas have strict requirements about being in school and having jobs. To finish in four years, Sooyeon took a heavy course load, including those two courses taken before their prerequisites. She made it work with her ability to teach herself and her willingness to get help from her professors. She will graduate on time and has an excellent job lined up with Carillion. This job came about because of, naturally, Sooyeon's hard work and persistence.



Sooyeon got a summer internship at Carilion in the Finance Department through her uncle. She did excellent work and outlasted the other two interns (from Virginia Tech). Her good work, good attitude, and persistent application got her a second internship, this working with other departments at Carilion such as Health Analytics. She talked with various co-workers about her visa situation and desire to work in the U.S. and finally got a meeting (She said, "I scheduled the meeting. You never know what you'll get.") at a time when the Finance department was interviewing for a job. A proven strong worker, Sooyeon has the job.



Music is an important part of her life. Sooyeon plays flute in the Roanoke College wind ensemble, and plays and sings with her uncle's band. Catch Sooyeon playing and singing with the Henry Downing Band on Alumni Weekend!



As a professor, my main image of Sooyeon is of a smiling face in my doorway, saying "Hello" in a sing-songy voice and wanting to ask questions about some material. It would be easy to miss the strength, ambition and *grit* that drives her. She has moved to different countries with different languages and had disruptions in her education, but nothing has stopped her from taking control of her life. It is why she is at Roanoke College, and why she is about to take the next step in a successful life.



## Picture Perfect

Students and visitors entering the MCSP office on the second floor of Trexler receive a warm greeting from Laura Bair. They then get the directions, forms, and/or conversation they need to make their day better. Laura is our boss, our assistant, and our friend.

Laura grew up in West Mifflin, PA, near Pittsburgh. She met her husband Mark in high school, and they have now been married for over 37 years. Mark's work with jewelry companies moved them to Charlotte and then to Roanoke. The Pittsburgh background explains her otherwise incomprehensible devotion to the Steelers (note: the author is a Dallas Cowboys fan), which during the NFL season often takes Laura and Mark to the Brambleton Deli to watch the games with other Steelers fans.

Along with raising their children Adam and Jill, Laura has worked a variety of part-time jobs. One job transcribing tapes for a vocational rehabilitation counselor inadvertently prepared her for nearly five years hard labor transcribing Roanoke College faculty meeting discussions. Four years at North Cross School (job sharing with Marcy Johnson, wife of then RC Dean of Students Mac Johnson) led to the MCSP post in February of 2009.

Laura loves the family atmosphere in MCSP, which includes faculty and students and their parents. A favorite part of her job is event planning for occasions like the department's Commencement reception, where she gets to meet those parents. At this reception, you can usually find Laura taking pictures which get posted in the MCSP office. The pictures remind her (and us) of the wonderful graduates that we miss. Part of the usual, but unique rhythm of college life: good friends leave, but the next group of students steps into place to become our new favorites.



Photography has become an important hobby for Laura. She traces it back to receiving a nice digital camera for her birthday when her kids were going to school dances and other important events. Family vacations to Hilton Head and the Caribbean gave lots of opportunities to start working on her photography skills. She still considers herself an amateur but is interested in taking classes and pursuing the hobby more seriously.



Most of Laura's photography sessions have been for friends and family. There were, of course, lots of prom pictures. For Jill's graduation from James Madison University, the photo session included more elaborate poses and thoughtful use of background. Laura's two dachshunds and "grand dog" have been favorite subjects over the years, as have children of friends. Although special occasions like Adam and Chandler's wedding and a friend's senior pictures can have a little pressure (are the pictures going to be right?), Laura finds photography relaxing. She feels great each time one of her pictures turns out to be frame-worthy. She has framed several of her pictures from the Washington D.C. area (where Adam, his wife Chandler and Jill live) and has them on the wall of a guest room at her house.



Adam recently gave her a couple of photography books that will be her summer project. He along with Mark, Jill and Chandler are all encouraging Laura to take her photography to a more serious level. She jokes about a future with her and Mark retiring near Hilton Head Island, SC, shuttling families to the beach, serving as a family vacation photographer, and selling her specialty, chocolate-covered pretzels.



But, for now, her work with MCSP, doing some volunteer work, and spending time with family and friends keep Laura and Mark quite busy. Drop by the MCSP office and see Laura. She'd love to talk with you.

# RC, Paper, Scissors

A display in Olin Gallery, a presentation by a documentary filmmaker, an Honors class, a stairwell in Trexler, an Applied Differential Equations class, and a Linear Algebra class all share mathematics and art. At Roanoke College, we love to blur the artificial lines humans use to divide disciplines and people. You might think that mathematics and art would be hard to combine, but you would be wrong.

Jan Minton's Honors 241 class specifically addresses connections between math and art. This spring, the class had a surprise visit (thanks to President and Mrs. David Gring for making this happen) from Vanessa Gould, the writer/producer of *Between the Folds*, a fascinating look at origami experts. The students also worked with Carolyn Deck, an artist who specifically incorporates mathematical patterns into her art. The class project was decorating a Trexler stairwell with mathematical shapes from the class: Fibonacci spirals, modular arithmetic, symmetry tables, fractals, and border patterns. All of these experiences are described in more detail at our blog at [mcsp.pages.roanoke.edu](http://mcsp.pages.roanoke.edu). Also this spring, Olin Gallery showcased *Paper Blooms*, a community art project of flowers made from paper.



Carolyn Deck with class

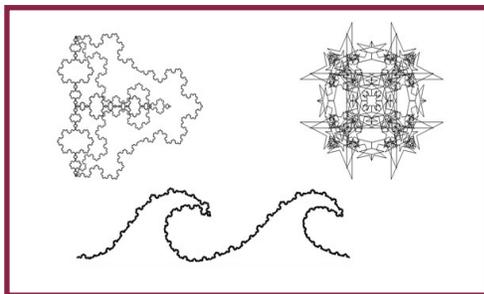


Paper Blooms in Olin



Vanessa Gould with class

The intricate shapes known as fractals have made appearances in our classes for many years. One of the student projects in Linear Algebra is a fractal contest, where students modify basic Mathematica code trying to create the "best" fractal. The variety of shapes you can get with minor tweaks of code is spectacular. A small sample is shown below.



Student Fractals



Amazing Trexler stairwell!



Great Pursuit Curves

What happens when things chase each other? The differential equations describing the result can be somewhat daunting, but the paths generated are often beautiful. Chris Lee has his students turn solutions into art. The samples shown are by April Raab and Damian Ream.

Are these creations math or art? We think the answer is "Yes!" and enjoy exploring the overlap between our MCSP disciplines and fields from "the other side" of campus. The overlap enhances and elevates us all.

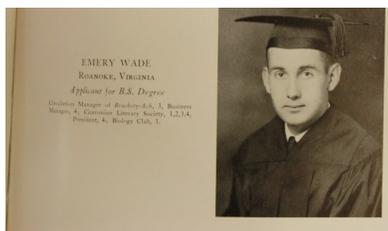


## Class From 1936

This year's alumnus profile features two members of the Class of 1936. They were both Math majors, but were as different as Army and Navy. Both represent Roanoke College at its best.

### A Man of Many Passions

Please don't say that you think that George Wade's double major in Math and English is a weird combination. Or that his career in actuarial science and his collections of historical memorabilia seem incompatible. Or that the writing of hymns and funding of an endowed professorship in music must have come from a different person. If you do think this, I'm worried that you might not see how George Wade's life is a perfect expression of a Roanoke College liberal arts education.



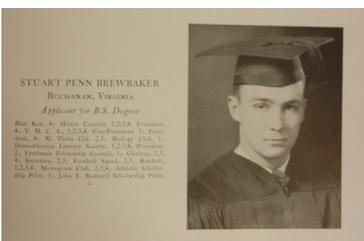
George Emery Wade was born in 1913, went to Jefferson High School in Roanoke, and graduated from Roanoke College in 1936. He went by Emery while at Roanoke, which he attended as a commuter student. His math training helped him land a job at Shenandoah Life, where he met his wife Naomi. They were married for 55 years until her death in 1992. He earned a Master's degree in actuarial science from the University of Michigan, then served in the Army as a cryptanalyst. His main career was as a pension consultant for multiple companies until his retirement in 1978. An active retiree focused on church work and collections of books and postcards from the Roanoke Valley.

He was a benefactor of Roanoke College and an honored alumnus. He endowed scholarships and, befitting a pension consultant, participated in the college's Charitable Gift Annuity Program. He wrote, "It's mutually beneficial. I see it is benefitting the College, and it provides me with a nice income. It simply makes perfect sense." As does his receiving the Roanoke College Medal in 1999, the highest honor the college gives to alumni. His name lives on through the Naomi Brandon & George Emery Wade Professorship of Music held by choir director Dr. Jeffrey Sandborg.



George Wade embodied what we strive for at Roanoke College. Devoted to service and successful in business, he had the skills and curiosity to pursue a variety of interests that just happened to include aspects of math, literature, finances, cryptography, history, and music.

### BMOC to BMIC



Stuart "Pete" Brewbaker made the transition from Big Man on Campus at Roanoke (voted the male student who contributed the most to the college) to Big Man in the Community (Lexington's football field and recreation center are named for him).

Brewbaker was born in 1912, the 11<sup>th</sup> of 13 children. A four-sport star athlete in high school, he was a starter on the famous Buchanan Five basketball team. He focused on football and baseball at Roanoke College (yes, we had both sports in the 1930s—see pictures on next page), and was elected to the RC Athletic Hall of Fame in 1974. He served as President of the YMCA and Honors Council at Roanoke. A math major, he was elected to Blue Key honor society. Upon graduation, he went to William Fleming High School as a math teacher and coach before moving to Lexington High School in 1938.

His work for Lexington is remarkable. While teaching math, he was the school's athletic director and coach of football, basketball, baseball, and track from 1938 to 1960 (with four years leave with the Navy from 1942-46). He continued as football coach until 1977, winning a record 224 games. Other coaches loved him. Joe Downing said, "They beat us my first year, and the next year when we beat them he came over and gave me the game ball.... I wonder if I could have done that." Brewbaker founded the school's golf team in the 1960s, and quickly won 3 state championships. In 1974, he received the National High School Coaches Association Distinguished Service Award.

As great as his coaching record is, his service record was his pride. He founded and served as director of Lexington's recreational program from 1946 until 1987! He served as President of the state High School Coaches Association, and many other groups. As track coach, he designed and engineered the school's asphalt running track, which was the first of its kind in the state. He was voted Citizen of the Year in 1994 by the Southern District of the Boy Scouts.

Pete Brewbaker was The Man at Roanoke College, one of 150 distinguished alumni honored in 1992. But his greatest contributions were in Lexington, where he was The Man for over 50 years with the sports and recreation programs he created. He wrote, "The success of the programs is measured by the positive influence on the lives of the community's young people whose own successes and, in many cases, change of direction, have led to useful and fulfilling adulthood."

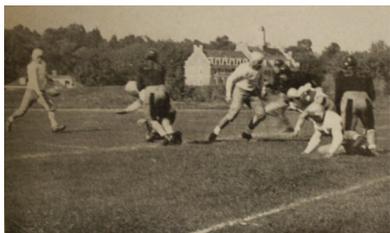
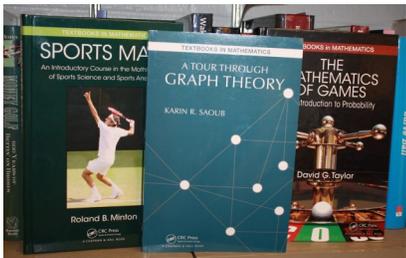
## From the MCSP Blog

The MCSP blog at [mcsp.pages.roanoke.edu](http://mcsp.pages.roanoke.edu) contains numerous posts on the activities of MCSP students and faculty. You can find more on each of these stories on our blog.

Karin Saoub's textbook *A Tour Through Graph Theory* has been published by CRC Press. Graph theory is a rapidly developing mathematical field that explores network relationships. Many colleges are discovering that graph theory is an excellent course for non-mathematics majors, and Karin's book is the first to serve this growing audience. One of the graph theory problems of great practical interest is known as the traveling salesman problem (TSP). FedEx, UPS, and others try to solve this each day. The "salesman" must deliver packages to many locations and finish his tour back at the office. The TSP is to find the most efficient route. It turns out to be a fiendishly difficult problem, but "good" solutions (meaning very efficient, but not necessarily the most efficient) can save industries millions of dollars per day. Karin's *Tour* gives undergraduates an efficient and interesting introduction to the TSP and other important problems in graph theory. This completes a trilogy of RC books published by CRC Press, following Dave Taylor's *The Mathematics of Games* and Roland Minton's *Sports Math*. In *Marvel*-ous style, the franchise continues as Karin has already signed a contract to write a graph theory textbook for undergraduate mathematics majors.

The solar eclipse on August 21 was a major event in the United States, with thousands of people traveling to be in the zone of totality and many more buying special glasses to watch the partial eclipses at home. It was a great day of excitement about science, and the Roanoke College physics group took full advantage of the opportunity to spread the word as eclipse ambassadors. Eight students and faculty were science ambassadors at the southern entrance to the Great Smoky Mountain National Park, setting up six telescopes with solar filters at the Oconaluftee Visitor Center. The students assisted members of the public in using the telescopes to observe the eclipse, and talked about various aspects of the eclipse to enhance everyone's experience. David Matheony took several wonderful pictures (there is an amazing story of recovering from having his camera stolen at the last minute, but enjoy the pictures now and ask David later!). A wonderful day of excitement, discovery and service!

The Virginia Sports Analytics Meeting (VSAM) was held in the Cregger Center on September 16. This regional conference drew faculty and student participants from eight states and featured a diverse set of talks and posters in the growing field of sports analytics. Roanoke College students David Moreau and Lexi Denning presented posters highlighting the work of the Maroon Stat Crew. Adam Childers got some love with his talk on tennis scoring. Co-organizers were Roland Minton and VMI's John David. A highlight of VSAM was the impromptu discussions that continued well after the last talk. In January, both Roland and Adam gave sports talks at the Joint Mathematics Meetings in San Diego. The Maroons continue to represent in the community of sports analytics!



Football at RC



Football Team



Baseball Team

## Message from the Chair:

Welcome to this year's edition of the *MCSP Times*! We've got a vibrant and high-functioning department here, and we've been perhaps busier than ever. Kathy Bauman, lecturer in mathematics, retired in December after many years of passionate and dedicated teaching at Roanoke College, and we recently hired Roger Reakes, an early-retired high school and community college teacher from upstate New York, to fill that position starting this coming fall. Our current visiting physics professor, Jarrett Lancaster, accepted a tenure-track position at High Point University for this fall, and we offer him congratulations and the best of luck in the future; he's been a great member of our department for two years, and we are sad to see him leave. As of my writing of this note, we are in the middle of a search for his replacement and a second visitor to cover Dan Robb's sabbatical for next year. Finally, last, in terms of hiring, and certainly not least, is that we've hired Wale Sekoni, who is finishing his Ph.D. in computer science at the University of Wyoming, as our newest tenure-track member for the department!



In terms of students, we're almost bursting at our seams in early-level classes; this past fall, we saw 100 students in some version of Calculus 1 (in the recent past, numbers have been in the high 70s), we saw 60 students in the introductory computer science course (recent numbers have been in the low 40s), and we continue needing two lab sections for our major-level introductory physics!

As programs, mathematics, computer science, and physics all went through their external evaluations (which happens every six years), and the overarching thoughts from faculty members external to Roanoke College are that our programs are well-constructed and highly-effective, and we've gotten some small ideas from our evaluators about potential new programs or improvements to existing programs! Overall, things continue to go very well for the Department of Mathematics, Computer Science, and Physics, and we are looking very forward to the future. As always, I wish the best for you, your families, and your friends for the coming year!

## Childers Wins Teaching Award



Adam Childers is the 2018 Dean's Exemplary Teaching Award winner. Adam is noted for his high level of enthusiasm and his commitment to hands-on student activities in his stat classes. He designed all of the STAT courses, and continues to revise them to increase participation in the Stat concentration. A valued member of the campus community, he works with Admissions to improve their selection processes, and does web design and analysis for the Stat Crew. Adam is the fifth member of MCSP to win the teaching award in the last 20 years. This extremely high rate is a testament to the high level of pedagogical and curricular innovation in the department, and the high levels of achievement of our students. All of MCSP shares in this recognition!

## Goldwater Winner!

Congratulations to Liam Lambert, a 2018 Goldwater scholar! The Goldwater is a highly prestigious prize awarded to students for their academic excellence and commitment to research in the STEM disciplines. He is one of 211 recipients out of 1280 nationwide applicants this year. Liam is a double major in physics and math, and has an outstanding research background. He started his work in Dr. Rama Bala's nanoscience lab as a freshman. He has synthesized and characterized nanocrystals of maghemite and hematite under various crystal growth conditions, has studied the crystallographic and magnetic properties of the nanocatalysts, and designed and built an instrument to map the magnetic hysteresis of his nanocatalysts. He traveled to Thessaloniki, Greece in September 2017 along with Dr. Bala, to present his research findings at Euromat 2017, an international materials research conference. He is currently working on a project with Dr. Karin Saoub to create lightweight structures using 3D printing and applying graph theory to improve the efficiency of the 3D printing process. Liam plans to map the aerodynamics of 3D printed wing surfaces at Coastal Carolina University this summer. It is easy to see why we MCSP faculty and the Goldwater committee are impressed!



## MCSP Honor Society Inductions



Sigma Pi Sigma



Upsilon Pi Epsilon



Pi Mu Epsilon