

Biology—by T. Bryan Tims '98

The Biology Department is proud of its many students that pursued Capstone research projects in 2019-20. **Jared Dunlap '20, David Fluharty '20, Eli Strong '20, Brian Tarnai '20, and Ryan Tomlin '20** pursued Honors Senior Capstone projects while **Andrew Howell '20** pursued a Departmental Distinction project.

The past year in the Biology Department saw its faculty and students working together on a wide variety of different research projects.

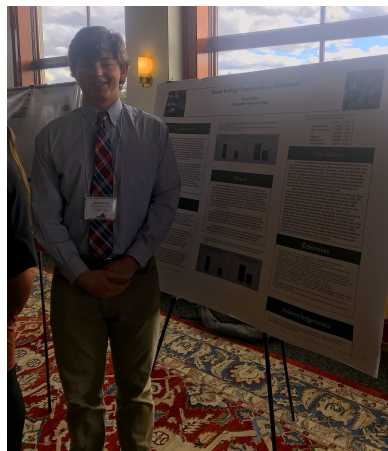
Dr. Kristian Hargadon '01 has continued to remain active and involve H-SC students in cancer research. In 2019 he received the Mary Louise Andrews Award for Cancer Research from the Virginia Academy of Science (a \$3,000 research grant) for a project entitled "The Role of Tumor-associated Chemokine Receptors in Lymph Node Invasion by Melanoma." Aspects of work related to this project were presented in Spring 2019 by one of Dr. Hargadon's research students, **David Bushhouse '19**, at the Annual Meeting of the American Association for Cancer Research (AACR) in Atlanta, GA. At this same meeting, two other students from Dr. Hargadon's laboratory, **Coleman Johnson '19** and **Corey Williams '19**, presented research related to the oncogenic activity of *FOXC2* in melanoma. Of note, Corey Williams received an Honorable Mention Award at the Undergraduate Student Caucus and Poster Competition at this national meeting. Each of these students, along with **Jefferson Thompson '16**, Eli Strong '20 and Brian Tarnai '20, became co-authors on a research article published by Dr. Hargadon on the role of *FOXC2* in melanoma progression. This multi-year study, which involved generation of a novel *FOXC2*-deficient melanoma cell line by CRISPR-Cas9 gene editing and also included analyses of clinical specimens from melanoma patients, is the first to describe oncogenic functions for *FOXC2* in melanoma and was published in late 2019 in *Cancer Genomics and Proteomics*. Dr. Hargadon has continued to work with Eli Strong and Brian Tarnai throughout the 2019-2020 academic year on bioinformatics projects related to *FOXC2* in cancer, and both students were set to present aspects of this work at the 2020 AACR meeting in San Diego, California prior to cancellation by the COVID-19 pandemic. In addition to his work in the laboratory, Dr. Hargadon is also currently serving as Editor for a new volume (entitled *Melanoma - Methods and Protocols*) for the prestigious *Methods in Molecular Biology* series published by Springer Nature. With an expected publication date of late 2020/early 2021, this volume will bring together cutting-edge basic science, translational, and clinical protocols from leading researchers and oncologists around the world.

Along with Physics Professor Stan Cheyne, Biology Professor **Dr. Alex Werth** is supervising the research project of junior **Charlie Lemon '21** on the bubble-net feeding behavior of whales. Charlie is investigating the sensory physiology of whales and fish plus the physics of bubble production, propagation, and collapse; he will conduct many experiments over the summer and next year for his senior research project. Werth and Lemon are

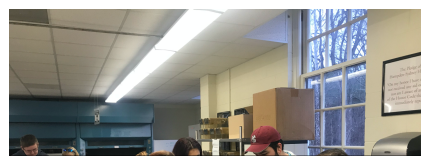
also writing an invited commentary about research on whale breaching behavior for the peer-reviewed science journal E-Life. In preparation for his upcoming sabbatical, Prof. Werth is continuing many collaborative research projects on whale morphology and biomechanics, the evolutionary-developmental mechanisms behind complex structures, and the public communication of science. In addition to his regular courses this spring, Werth is working with two groups of students learning more about nutrition and medical terminology and working with the architects planning the new Pauley Science Center.

In the fall of 2019, **John Walker '21** conducted a research project under the advisement of **Dr. Rachel Goodman** and with the help of **Dr. Ed Lowry**. Walker worked to determine if there was a significant difference between man-made planted pine forests and natural hardwood forests by measuring the over-story and under-story density, soil temperature, percent nitrogen, phosphorus, and pH. He found that over-story density, pH, percent nitrogen and phosphorus had a statistically significant difference between the two forests types, indicating that there is a significant difference between the man-made forest and natural forest.

This past year has been a busy one for **Dr. Michael Wolyniak**. In the spring, he was slated to travel with Brian Tarnai '20 and **Ivan Woodruff '20** to the National Conference on Undergraduate Research (NCUR) at Montana State in Bozeman, Montana and with Jared Dunlap '20, Ryan Tomlin '20, Andrew Howell '20, **Tim Bryant '20**, and **Charlie Wolfe '20** to the Annual



John Walker '21 presents his research done under Dr. Rachel Goodman at the 1st Annual Virginia Conference on Undergraduate Research and Creative Activity, hosted by H-SC.



Chris Parrish '21 works with Appomattox High School students visiting H-SC as part of the Biology Department's ongoing outreach efforts.

Meeting of the American Society for Biochemistry and Molecular Biology (ASBMB) in San Diego, California prior to cancellation by the COVID-19 pandemic. He participated in several research grant proposals and a virtual review panel with the National Science Foundation (NSF) and was part of an external reviews of the University of Maryland-Eastern Shore. He also had papers published in *The Journal of Microbiology and Biology Education* as well as *The Plant Journal* for his work with collaborators in developing educational programming for undergraduates. He continued his work with Dr. Anil Challa of The University of Alabama-Birmingham to develop tools to teach CRISPR-Cas9 technology in the undergraduate classroom and received NSF funding to run a workshop for undergraduate educators over the summer at The University of Minnesota-Twin Cities. Through his work with the new Network for Undergraduate Research in Virginia (NURVa), Wolyniak helped Hampden-Sydney to host the first annual Virginia Conference on Undergraduate Research and Creative Activity, and as President-Elect of the Virginia Academy of Science was program coordinator of the group's annual Fall Undergraduate Research Conference held in 2019 at Christopher Newport University. In a new collaborative research initiative from the Virginia Foundation on Independent Colleges (VFIC), Wolyniak is helping a to coordinate a Commonwealth-wide research project that over time will provide data on climate resilience efforts in different regions.

This past summer, **Dr. Kristin Fischer** mentored four different summer research projects. **Alexander Washington '21** and Dr. Fischer collaborated with Dr. Mike Wolyniak on inserting a gene into *E. coli* that would cause it to manufacture a growth factor protein with the potential to enhance skeletal muscle maturation. **Ivan Woodruff '20** investigated the effects of caffeine on Zebrafish development. Andrew Howell '20 continued his previous summer's work on fabricating a 3D printed stretch bioreactor. **Dr. Paul Mueller** and Dr. Fischer collaborated with **Brahm Dean '21** to use the polymer synthesized previously by **Hunter Lee '19** to fabricate hydrogels. **Dr. Trey Thurman** also helped with this project by creating a four point probe that was used to determine the hydrogels' conductivity. Andrew, Brahm, and Dr. Fischer presented their work at the Biomedical Engineering Society (BMES) Annual Meeting in Philadelphia this past October. Dr. Mueller and Dr. Fischer also collaborated with Ryan Tomlin '20 on his project exploring ZIF-8 nanoparticles as an additive to increase skeletal muscle maturation. Ryan presented this work at the Virginia Academy of Sciences (VAS) Fall Undergraduate Research meeting and received an honorable mention.

In January 2020, Dr. Fischer had a review article published entitled "Hydrogels for Skeletal Muscle Regeneration" in the *Regenerative Engineering and Translational Medicine* journal for the special Robert Langer 70th Birthday edition. Robert "Bob" Langer is considered the father of tissue engineering and Dr. Fischer was a postdoctoral associate in his laboratory. This article includes skeletal muscle hydrogel research that Dr. Fischer conducted with **Tyler McGaughey '18** and Dr. Mike Wolyniak.

T. Bryan Tims '98 joined the Department of Biology in the fall of 2019 as a Visiting Instructor of Biology. He earned his M.S. Degree at the University of South Florida developing rapid immunoassays for food-born and bioterror threat agents. He comes back to his alma mater after working the last 15 years at the Division of Consolidated Laboratory Services in Richmond VA, where he worked in the Molecular Detection Lab. His service included rapid testing in response to West Nile Virus, 2009 Pandemic Influenza, Ebola, and other emerging and ongoing health threats.



Mr. T. Bryan Tims '98 joined the Department as a Visiting Instructor in 2019.