

THE MCSP TIMES

A Brigade of New Majors

The world is changing rapidly, especially in the technologically-oriented fields we work with in MCSP. We have always been innovative teachers, keeping our courses up-to-date. We are now taking this to the next level with new programs in data science, engineering science, and sports analytics joining the 3-year-old actuarial science program.

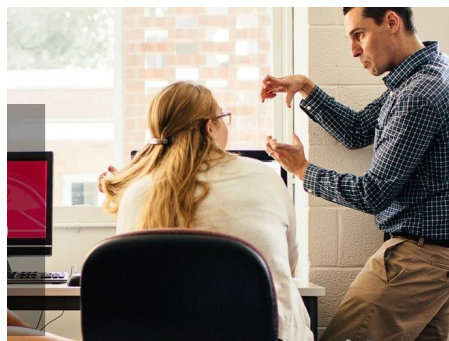


Some colleges have a “design your own major” option so that students can tailor their academic career to their interests. The actuarial science and data science majors and sports analytics concentration essentially do this for the students, piecing together interdisciplinary programs of courses that prepare students for current job opportunities. Actuarial science combines math, statistics, economics, and business courses leading to risk management jobs. Data science combines computer science and statistics courses with track options including business and economics. Sports analytics combines statistics, computer science, and sport management courses with practical experience from data collection and analysis with Stat Crew.



An engineering science major has been approved by the faculty, pending approval by the Southern Association of Colleges and Schools Commission on Colleges. Engineering science covers the principles and skills of engineering without a full specialization in one branch of engineering. This benefits students with an interest in engineering but not knowing which branch is best

Would a traditional major in physics, computer science, or economics with carefully chosen electives prepare students just as well? Perhaps, but we think that the guidance provided by the majors is helpful, allowing students to plan their courses in advance. For employers, the clear message that a student completing a data science major is prepared to do data science will improve graduates' job searches. We are, of course, hopeful that the new majors will help with student recruitment. You can come to Roanoke College and gain the benefits of our small college culture *and* be trained for cutting edge jobs.



There are 18 different types of Cheerios. For some, this is a result of mindless marketing, and they might classify an explosion of new programs the same way. However, there is a reason that all the types of Cheerios sell well, and the new majors recognize a reality that goes beyond marketing.

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Before the computer, the STEM curriculum was heavily influenced by the quirks of which types of equations could be solved algebraically. (Sad fact: most can't!) If an equation of motion that takes air drag into account is unsolvable, then we had to make do with an equation of motion that ignores air drag. It's an inaccurate model, but it is one that we can solve. With advanced computing power, those artificial limitations are removed (most equations of interest are solvable). New avenues of research develop, without the need to respect traditional academic boundaries. For example, machine learning gives us a powerful set of problem-solving tools that do not fit into standard statistics or mathematics curricula. This is truly new and important material.

With the addition of these new programs, our acronym of MCSP is outdated. However, that is a small price to pay for providing our students with the best modern college education we can. Welcome to the MCSPASDE world!

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The Dan and Dave Show

Years ago, Reebok shoes launched an ad campaign featuring Dan O'Brien and Dave Johnson, the two favorites for 1992 Olympic gold in the decathlon. The "Dan and Dave" commercials were very popular (the current Gatorade commercials with Dwyane Wade and Gabrielle Union are quite similar). Not to say that running the decathlon and running the MCSP department are comparable, but we have our own Dan and Dave Show as Dave Taylor steps down as Department Chair and Dan Robb takes over.

Dave will have served for six-and-a-half years. He has done an excellent job keeping day-to-day operations running smoothly, while also sparking innovation and keeping the department a fun place to work. That is an amazing set of accomplishments! The new programs highlighted on page one, numerous pedagogical innovations, and several successful hires mark a department achieving at a high level.

After a sabbatical, Dave will be in the administration business as an Associate Dean while beginning a stint as Director of IPOR, the college's political survey program. The students will miss his energy in the classroom and we will miss his daily, cheerful presence in the office. We wish Dave the best!

Dan Robb, a member of the Physics Group, steps into the Department Chair role in July. Dan has proven himself a popular teacher and valuable department member. We are confident that he will do a great job nurturing the growth of engineering science and our other programs.

Thanks to Dave for his years of service, and thanks to Dan for stepping up!

Message From the Chair

Welcome to this year's edition of the *MCSP Times*! We've got a vibrant and high-functioning group of faculty and students here, and we've been perhaps busier than ever. As I write this, most students are not on campus, as we are currently teaching via distance learning due to the COVID-19 pandemic; how long this lasts is unknown, but we're excited to be back in the classroom as soon as possible. Our faculty have risen to the challenge and are working to deliver classes to potentially cover the remainder of the spring semester as best they can to serve our students.

This year, department faculty worked with the members of the Business and Economics Department to develop a new major in data science that gives students the choice between preparing for a job upon graduation or preparing to enter graduate school; the program focuses on the development of skills in Python, R, and SAS with courses such as data mining and data visualization, builds on the Intellectual Inquiry core curriculum in the development of people skills, and culminates in a year-long capstone sequence, part of which has students answering real questions about real data from external companies.



Dr. David Taylor

In addition, the physics faculty worked very hard to develop and have approved by the faculty B.S. and B.A. degrees in engineering science. The B.S. has been designed so that it adheres with ABET accreditation standards, which will be pursued in four years and the B.A. provides a healthy flavor of engineering for students that want to pair it with other programs on campus. Both options build on the existing strength of our physics program and the growing interest of our students in engineering topics; I'm excited for the possibilities that these new programs bring!

This year, Rama Balasubramanian was on a full-year sabbatical and Anil Shende took the spring semester for his sabbatical; Adam Childers had a reduced teaching load due to a Faculty Research Year award, and Chris Lee also taught fewer classes this spring due to being named Director of the Teaching Collaborative for the College! Next year will bring more changes to our department, as my term as chairperson ends when June ends, and Dan Robb will be taking over as department chairperson, while Karin Saoub becomes the program coordinator for mathematics.

I have a sabbatical coming this fall, and starting January 1, 2021, I will be both the Director of the Institute for Policy and Opinion Research and the Associate Dean for Academic Affairs and General Education. I'm definitely excited about my upcoming new roles, but also saddened to be leaving the people in the department that have been my mentors, friends, and family for so many years.

Thirty Plus Teaching Plus

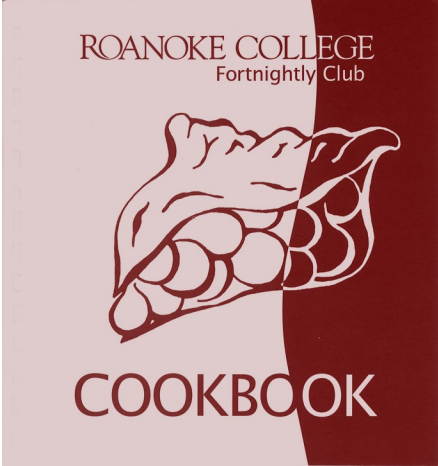
Jan Minton is retiring after thirty-plus years teaching mathematics and statistics at Roanoke College. Her contributions to Roanoke College extend well beyond the classroom.

Did you know that there is a Roanoke College Cookbook? Jan was the editor of this Fortnightly Club publication. She collected recipes from college faculty and staff past and present, and supplemented them with charming vignettes about the college. For example, there is the recipe that Henry Kissinger is said to have taken home with him after a Fowler lecture. A Graphic Design class project to design a cookbook was aced by Art major Jesse Wolf ('97), who gave the book a unique design with graceful maroon swoops outlining ingredient lists.

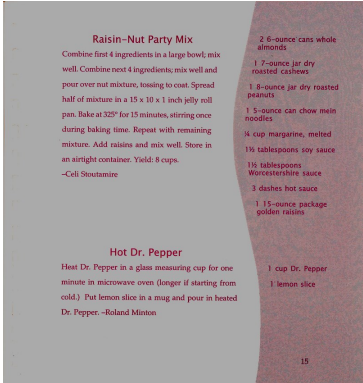


Jan served as the Associate Director of the Honors Program for eight years, including one year as Acting Director. One annual duty was organizing the Washington DC trip, making reservations for museum tours, meals, and theater events. One trip had the fortunate bonus of being at the height of cherry blossom blooms. Jan worked closely with the students to organize the annual Roanoke College conference, and traveled with them to national Honors conferences.

Jan's research creating this course had a surprising and wonderful payoff: the Roanoke College Coral Reef. It starts with a book about crocheting twisty shapes that illustrate complicated properties of hyperbolic geometry. Others had decided that the twisty shapes looked like coral. When Jan saw that there was an exhibit of a crocheted coral reef in Washington, D.C., she visited it and came home determined to start one here. A community art project was started, with over two hundred people participating. The project was beautifully staged by Olin Gallery Director Talia Logan, who was an invaluable collaborator. The reef was on display for a month, set Gallery attendance records, and was voted the second-best exhibit in the Roanoke Valley for 2012. More pictures and information can be found at the Coral Reef link in the A-Z index of Inside Roanoke.



Jan created the course The Art of Mathematics for the Honors Program. Stitching together numerous connections between the arts and mathematics, she introduced students to several of the most beautiful facets of mathematics. Tilings (think of M.C. Escher's interlocking birds and fish), the Fibonacci sequence and its relation to the Divine Proportion, and fractals are among the subjects explored. Guest speakers included local artists and a documentary film maker (see *Between the Folds*). Student projects created galleries for the Honors classroom and a Trexler Hall stairwell.



Jan helped design several general education courses and was a winner of the college's Innovations Award in 2007. Most recently, she collaborated with Maggie Rahmoeller to design a new math course for biology majors.

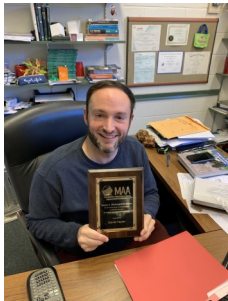
Thirty-plus years of patient guidance of students, curricular revisions, plus much more, wrap up this spring. We thank Jan for all of her contributions and wish her the best as she steps away from the college to add more to the community at large.

In the News



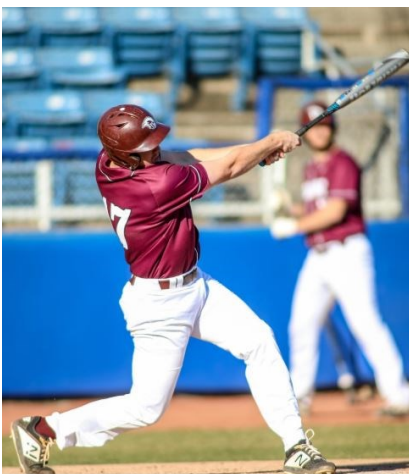
Eric Lee, a junior Actuarial Science major at Roanoke College, has passed Exam P (Probability) and Exam FM (Financial Mathematics) offered by the Society of Actuaries (SOA) and the Casualty Actuarial Society (CAS). Eric is from Archbald, Pennsylvania. He is in the Roanoke College Choir and is an accomplished pianist. In the actuary field, salaries and promotions are tied to the number of SOA/CAS tests passed, so Eric already having two such tests passed is huge. His success is also an important milestone for the newly-created Actuarial Science program at Roanoke. The program is designed to prepare students to pass these two exams and provide broad training in math, business, and communication skills needed in the profession. Eric has landed a good actuary internship for the summer. Congratulations to Eric!

The mathematics faculty kept a busy schedule writing books for CRC Press. Currently available are books by Karin Saoub (Graph Theory), Dave Taylor (Mathematics of Games), and Roland Minton (Sports Math). Karin's book is used in her INQ 241 course, Dave's in his INQ 177 course, and Roland's in his INQ 177 course. In various stages of productions are a second book by Karin Saoub (higher-level graph theory), a second edition of Dave Taylor's book, and a new linear algebra book by Hannah Robbins. Karin's book has been class-tested in her Math 268 (Combinatorics and Graph Theory) course, and Hannah's book has been class-tested in her Math 201 (Linear Algebra) course. The Roanoke College catalog at CRC keeps growing! Dave Taylor is co-editor of *Living Proof: Stories of Resilience along the Mathematical Journey*, a book of essays by successful mathematicians (including John Urschel - see page 6) on their struggles. It is available online for free!

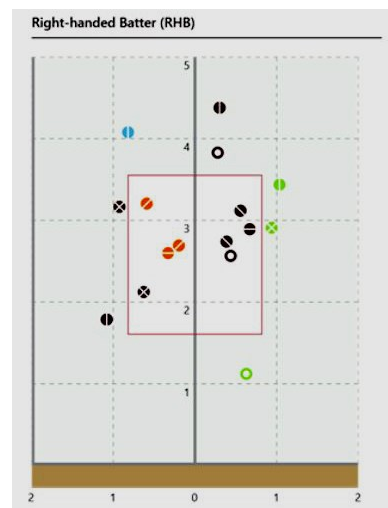


Other awards earned by mathematics faculty include Adam Childers' Faculty Research Year and Chris Lee's appointment as Director of Roanoke College's Teaching Collaborative. Adam is working on a general purpose app for groups such as Stat Crew to gather sports data. Chris organizes meetings of college faculty to promote discussion of teaching issues. Online teaching was clearly a hot topic this spring. A new common room for the Collaborative promises great things for the future.

Maggie Rahmoeller is co-author of a mathematics paper published in *Online Journal of Combinatorics*. Congratulations to Maggie on this important milestone in her career! Maggie has also submitted a paper with Biology colleague Meg Steinweg to *PRIMUS*, a long-standing mathematics education journal. This journal will soon be publishing an article by Adam Childers and Dave Taylor on their Classroom Stats application. Their presentation of this app at the 2019 Joint Mathematics Meetings was voted the best paper in statistics education.



Stat Crew added baseball to its list of sports this spring. Although the season was cut short by the pandemic, we were able to collect some amazingly detailed data using the Trackman radar system at Salem Memorial Stadium. The picture to the right shows the locations of all of Roanoke's pitches to right-handed batters in the first five innings of a game. The pitches are color coded by type of pitch (as determined by the radar based on speed, spin rate, and break). Data for batted balls includes exit velocity and launch angle. That's actuarial science major Will Merriken shown to the left.



In the News

Physics majors Morgan Hale ('22), Sophie Martin ('21), Rosie Hamed ('21), attended a 3-day long national conference, PhysCon 2019, in Providence, RI. The Roanoke contingent got together with one of our accomplished graduates Dr. Jake Bennett (2008), currently an assistant professor at Mississippi. According to Jake, "It was really great to see Roanoke College well represented at the national conference!" During his undergraduate days, Jake did mathematics research and nanotech research at Roanoke and an REU at Cornell. Morgan Hale presented her results analyzing data from the Mars rovers.



We're on the web!
mcsp.pages.roanoke.edu



Six female students and two women faculty from Roanoke College attended the Conference for Undergraduate Women in Physics in Pittsburgh. The Roanoke delegation consisted of majors Rosie Hamed, Jean Getz, Rachel Lindsay, Sophie Martin, Adrienne Spring, and Morgan Hale along with physics faculty members Hiba Assi and Rama Bala. Rama organized a session on experiences in transitioning to a four year college for physics. This was a 3-day conference organized by the American Physical Society. The conference is designed to give students access to information about graduate school and physics-related professions. Roanoke College had a strong presence at the conference.

The Roanoke College chapter of the Society of Physics Students (SPS) has won a 2019 Outstanding Chapter Award from the SPS National Office. This award recognizes the chapter for its high levels of outreach and general excellence as a student-led physical sciences organization. The chapter had previously been recognized as a distinguished chapter by SPS nationally in 2016, 2017, and 2018. In 2018, the chapter also received a Blake Lilly Prize for serving as eclipse ambassadors during the total solar eclipse, helping hundreds of people safely view the eclipse through telescopes at the Great Smoky Mountains National Park. The SPS chapter at Roanoke College is advised by physics professor Matthew Fleenor and is led by student officers Rachel Lindsay '21, Razan Hamed '21, Sophie Martin '21, Joe Carman '21 and Gretchen Michaels '20.



Roanoke College was pleased to host Professor Todd Timberlake from Berry College as a visiting Copenhaver Scholar. Dr. Timberlake was in residence for a week to give public talks and interact with physics faculty and students. At least that was the plan until COVID-19 struck in the middle of the week. Dr. Timberlake did give a talk in Antrim Chapel based on his book *Finding Our Place in the Solar System*. Computer simulations helped the audience see solar system behaviors that Ptolemy, Kepler, Galileo, and Copernicus were struggling to describe and understand. The Ptolemaic models, which are easy to make fun of today, were given their due as reasonable responses to the limited data available and the prevailing "common sense" of the time. The battle between Ptolemy and Copernicus was presented as a scientific disagreement settled by Kepler's superior data, rather than a cartoon battle between superstition and knowledge. The messy truth is much more interesting!

On Heroes

A conjunction of events provoked me to think about the role of heroes in our lives. Spoiler alert: in what follows there are no Marvel* heroes or even a Marvelous Mrs. Maisel.

To me, an interesting article is a great gift. RC History professor John Selby came across two items in quick succession that he thought I would want to see (he was right). They were about mathematics professors Francis Su and Tim Chartier. The same day a colleague invited me to VMI to chat with John Urschel. All three are heroes of mine.

For young people, heroes are magical and perfect beings. As experience adds shading to our initial black-and-white view of the world, we risk growing cynical and closing the door to potential heroes. If "hero" means someone who inspires us, adding a little magic to the daily grind, we can draw important psychic benefits from heroes while acknowledging that they are imperfect humans like us.

Francis Su is a mathematics professor at Harvey Mudd College in California, where my son graduated. He is kind and generous, taking time to chat when we visited Mudd and when we run into each other at mathematics meetings. Francis was in the news as the author of a moving ode to mathematics, *Mathematics for Human Flourishing*. Francis articulates, in a style that is best described as lyrical, the benefits of seeing the world mathematically. If this strikes you as a narrow world view, get the book and discover how your best thinking is more mathematical than you realize.



Dr. Francis Su

Tim Chartier is a computer science and mathematics professor at Davidson College. He supervises Cats Stats, a student group that provides analytics to athletic teams at Davidson. His appearance in the news was through the sports-oriented *Only a Game* podcast, which told the story of Cats Stats' growth from a student project to a valuable asset for Davidson athletics. Tim is quick to introduce colleagues to each other when he sees connections they could explore. Afterwards, he will send a quick email asking, "Was that helpful?" It always is. If you are wondering how Cats Stats relates to Roanoke College's Stat Crew, I stole the idea directly from Tim, and continue to get new (and very helpful) ideas from him.



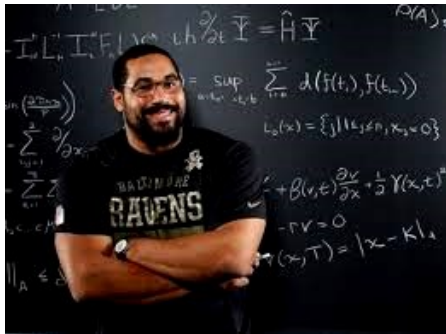
Dr. Tim Chartier



John Urschel is a Ph.D. candidate in mathematics at MIT, scheduled to graduate in May. This is impressive, but his fame comes from his previous job as offensive lineman for the NFL's Baltimore Ravens. John is thoughtful and unassuming, and a very strong mathematician.



When one of the VMI people referred to some software he had not heard about, John quickly stepped in and asked for an explanation of the software. This was not a rude interruption, it was gathering information to allow John to fully participate in the conversation. This is the nature of a true scholar and a sign of respect. John is getting a lot of publicity, but he says his immediate goal is to establish himself as a competent mathematician. His list of publications says he is already there.



John Urschel

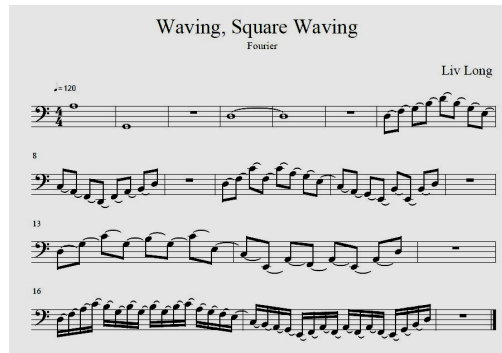
When I was thinking about writing about John, I came up with the opening line, "In the end, I decided to not ask him to autograph my copy of his book." In the magical world of childhood heroes, I would cherish that autograph. However, it felt like a more appropriate response to a high-level conversation about mathematics and life to shake his hand and thank him for his time.

So, what is a hero? Here are three people who are likable and inspirational: Francis and his love of mathematics, Tim and his amazing work with his students, and John with his work ethic and intelligence. They all make me a little more excited about the life I lead. And that's pretty magical.

(* Note: This is not exactly true. John Urschel has been working with Marvel on a video series "Marvel University" on Marvel's YouTube channel.)

Music and Mathematics

Mathematics major Olivia (Liv) Long is in the Honors Program. As a junior, she is working on her Distinction Project, a unique year-long research project. Liv wants to use music to illustrate mathematical ideas, believing that more people will be open to learning about the beauty of mathematics after *hearing* its beauty. She has written several short pieces that are posted on a website that will allow visitors to interact with the music and the mathematics.



Liv also helped out the department blog with a series of “Getting to Know Us” interviews of the tenure track mathematics faculty. We were asked what education would be like in 2050, and what a favorite phrase is.

Dave Taylor: In the year 2050, he views liberal arts colleges as possibly teaching online, plus one-on-one interactions, with math research being more specialized. His favorite phrase is “Bingo.” His favorite games are Clue, Pandemic, and Betrayal at House on the Hill.

Roland Minton: In 2050, online work will be common, with Roanoke moving away from fact-based testing towards research and internships. His favorite phrase in class is, “Does that make sense?” He enjoys levitating light bulbs (see the cover of the Roanoke College Magazine, 2019), Klein bottles, and various illusions.

Karin Saoub: In 2050, she pictures schools like Roanoke College with more job training, distance learning, more about skills and less about processes. Her favorite phrase is “Essentially.” Her bulletin board includes student projects from a geometry class and drawings by her two children.

Chris Lee: He believes that if schools like Roanoke College are around in 2050, they will maintain the importance of human contact and application of knowledge. His favorite phrase is “For results to change, behavior has to change.” He is co-founder with his wife of the Deaf Dogs Rock organization. From time to time, one of his dogs will come in and charm students.

Hannah Robbins: In 2050, she imagines human-human interactions being prominent even as the shift moves away from lectures, with more skills being taught on the process of learning. She also hopes for holograms. Her favorite phrase in class is, “At least I’m having fun.” Her May term class uses her experience as stand-up bass player and singer in traditional American music bands.

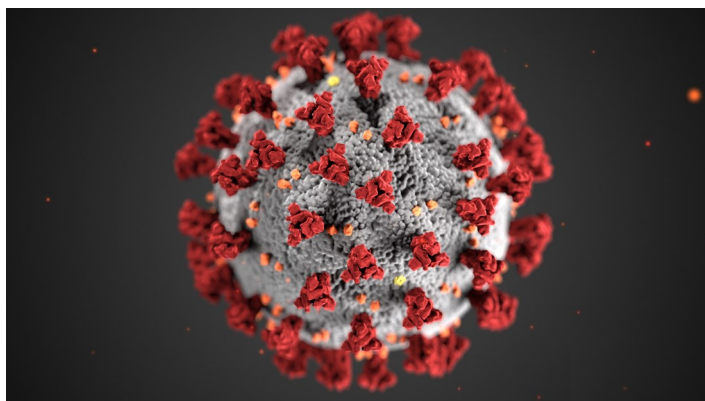
Maggie Rahmoeller: In 2050, she pictures a new science building and classes and research filled with innovative tech, staying away from lectures. Her favorite phrases in class are “Does that make sense?” and “Alright I got distracted again. Focus.” She is an accomplished oboist who plays with regional orchestras and musical groups.

Adam Childers: In 2050, he imagines liberal arts colleges as more of a hybrid between online and classroom learning. A favorite phrase is “That’s what I’m talking about.” A picture that might capture his personality would be an action shot on the badminton court or outdoors chasing his two boys.

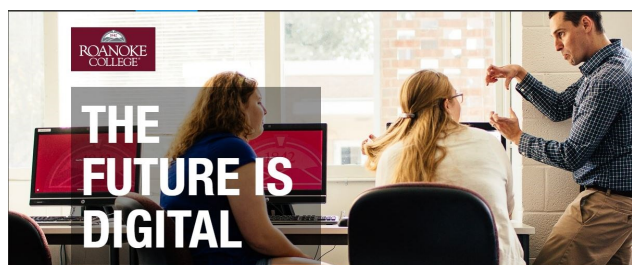
The interviews were done in the spring of 2019. Little did we know that we would be teaching online in the spring of 2020. The future arrived faster than we expected. As the saying goes,

Prediction is difficult, especially about the future.

Images of the Year



An artist's rendering of COVID-19, the virus that sent the students home after spring break, and put us online and out of our comfort zones.



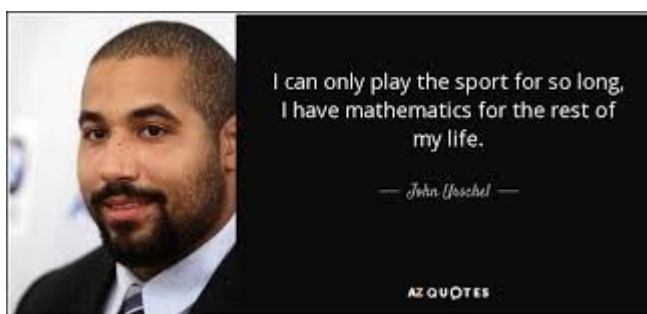
New majors — see page 1



Coral reef — see page 3



Faculty books — see page 4



Football and mathematics — see page 6

We hope that each of you is healthy and weathering the COVID-19 storm well. We are disappointed that the necessary precautions sent us online and disrupted the traditional celebrations of our graduating seniors. Congratulations to the Class of 2020!

Classes of 2021 and beyond, see you in the fall! To all, stay safe and come back and visit when you can!