THE MCSP TIMES

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ROANOKE COLLEGE
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MCSP Summer Road Trip

Roanoke College students have great on-campus summer research opportunities, but spending the summer elsewhere can provide unique perspectives. Here, we highlight MCSP students who took their talents south and north of Roanoke.

Physics majors Cam Cassady ('15) and Chris Valentine ('15) worked at Oak Ridge National Laboratory in Tennessee. They each completed a project in coded-aperture imaging. Cam and Chris compare the problem to trying to use the shadow of an object to determine the location of the light source. The problem is more complicated when the particles you are trying to detect are gamma rays and neutrons. The coded-aperture part of the technique involves a "mask" that the signal passes through. Chris' project focused on algorithms used to detect sources, while Cam's project focused on a type of mask used on the signal. Working with scientists at one of the world's top nuclear facilities gave Cam and Chris a revealing glimpse into the world of physics research.

Matthew Fleenor, Matthew Blackston, Cam Cassady and Chris Valentine

Mathematics and Physics major Taylor Ferebee ('17) worked with internationally renowned mathematician Stephen Wolfram at the Wolfram Science Summer School. Along with attending lectures on new and important mathematics and computer science topics, Taylor worked with Wolfram to develop an app for the upcoming Wolfram cloud. The app asks you to input some data (title, genre, release month, and so on) about a prospective movie and then predicts the success of the movie. Along with her one-on-ones with Wolfram, Taylor befriended creative people from all over the world. Her work with Wolfram continued during this school year as she has refined her algorithm.

Taylor Ferebee
and
Stephen Wolfram

Natalie Wilkinson

Computer Science and Mathematics major Natalie Wilkinson ('16) participated in a Research Experience for Undergraduates (REU) at the University of Maryland. Natalie worked on Ramsey Games, which are generalizations of Tic-Tac-Toe games that are related to an important (if entirely theoretical) area of mathematics. The research paper produced by Natalie's group of three was selected for submission to a top journal for publication. Natalie got to explore Washington DC on the weekends, and made friends with a variety of other REU students on the Maryland campus.

Physics major Amanda Wright ('15) worked for Roanoke alumna Erin Hackett at the School of Coastal and Marine Systems Science of Coastal Carolina University. Amanda developed and calibrated photographic techniques for measuring the movement of oyster larvae. The oyster population in the Chesapeake Bay is in critical decline, and this research could help scientists learn how to help oysters make a comeback. Amanda made important contacts that will help with her longstanding goal of being a marine researcher.

Amanda Wright

These impressive summer projects were made possible by Roanoke College contacts (Dr. Fleenor has worked with Oak Ridge National Laboratory) in two cases, and student initiative and excellence in two cases: the Wolfram school and Maryland REU are highly competitive, with only ten students chosen for each. Congratulations to Cam, Chris, Taylor, Natalie, and Amanda!

Inside this issue:

Editor's note:

The MCSP blog at mcsp.pages.roanoke.edu has many interesting posts, including longer versions of some of the stories shown here.

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Faculty Profile: Dr. Adam Childers

Life is good for Adam Childers. There's the stuff that matters: a great wife and two young boys, a job that he loves, the recent granting of tenure, an upcoming sabbatical, … but what he's celebrating right now is being in first place in the college basketball contest. "Sic semper Tayloris!" he tweets, a shot at past winner and buddy Dave Taylor. Adam has a mischievous enthusiasm that enlivens his stat classes, Math Club, and the second floor of Trexler.

Adam is an excellent example of someone who did not have to travel far to find what he wanted. Raised in Roanoke by parents who are teachers (high school biology for Dad, kindergarten for Mom), his Roanoke College career started with mountain bike races (you never know in life). His high school internship was with leaders of the state race series, including a guy named Chris Lee. Adam was the young squirt who could keep up with the adults (Chris's review: "he kicked our butts!"). Adam then went off to James Madison University, where as a junior he found a love of mathematics in a course with Ed Parker. The combination of challenging proofs and side conversations about sports hooked Adam. Graduate school at Virginia Tech followed, where he took on a project to learn about experimental design, launching his career as a statistician.

At Virginia Tech, Adam met his future wife Kristin in an Ultimate Frisbee summer league. Adam received the Ultimate Rejection when he asked Kristin out on a date and she responded by leaving the country for three months! This was a scheduled part of her medical training (she is a doctor of internal medicine) and they made a good connection on her return.

Adam says "the stars aligned" to bring him to Roanoke College. His advisor was pushing him to do a research postdoc, but Kristin had started her residency in Roanoke, Adam's family all lived here, and teaching felt like the right profession. Upon researching Roanoke's job opening, Adam discovered that his old riding friend Chris Lee is a mathematics professor, and some conversations with Chris convinced him that RC is the right place for him. In all, 2009 was a "good year": marriage, Ph.D., and job.

Adam says that Roanoke has "met and exceeded all of my expectations." He is part of a very young mathematics faculty who work well together and are good friends. Adam notes that on a given issue everyone has good ideas, but is willing to "cave" when better ideas are presented. Nonetheless, his first couple of years were challenging, as he was given complete responsibility for the statistics program. He is grateful that the students were patient as he learned what was going to work well here, and credits his "over-the-top enthusiasm" for their goodwill. Student feedback on Adam has been uniformly positive, and his statistics concentration is thriving.

Adam is excited about the future of his research and teaching and family and, more immediately, maintaining his lead in the basketball contest!

Message from the Chair: Dr. David Taylor

Welcome to this year's edition of the *MCSP Times*! The Department of Mathematics, Computer Science, and Physics has been busy over the last year, educating students inside and outside of the classroom. Our faculty have been traveling to conferences, not only to stay current in their own research areas, but also to learn about new pedagogies being used in classrooms across the country and world, bringing back new ideas to implement in our own classrooms. Calculus has taken a "new look" this past year, with a two-semester version of Calculus I being offered to ensure success for students whose algebra backgrounds may be weak, the second iteration of our "Physics and Engineering Colloquium" has continued to connect students interested in those areas with our physics faculty earlier and give them a sense of "who we are" and "what we do," and moving our computer lab to the third-floor of Trexler next to the computer science faculty offices has really reinforced the idea of "community" amongst our students. We continue to observe each other teach, learning from each other and taking high-level teaching even higher, and more program-level changes, including an Actuarial Science major (with help from the Business Administration and Economics Department), are in the works. As always, I welcome suggestions from our students, colleagues, and alumni about things we can do to make our department and programs even better – feel free to stop by or send me an email! As I wish the best for you, your families, and your friends for the coming year, I also want to give thanks to Dr. Jeff Spielman, who retired this year after 28 years of great service to Roanoke College, and I want to wish Dr. Rich Grant the best as he assumes the role of Associate Dean for Academic Affairs and Student Engagement starting in July of 2015.

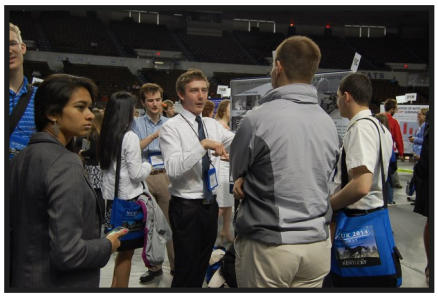
Student Profile: Thomas Lux

If you want an interesting conversation, take a couple of minutes to chat with Computer Science major Thomas Lux ('16). Make that several minutes. Thomas is an engaging, thoughtful, and relentlessly upbeat person. He attributes his positive outlook to years of being a camp counsellor. At any given moment in life, you can choose to act to improve your situation; so, why wouldn't you? His adoption of this attitude has shifted what he is capable of doing. In his first year at Roanoke, he was active in Habitat for Humanity, the Math Club, the Physics Club, Student Government (SGA), and the Psychology Club (there was more, but my hand started cramping taking notes).

Thomas categorizes his dizzying array of activities as community and research. Community includes his work with Residence Life and SGA, of which he was President. Research includes course work, special projects and summer research. After their freshman year, Thomas and Randall Pittman worked together using various sensors (the Kinect infrared technology worked the best) on a robot to efficiently create a map of a room. This work won Thomas and Randall first place in a student research paper competition at Furman University. As a sophomore, Thomas did work on image detection that would be useful for robot navigation. Another first place award resulted. Machine learning is on the agenda for this coming summer. His ultimate goal is to combine his two areas of interest by doing research that improves community. Robotics and machine learning both have potential for enhancing lives. Thomas is currently excited about the possibilities of having individual artificial intelligence "assistants" that could let me know, for example, that I've already told that story to that person three times, or that the person I'm talking to is recovering from an illness that I should ask about.

Thomas calls his election as SGA President as a sophomore "crazy cool" but a big time commitment (or maybe that was a big-time commitment). He says he is not disappointed in the low level of student engagement in campus isues in the sense that the level is what he expected. He would like to find a way to change the system so that being uninvolved is not the path of least resistance (and therefore a logical choice for most students). He views his most important leadership quality as open-mindedness: new ideas are necessary for change.

Roanoke College has been a great fit for Thomas. He says that if you have creativity and optimism, RC is a place that helps you follow through and pursue your dreams. His award-winning work with Randall started with an invitation from the Computer Science faculty to attend a meeting about student research. As a pair, they kept each other motivated and used basic problem-solving skills to work their way, mostly by trial and error, through problems that they knew little about. Keeping an open mind and a positive attitude that the next thing they try will work: this success is a product of the outlook on life that Thomas Lux embraces.



Maya Shende, Thomas and Randall

Natalie, Thomas and Randall

Jon Marino

Sam Parsons

Award Winning Students

MCSP students compete academically, as well as athletically, and represent Roanoke College well. Computer Science majors Thomas Lux and Randall Pittman placed first and third, respectively, in the Consortium of Computing Sciences in Colleges (CCSC) southeastern regional conference research paper competition. Thomas, Randall, Natalie Wilkinson, and Derek LaFever placed fourth in the programming competition at the same meeting. Mathematics majors Jon Marino, Sam Parsons, and Heather Cook presented research at MathFest in Portland, Oregon. Both Jon and Sam won Pi Mu Epsilon prizes for outstanding presentations! Jon had previously won the student presentation competition at the spring Maryland-DC-Virginia section of the Mathematical Association of America meeting. Congratulations to all of our students who competed during the year!

For The Love of Games

Dave Taylor has joined a long line of MCSP authors, with a textbook that has been tested in a May term course. A quick glance at the May term class might make you think that Dave and his students are just playing games. A closer look shows that the students are doing calculations, and you hear them talking about strategies and optimal results. And then it dawns on you: they're doing mathematics! (But maybe you shouldn't tell them: they're having fun.) Dave has taken two solid ideas – students learn best by doing, and many people love games – and turned them into an excellent Introduction to Probability textbook. Instead of having the standard dry introduction to permutations and combinations ("We define a permutation to be the number of ways ..."), Dave discusses the odds in Texas Hold 'Em, blackjack, and other games. The calculation of those odds requires ... wait for it ... permutations and combinations. In this enjoyable context, the math is not a burden, but part of the fun. If it sounds like Dave's book embodies the spirit of Roanoke College's acclaimed INQ curriculum, I imagine Dave would be pleased. Meanwhile, if you would like to know the odds and best strategies in casino and other games, or what it means to Farkle, or how mathematics can be used to analyze games, check out *The Mathematics of Games: An Introduction to Probability* at Amazon and other booksellers.

Department News

New Faculty Hire

We are pleased to welcome Maggie Rahmoeller to MCSP next year as a visiting Assistant Professor in Mathematics. Maggie is receiving her Ph.D. in Mathematics from North Carolina State this summer. We look forward to getting to know Maggie. Stop by and meet her!

Faculty Retirement

Jeff Spielman has retired after 28 years of teaching mathematics and statistics at Roanoke College. Jeff played a large role in the creation of the statistics concentration, and was a mainstay of the mathematics faculty for a generation of RC mathematics majors. We wish him the best in his retirement.

Teaching Award

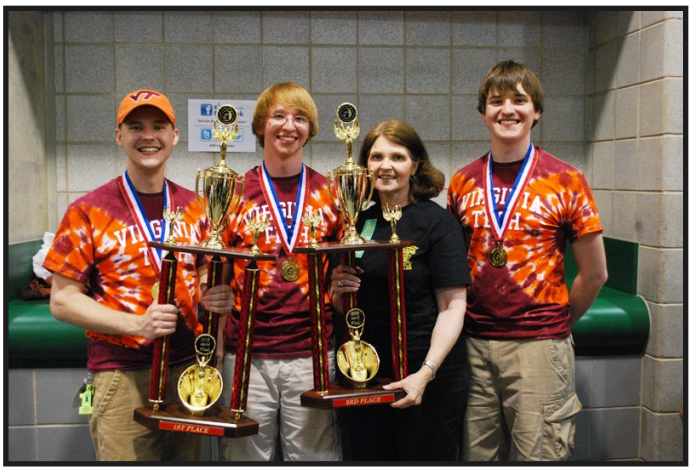
Roland Minton received the 2014 John M. Smith Teaching Award from the Maryland-DC-Virginia section of the Mathematical Association of America. This award celebrates teachers in a broad sense, in the classroom and also having influence in their teaching beyond their own institution, fostering curiosity and generating excitement about mathematics in students. Roland's work with mathematics contests, secondary school teachers, elder scholar programs, and his book-writing fit this description. Like Dave Taylor, Chris Lee and Rich Grant, Roland is a past winner of the Roanoke College Exemplary Teaching Award. MCSP prides itself on excellent teaching for current students, graduates, and the larger community of colleagues and neighbors.

A 17-Year Odyssey

Bonnie Price has taught Physics for over 20 years at Roanoke College, primarily running the labs, while commuting from Rocky Mount. This story is about her outstanding contributions to the education of Franklin County students.

Bonnie watched anxiously as the high school students carefully placed weights on their tiny balsa wood structure. They added more weights, and then still more weights, until eventually the 17.2 grams of balsa supported a staggering 1229 pounds of weight! Let the competition deal with that!

Bonnie has coached an Odyssey of the Mind team at Franklin County High School for 17 years. Her teams have competed in the Balsa competition for most of those years, although there are five different events in all. An important part of the Balsa competition is building a structure to hold as much weight as possible. Teams are graded also on presentation style (essentially a skit surrounding the testing of the structure) and on a spontaneous explanation or demonstration of, well, almost anything. Bonnie has watched many structures go up and come down. The extra challenge this year is to incorporate five marbles into the structure. Five times during the presentation, a piece of the structure is removed and a marble is released. As coach of the team, Bonnie mostly directs and motivates (often by baking cookies and cakes). Unlike the science fair projects you may remember from middle school, coaches and parents are not allowed to participate in the building of the structures. The kids discover good and bad ways to solve the problem through hours of practice. And it is *hours* of practice: five hours a week starting in September, plus all-day Saturdays starting in January. By March, the team has logged over 1500 person-hours. The practice culminates in a regional competition in March, the state championship in April, and then the world championship in May. Bonnie's teams had made the world championship nine consecutive years until missing last year. She has 1229 reasons to be hopeful of a return this year.



Bonnie with sons Tyler, Matthew and Andrew

Bonne with OM Founder Sam Micklaus

The odyssey started when Bonnie's daughter Melissa was invited to be on a team when she was in the third grade. Bonnie gave birth to her son Tyler the day before Melissa's first regional competition. Tyler and his brothers Byron, Andrew, and Matthew also competed, so it was inevitable that Bonnie would become a coach. She loves the creativity of the competition, with students trying whatever crazy idea occurs to them. The hands-on building of structures is unique, and the teamwork lessons are only matched in some sports. This makes up for the months in which Bonnie's home is overrun by teenagers with hammers and saws, with Trojan horse-like structures hiding her dining room table. Thanks to her, a generation of students has heard the siren call of group exploration and experimentation, and many have become competition judges after graduation as the odyssey begins for others.

Placing weights evenly on a balsa structure

Winning 2nd Place at Worlds!

One of Bonnie's former OM students, Sam Parsons (left), is now getting ready to graduate from Roanoke College!

Alumnus Profile: A Man Called Q

Al Bayse meets all of the criteria for an exemplary MCSP alumnus. Excellence in all three disciplines: double major in Physics and Mathematics (RC '58), jobs at NASA and the Army, and a long stint as assistant director in charge of computer technology at the FBI. Influence in the world: he developed models used in the Mercury Space program, the Cuban missile crisis, the Vietnam War, Army personnel decisions, artificial intelligence to provide real-time feedback to FBI agents in the field, and so on; he was head of computer security at the 1996 Olympics, and testified before Congress annually. Honors: Distinguished Service awards from the Army and the Department of Justice, and in 1992 a Roanoke College Sesquicentennial Alumnus Award. The "It" factor: his colleagues at the FBI called him "Q" after the James Bond character who gives Bond all those cool gadgets.

Assistant Director of the FBI

Researching Bayse (who passed away in 2004) for the "Q from RC" blog posting, I found signs of an impressive leader who was admired by many. According to Ronald Kessler in his book *The FBI*, he was "charming and smart." And a bit of a geek. "If he can use a technical term to describe a new computer development, he will." And an outstanding worker. "Bayse is in his element showing off some of the artificial intelligence systems his 1026-employee division has developed." I'm visualizing Q, as played by Desmond Llewelyn? I found a transcript of a conference called Computer Professionals for Social Responsibility at which Bayse spoke. The title is certainly uber-geeky, but there was something about the exchange between Bayse and his audience that

January 4, 1988 FEDERAL COMPUTER WEEK

PEOPLE

Air and Space Museum Trophy Room

"That the Scout — they just used it to launch a satellite, the same type of rocket that's in the museum."

Mathematics Leads FBI's Bayse Toward Role in History

By SCOTT D. PALMER

Al Bayse, Media Star

seemed special. Then, out of the blue to magically confirm that vague impression, I found a description of this meeting in Sandeep Gupta's book *Hacking In the Computer World*. "Al Bayse, computer technician for the FBI, … waxes eloquent and even droll, describing the FBI's 'NCIC 200,' a gigantic

Al Bayse at Roanoke College

digital catalog of computer records, as if he has suddenly become some weird hybrid of George Orwell and George Gobel." Bayse makes a joke about his last name, Bayesian statistics being a well-known but controversial branch of statistics. "'They didn't laugh at that at my last speech,' Bayse observes. He had been addressing cops … It had been a worthy meeting, useful one supposes, but nothing like this. There has never been anything like this. Without any prodding, without any preparation, people in the audience simply begin to ask questions. Longhairs, freaky people, mathematicians. Bayse is answering, politely, frankly, fully, like a man walking on air. The ballroom's atmosphere crackles with surreality." That sounds like the ideal classroom, everybody – longhairs, freaks, mathematicians (I'm glad Gupta saw a difference) – engaged and participating, challenging each other with concerns and alternative ideas. This ideal classroom occurred at a professional meeting being led by an FBI bureaucrat! And this completes the resume of Al Bayse for exemplary alumnus: "a love of learning, an openness within the vastness of what we do not know, and a desire to use what we do know in … service for the general good" (*Freedom With Purpose, The Liberal Arts at Roanoke College*).

A Man of Character

Bob Hudson passed away on February 16, 2015. Bob was a Physics teacher at Roanoke College for 34 years. He was known throughout Roanoke for his Model T truck rides at the Museum of Transportation. To all who knew him, he was a man of integrity and knowledge. We will miss Bob.

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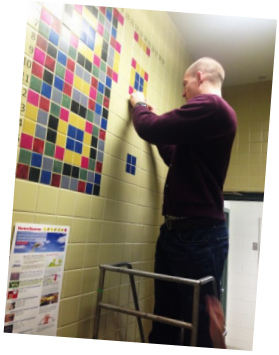


J.

A. Emily Huffman, Megan O'Neil, Elena Stone, Maya Shende, Stephanie LaFever, Melissa Eckert, and Marissa Patton at the Grace Hopper Conference in Phoenix.

B. Nick Guendel, Timmy Balint, Dr. Rama Bala, and Dr. Grant at Alumni Weekend.

C. Julian Ramirez ('15) launches a 3.

D. President Maxey pies Chris Lee on Pi Day.

E. Inquisition students dressed as Mathematics faculty.

F. Becky Muolo and Sam Parsons making pies on Pi Day.

G. Pi Day of the Century (3/14/15 at 9:26.53) at Mac and Bob's.

H. Rich Grant demonstrates the physics of a slap shot.

I. Math and Art student Cameron Smith works on the stairwell project.

J. Rachel Guilliams at bat for the Maroons.

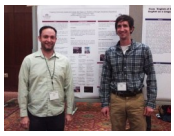
FACULTY PUBLICATIONS

Karin Saoub published "Generalized Dynamic Storage Allocation" in the journal *Discrete Mathematics and Theoretical Computer Science*.

Matthew C Fleenor, **Matthew A Blackston, Klaus P Ziock**, "Correlated statistical uncertainties in coded-aperture imaging", Nuclear Instru ments & Methods in Physics Research, A (2014) in press.

David Taylor published *The Mathematics of Games: An Introduction to Probability* CRC Press/Taylor & Francis Group, ISBN 978-1-4822-3543-2

FACULTY and STUDENT COLLABORATION



Jonathan Marino and **David Taylor's** paper "Integer Compositions Applied to the Probability Analysis of Blackjack and the Infinite Deck Assumption" will appear in *Topics in Recreational Mathematics*.

Adam Childers, Jan Minton, Hannah Robbins, Kristin Emrich, and David Taylor presented "Curing the High DWF Rate in First Year Science Courses" at the *Conference on Higher Education Pedagogy* at Virginia Tech.

Daniel T Robb, Maya Shende, Peter Griffin and Natalia Toporikova presented "Evolutionary algorithm search for connectivity patterns conducive to bursting in respiratory neural networks" at the Organization for Computational Neurosciences meeting in Quebec City

GROUP PROJECTS

Students in the Computer Science and Mobile App INQ courses presented their newly created apps in a Software Showcase event.

Roanoke College faculty and students led by Professor **Jan Minton** contributed to the Mega-Menger international distributed fractal project.

STUDENT REU

Maya Shende, "Computational Enzyme Design", REU at University of California, Davis through the Rosetta Commons Internship Program.

Randall Pittman, "Passionate on Parallel", REU at University of Illinois at Urbana-Champaign
Thomas Lux, "Medical Informatics Experiences (MedIX)", REU at DePaul University/University of Chicago

STUDENT RESEARCH

Sam Parsons "Protecting Confidentiality Through Synthetic Data and Mediator Servers"

Phillip Barbolla "Swarm Intelligence, Evolutionary Computation, and Particle Swarm Optimization"
Aaron Jackson "Graph Theory Analysis of Food Deserts in Roanoke"
Kristin Emrich "An Analysis of the Effectiveness of Changes in First Semester Calculus"
Heather Cook "Assessment of Water Quality in the Chesapeake Bay by Parameter Estimation"
Thomas Lux "Recursive Median Blob Detection"
Randall Pittman "Predicting Memory Performance of Graphics Card Programs"
Taylor Ferebee "Forecasting Blockbusters"
Amanda Wright, Summer Student Researcher, Coastal Carolina University, "Evaluation of Tracers in Optical Flow Measurements"
Reem Zeidan, Summer Student Researcher, American University of Beirut, "Accretion Discs and Black Holes"

Jamie Deyerle "Maximal Snakes of Length 2d+1"
T.J. Kemper "Memorability of BDAS Passwords with System Generated Grid Selection"
Sean Reed "Distributing Tasks Using Stigmergy and Ant Behavior"
Melissa Rickman "An Android App for Detecting Engine Misfires"
Drew Bowers "Multiple Image Steganography With an Image Deficit"
Allen Kirby "Instrument Identification in Rock and Metal Using Partials"