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Nicole Brooks, Biological Sciences ’16, works in Dr. Darlene Berryman’s lab.
Photo by Rob Hardin, HTC Telecommunications ’08

FROM THE DEAN
The HTC Research Apprenticeship Program continues to grow and thrive.
Pairing a motivated HTC student with an outstanding faculty tutor, the program teaches our undergraduates how to conduct research in their discipline while giving the faculty member a bright, energetic student to help move a project forward.

Thanks to our alumni and our partners across campus we offered more apprenticeships this year than in any previous year: 24 students worked as research apprentices.

Five of this summer’s projects were funded through the Brege Family Research Apprenticeship Fund, which was set up by Bruce and Laura Brege.

My fellow deans and the Vice President for Research and Creative Activity, Dr. Joe Shields, have also provided funding for apprenticeships this year. The College of Arts and Sciences funded two, and the Russ College of Engineering and Technology, the College of Health Sciences and Professions, and University Libraries each funded a project. The College of Fine Arts and the Scripps College of Communication each partnered with us to partially fund projects. Dr. Shields’s office funded three apprenticeships, and the Diabetes Institute and a grant obtained by Jenny Nelson and Tyler Aryes also provided partial funding for projects.

As you’ll see in the following pages, the apprenticeship program is one of the most valuable research opportunities for undergraduates at Ohio University. I hope you enjoy reading about these projects and will be moved to sustain this program financially. The only way to guarantee that this program continues to grow and thrive is if alumni and friends like Bruce, Laura, and our campus partners support it.

Sincerely,

Jeremy W. Webster

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projects
AT A GLANCE

Sorting Salamanders

Story by Brian Vadakin
Photos by Rob Hardin

Taxonomy, or the scientific classification of species, is a field of science assumed fairly static. However, for members of the genus Plethodon, otherwise known as Woodland salamanders, that is not the case. In fact, evolutionary biologists are still discovering different salamanders within the genus and questioning if, when and where they diverged from a common species.

Dr. Shawn Kuchta, assistant professor of biological sciences, and his apprentice, sophomore HTC Biological Sciences major, Kaylee Soellner are examining genetic material from four species within the genus. Previous research has showed these species to have poorly understood genetic diversity or the presence of multiple genetic lineages, said Kuchta. As a result, he decided to focus on the species Plethodon kentucki, Plethodon cinereus, Plethodon wehrlei and Plethodon punctatus, to find more details about the relationship between them.

Soellner begins by extracting DNA from the nucleus and mitochondria, and then performs polymerase chain reactions (PCRs) to create numerous copies of the genes from those samples, she said. The PCR process ensures that the DNA is sufficiently concentrated so that a sequencing lab can produce an accurate DNA sequence.

Once the team gets the sequenced DNA back from the lab, the true analysis begins. Using the DNA base pair sequences, Kuchta and Soellner look at the differences between the samples to infer how different the species are and how long ago they diverged from a single species complex.

For Kaylee, the project has been an extension of work she did with Kuchta during the school year.

“I didn’t know I was interested in evolutionary biology until I started working with Dr. Kuchta,” she said. “We started working on species interaction and different evolutionary stuff too, and when I found out he was looking for an HTC student to work with this summer, I jumped on it.”

Project funded by the College of Arts & Sciences
The Bare Bones Measure
By Ben Postlethwait

Junior HTC Biological Sciences major Gabby Hausfeld is exploring new, less invasive ways for doctors to detect the onset of osteoporosis. A disease characterized by loss of bone mineral and protein, osteoporosis makes the skeleton very fragile and susceptible to fracture. Hausfeld is working alongside Dr. Ann Loucks, professor of biological sciences, to test the effectiveness of a new piece of technology that uses vibrations, instead of potentially harmful radiation, to test an individual’s bone strength, an indicator of osteoporosis.

Using newly developed technology and a technique called Mechanical Response Tissue Analysis (MRTA), the researchers are attempting to break new ground in the field of osteoporosis diagnosis. Using a machine equipped with a probe, Hausfeld applies different frequencies of vibrations to cadaveric human arms from a range of deceased individuals — differing in age, gender and health. After dissecting the arms, she repeats the process for the ulna, the innermost forearm bone.

The team hopes to find that the device produces bone strength measurements from the bare bone comparable to that of a Gold Standard measurement—a form of measurement that could not be used on a functioning arm. From the collected data obtained before dissecting the cadaveric arms, the team also hopes to observe a comparative relationship between the Gold Standard and MRTA measurements, allowing them to consistently deduce an accurate measurement that will one day make the technique ideal for patients.

Hausfeld said that while using MRTA in a clinical setting is a long way off, the research she is doing with Loucks is a necessity. Verifying the accuracy of the detection method involves many steps of testing and adjusting instruments and techniques to produce reliable results.

“It’s a great experience,” Hausfeld said. “I would love to continue this type of work for my senior thesis.”

Project funded by the Brege Family Research Apprenticeship Fund

Lady of the Flies
By Hannah Ticoras

Covered in river sludge, carrying containers full of mayflies, research apprentice Jessica Lindner assesses the effects of acid mine drainage in Monday Creek in New Straitsville, Ohio. Summer 2013 marks the second time that junior HTC Environmental and Plant Biology major Lindner is working with Dr. Morgan Vis, a professor of environmental and plant biology.

Lindner will be studying 30 southeastern Ohio streams but is focusing on two in particular: Monday Creek and Hewitt Fork. Acid mine drainage affects the amount of biofilm, or slime-like algae, on the rocks in the streams by changing the concentrations of key elements such as phosphorous or nitrogen. However, grazing by insects such as mayflies—an insect classified in the same grouping as dragonflies or damselflies that eat the algae—can alter concentrations as well.

Vis and her team hypothesize that the chemicals from acid mine drainage affect the environment more so than the grazers, but she hopes that the data collected about grazing patterns will give a better insight on the activity of the streams’ ecosystem as a whole.

The extra year Lindner has had working on the project has allowed her to construct new equipment for the research: tiny enclosures full of mayflies and algae to place around the stream to study the effects of this mini-environment’s presence. The enclosures are 20 milliliter plastic containers with three mayflies and cutouts covered in mesh and filled with a tile on which algae grows. The containers are then tied into strips of mesh nailed to the stream bed.

“It’s like MacGyver a little bit,” Lindner said.

Project funded by the Vice President for Research
Invoking Mary’s Wrath

Story by Hannah Ticoras
Illustration by Paula Welling

Among Latin-based medieval charters, which range from rental agreements to war treaties, senior HTC Philosophy major Raul Inesta searches for two words: iram Maria. The cursing clause, Latin for “the wrath of Mary” appears hidden in a handful of forms within the 12th and 13th century charters from the Iberian Peninsula that interest history professor Dr. Miriam Shadis.

The clause can be as short as iram Maria or can be masqueraded within a longer phrase, such as iram Dei omnipotentis et beate Marie virginis incurrat, which means the subject of the charter “will incur the wrath of Almighty God and the blessed Virgin Mary.” Shadis and Inesta are attempting to uncover the reasons why this specific phrase occurs, specifically studying a correlation between the threat of the iram Maria curse against individuals who defaulted on a charter and the presence of a queen in power.

Inesta has always been interested in the region of Spain from which the charters originated, and his fluency and minor in Spanish helps him understand the medieval Latin. Nevertheless, Inesta was thrilled to discover the first charter written in Spanish. “It's been really cool to see the switch,” Inesta said.

The switch from writing Latin to Spanish was propagated by the heroes of the Reconquista and continued through their retelling of battle stories, according to Shadis. She hopes to finish cataloging the charters, in both Latin and Spanish, as part of an ongoing bibliography, as well as to begin work on a map of the region pinpointing instances of charters within the Castile-León region.

Project funded by University Libraries

The Business of Diabetes

By James Chrisman

As a senior HTC business major, Brianna Rea seems an odd choice for an apprenticeship with Ohio University’s Diabetes Institute. But her business savvy and pre-med concentration are what make her a fit for this jack-of-all-trades apprenticeship.

Effectively treating diabetes requires a team-based approach that includes patients, nutritionists and diabeticians. The structure of the Institute reflects this method — and so does Rea’s apprenticeship.

Rea is involved in all aspects of the Diabetes Institute: writing brochures, making handouts on apps for diabetics, shadowing medical professionals, assisting in animal model research, organizing a diabetes boot camp and helping with class with the Diabetes Prevention Program. Rea hopes to utilize the marketing facet of her degree in a variety of upcoming assignments, including advertising of the diabetes clinic at the Castrop Center at O’Bleness Memorial Hospital.

“What I’ve been trying to figure out this whole internship — and I still don’t know — is how do you make people care?” Rea said.

Type 2 diabetes accounts for 90 percent of diabetes cases in the United States; yet, it is preventable. Type 2 diabetes is comparable to cigarette smoking: In the early stages one does not see long-term effects, so people tend to ignore the consequences and continue their unhealthy habits. Whereas decades of public health campaigns about the dangers of cigarettes have changed public perception, diabetes remains under publicized.

With about 1.9 million new cases diagnosed annually, one thing is for sure: Rea’s experience with diabetes will be relevant no matter where her degree takes her.

Project partially funded by the Diabetes Institute
**Questioning a Treatment**

By Ben Postlethwait

Sophomore HTC Biological Sciences major Phillip Craigmile is tackling the complex problem and questions surrounding cancer metastasis. Working in the lab of Dr. Shiyong Wu, professor of chemistry and biochemistry and director of the Edison Biotechnology Institute (EBI), Craigmile is examining how radiotherapy, a common treatment used to kill cancer cells, may decrease or increase the chance that surviving cells metastasize and spread to other parts of the body.

Craigmile, working under the guidance of post-doctoral fellow Dr. Shin Hee Lee, is performing a variety of experiments or assays on cells that have been treated with radiation. The team hopes to discover the reasons why these cells may be more vulnerable to metastasis. Craigmile performs one such test, called western blot, to separate and identify the proteins within irradiated cells. He separates these proteins in a gel through which an electric current is run. This step in the process, called gel electrophoresis, separates proteins by their size, allowing their levels to be analyzed. Depending on what kinds of proteins are present and their quantity, Craigmile can evaluate the potential metastatic activity of the irradiated cell. Understanding this activity of cancer cells, after radiotherapy, aids the team in determining whether or not they are metastasizing.

Lab work has brought Craigmile increased confidence and independence as he learns a variety of scientific techniques. More than that, however, he is happy to be working under the guidance of such knowledgeable professionals.

“[Dr. Lee is] helping me to understand the science behind the experiments we’re doing,” Craigmile said. “It’s good to understand how and why something works, not just accepting that it is working.”

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**Framing Feminism**

By Max Cothrel

Senior HTC Art History major Barbara Jewell is spending her summer in the Kennedy Museum. She is searching through rooms of prints—more than 1,500 of them—that the university has collected over the course of decades. She is looking for pieces to include in the third and final exhibition of a series called, “Women Artists of Kennedy Museum of Art.” Working as an apprentice for Dr. Jennie Klein, associate professor of art history, she is playing a major role in the show’s composition.

Assembled by past and present faculty from the School of Art, the print collection is comprised primarily of works that the museum has acquired, but also includes a mix of undergraduate class projects and visiting artists’ gifts. Part of Jewell’s work this summer is going through the collection, looking for works by female artists who are still active. These are the simple criteria for the exhibition, which allows myriad styles and subject matters, particularly those relating to femininity. Instead of looking for something specific, Jewell and Klein can select prints that impress them. Together, they are identifying prints to include in their fall 2014 exhibition.

Using an Ohio–wide network of art historians, Jewell has done some deep research on some of the artists. That is one of her favorite parts. “For me, acting as a professional and contacting organizations and saying that I’m interested in art you have are fun,” she said. “It’s so much more tactile than sitting in a class.”

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Project funded by the Vice President for Research

Elizabeth Cartlett’s image, entitled “Man” (2003) will be displayed at the Kennedy Museum’s third and final Women Artists exhibition. Image provided by the Kennedy Museum of Art.

Project partially funded by the College of Fine Arts
As a novice researcher, sophomore HTC Biological Sciences major Eric Leach is learning the art of multitasking. He has a hand in a variety of projects related to growth hormone (GH) in Dr. Edward List’s lab at the Edison Biotechnology Institute (EBI). GH is produced by the pituitary gland and is involved in many aspects of health, including growth, aging, diabetes, cancer and obesity.

Most of Leach’s projects this summer use mice to look at cases of GH disorders and GH resistance or insensitivity. One project he focuses on is the study of cellular senescence, a process cells use for resisting cancer. If a cell is about to become cancerous, it can shut down its ability to replicate itself. Although this technique is successful at preventing cancer from spreading, List noted that mice with many senescence cells tend to age more dramatically.

List and Leach are determining whether GH may play a role in cellular senescence, seeking to publish their results by the end of the academic year. The team hopes that these findings will give scientists and doctors better understanding of the effects of cellular senescence, and eventually help people to live longer and healthier lives.

Leach added that one of the benefits of working in the molecular biology lab at EBI is the support of the other scientists. He is learning research techniques such as body composition analysis and dissection, as well as practical skills including grant writing. With several different projects going on in the lab at once, researchers lend each other a hand. Leach values that he has multiple mentors. “There are people from all different levels working in the lab, and it’s been great to get to learn from them,” he said.

Project funded by the Brege Family Research Apprenticeship Fund
List and Leach utilize mice to conduct multiple research projects related to growth hormone at the Edison Biotechnology Institute.
Stamping Out Western Influences

About 50 years ago, New Zealand designer Mark Cleverley was commissioned to design a line of postage stamps that galvanized his country’s aesthetic. Since then, he has fallen into obscurity, though his work continues to help New Zealand break from Western design.

In the 1970s, Cleverley introduced Western notions of aesthetics to a country where design was nonexistent or simply dysfunctional. While the New Zealand aesthetic is still evolving today, Cleverley began the country’s tradition by combining South Pacific and Modernism design influences. His design utilizes simplified composition and flat, bright colors.

Calling Cleverley “an unsung hero,” Sherry Blankenship, associate professor of graphic design, has fought for four years to publicize his work and recognize its influence. After trying the traditional route of academic publishing, she is now harnessing the do-it-yourself potential of the Web to achieve her goals.

Throughout her career, Blankenship has taught in non-Western countries that have a tendency to define themselves in relation to the West and, in the process, do not form an artistic identity. While teaching in New Zealand in 1993, she found herself on faculty with Mark Cleverley, and the two became friends.

She discovered that he had been a designer for decades, making contributions to graphic design, ceramics, packaging, architecture and most importantly, postage stamps. Shifting from the standard “Queen’s head” iconography, Cleverley began to depict the local environment—including flora, fauna and geography—converting the stamps, in effect, to miniature posters. Because the stamps traveled far beyond New Zealand’s borders, recipients around the globe saw their artistry and a glimpse of the country’s unique aesthetic. However, few viewers took the time to consider the actual artist who designed the stamp on their envelope.

Blankenship’s mission is to make a wide au-
dience aware of Cleverley’s contributions. She asked his former professors and colleagues for their accounts of working with him. Because of their older ages, their responses came in the form of handwritten letters. She carefully transcribed the texts and sent them back to the authors in order to insure accuracy. Her efforts resulted in a book’s worth of content. However, at more than 300 pages, New Zealand publishers lacked the funds to produce it, and American publishers feared it might appeal to only a small audience.

Blankenship realized that a website requires neither funding nor a publisher. However, it does require technical expertise, so she enlisted the help of the Honors Tutorial College in finding someone to digitize her book and make public the work to which she is dedicated. Sophomore HTC Computer Science major Charlie Murphy told Blankenship during his apprenticeship interview that although he had no experience in design, graphic or otherwise, and had not worked on web builds since he was a freshman in high school, he was willing to learn. And he did.

“He’s the expert on the website end of it,” Blankenship said. “He’s not one of those really rigid scientific kinds of people; he’s quite personable and easy to talk with.”

The team is a microcosm of the design process. They, in their motivations and personalities, are a blend of pragmatics and aesthetics, working towards a functional goal. While Murphy admires the aspirations of the project, for him, the apprenticeship represents an applicable look to the future.

“I’m approaching her almost as a client for what a freelance web designer would do, working with her toward what she thinks the design should be,” he explained.

Murphy’s digitizing and spreading of Blankenship’s text may be indicative of the Web’s capability to do for scholarship what it has already done for literature and music: foster a do-it-yourself mentality and a democratic system of publication.

But for Blankenship, though the format of the project has changed, its goals remain the same. “I see it as developing a platform for the next researcher who can build on it, and build on it, and build on it, which I guess is what research is about. It’s not just—okay and now I’m done. Hopefully it’s useful to other people that come along.”

*Project funded by the Brege Family Research Apprenticeship Fund*

Designer Mark Cleverley’s stamps were the first to move New Zealand postage away from depictions of royalty to colorful, straight line illustrations of the country’s local environment.
High quality produce in the farming industry may not equal quality wages for workers.

In a market dominated by Monsanto-sized companies, undercut only by the occasional farmer’s market, mid-sized farmers struggle to find a niche. Too small to earn profits in a conventional market, those farmers have shifted to developing premium products—such as all-natural, organic or environmentally friendly produce—that fetch higher prices than standard goods.

Those products are sold based on the values attached to them, both in terms of the value associated with the food, such as being organic, and on the values associated with the way farmers conduct business, such as being fair trade. The journey from farm to table is known as a supply chain, and in this case it is referred to as a values-based food supply chain.

Dr. Larry Burmeister, professor in the department of sociology and anthropology, and senior HTC Political Science major Grace Curran are studying those values-based supply chains. They are attempting to understand whether farmers who have high quality standards for their produce also have high standards for other business practices in the supply chain, such
as packaging or transportation. They believe other research has neglected to answer important questions, such as: How are workers in the supply chains who are in processing, retail or shipping treated? Are policies such as fair labor, living wages and a safe work environment valued just as much as the farmer receiving a fair price and the consumer a premium product?

The team hypothesizes that while some supply chains have taken a public stance on fair trade and just compensation for all agents, they may not follow the standard in practice. The project, called “Renewing an Agriculture of the Middle: Value Chain Design, Policy Approaches, Environmental and Social Impacts,” explores mid-sized farming enterprises to see if fair trade is a concern throughout the entire supply chain, not just at the farmer’s level.

While actors in the supply chain are fairly independent in terms of what values they uphold, the team hopes to find out if companies that market products as high quality and fair trade actually follow through with commitments to just labor arrangements throughout the supply chain. “A group of farmers get together and form a cooperative to produce and market high-quality beef, for example,” Burmeister said. “That has to be processed. What about the meat processing workers? Is part of the supply chain’s values giving them a fair wage?”

The team’s work consists of content analysis of the literature in case studies and websites to see what kind of labor arrangements are employed by those mid-sized enterprises, such as Shepherd’s Grain, a cooperative comprised of 30 wheat farmers in the Pacific Northwest. Shepherd’s Grain produces high-quality wheat to be used in regional artisanal bakeries, resulting in a premium-priced, value-added agricultural product.

Curran said that they hope to go further than simply establishing that supply chains may be problematic. She would like to see certification developed for consumer products that shows that ethical labor standards were used in the processing of produce, much like some products are given fair trade certifications to ensure products are meeting certain ethical standards of production.

“When people are talking about this one type of mid-sized values supply chain, they’ll talk all about this company, but they won’t talk about labor at all,” Curran said. “These companies are patting themselves on the back for this ethical economy. It seems like it’s either built on the backs of cheap labor, or [other problems are] just being ignored.”

After completing research on their case studies, Burmeister and Curran presented their findings at the Rural Sociological Society’s annual meeting in New York City at the beginning of August. From there, they hope to continue the research, perhaps by conducting their own study by interviewing farmers and laborers within the supply chains.

Curran’s academic interest in the field comes from her personal interest in the relationship between power dynamics and agriculture. She’s done research on the United States FARM Bill and has done internships with the Environment Law and Policy Center in Madison, Wisconsin.

“I am fascinated by how food and politics come together, because they’re both sort of ubiquitous forces...”

—Grace Curran, Political Science senior

come together, because they’re both sort of ubiquitous forces that everyone comes into contact with all the time,” Curran said. “It’s really interesting, and to me … agriculture is kind of a hidden world. We can be so insulated from it and still reap the benefits.”

Curran hopes to continue studying agriculture and the social and political interactions within it. She wants to produce an undergraduate thesis on the connections between feminism and agriculture, a topic that drove her into this area during her freshman year.

“I think it’s changing my perspective on the food system, and I’m hopefully going to go forward in a career in Agricultural Policy with this work in the back of my mind,” Curran said. “If I’m not aware of these issues in what I’m doing in the future, then I need to be.”

Project funded by the Brege Family Research Apprenticeship Fund
Novel Advertising

One scholar’s look into a Dickens’ classic reveals that advertisements affect our experience of reading.

Modern media offer seemingly unlimited options for instant gratification. An especially tempting one is streaming the complete season of a favorite television show. Whether a classic sitcom like Friends or a more recent drama like Lost, marathon viewers do not experience breaks in the action like traditional viewers do. The plot marches on without commercials or weekly breaks between episodes.

Dr. Joseph McLaughlin, associate professor of English, has found an unlikely parallel between TV binging and classic novel reading. A Victorian scholar, he explained that modern readers enjoy the luxury of having access to novels’ full manuscripts. Classic works, such as Dickens’ Great Expectations and George Eliot’s Middle March, were originally released in serial magazine installments over the course of a year or longer. Readers in the mid-19th century consumed them segment by segment.

McLaughlin encourages his students to mimic the original reading experience. “I have been teaching these long Victorian novels [and] for-
bidding students to read ahead, making them wait, [having] the text unfold ... one installment at a time,” he explained.

He also has become interested in another aspect of the original texts—the presence of advertisements. “Sections would come out every month,” explained his apprentice, senior HTC English major Anne Sand. “But with those sections would be anywhere between 13 to 40 pages of advertisements and illustrations.”

For her apprenticeship, Sand is analyzing Dickens’ *Our Mutual Friend* because its original manuscript is available in Alden Library’s rare book collection and its installments were published during a significant period in commercial history. McLaughlin explained that the 1860s are often identified as the dawn of modern advertising culture.

He does not consider the advertisements as part of the external world that surrounded the novel; he views them as part of the very novel itself. “There is this very idealistic notion of literary experience [in which] somehow the words, the actual material words on the page, are just some kind of conduit to a more refined, cerebral, intellectual, imaginative experience,” McLaughlin said. “And how you get there is the medium—it’s a means to an end.”

However, McLaughlin resists this notion. For him, changing *Our Mutual Friend*’s medium into one cohesive work without advertisements and illustrations—as modern publishers have—alters the way readers experience the novel’s content. As a result, Sand’s work is less about the advertisements and more about the fact that the way a text is presented is intimately related to a person’s overall engagement with the story.

“So the goal was to look at the ads and the novel and how they reflect off each other and what we can learn about the themes of the novel from what we see in the advertisements,” Sand said.

Sand performed a content analysis on more than 320 pages of Victorian advertisements. Categorizing ads by what product was being sold, what gender was targeted, and what advertising techniques—such as illustrations or celebrity endorsement—were used, she filled Excel files with data. Along the way, she became fascinated with what she referred to as a “treasure trove of fun and funky Victorian things.”

Sand particularly appreciated the quirky advertisements, such as those for umbrella frames and parlor books about perfumes. She has noticed some trends in which advertisements seem to mirror the story plotline running alongside them, but for the most part, she said that this is not the ultimate takeaway. Instead, she explained, the project allows readers to peer into the original Victorian reading world.

“I think the biggest learning part has been not to take things for granted,” Sand said, adding that she does not mean in the sense of modern conveniences or technology, but in how we think about commodities. “The products that we have now, we think about them in the way we use them, as if that is the way that everyone has always used them. These ads show that this is not the case.”

However, looking beyond the advertisements, Dr. McLaughlin believes Sand’s research has broad implications for literary culture.

“At [the project’s] core is a kind of insight that how we read matters—that its not just a temporal experience, it is a material experience,” Dr. McLaughlin said, commenting on the profound ways in which reading continues to evolve with the advent of e-books.
The Mysterious Case of the Benjamin Letter

Dr. Brian Schoen’s discovery of an anonymous pre-Civil War letter may redefine the way historians think about the bloodiest per capita war in United States history.

Story by Max Cothrel
Illustration by Paula Welling
It is tempting to think of history as settled and unmoving. But historians are always searching for new information and new interpretations to help us better understand how we got to where we are.

“Historians tend to combine what it is we know based on what other researchers have generated and what it is we find,” said Dr. Brian Schoen, associate professor of history. This is history research’s methodological one-two punch.

In a small public records office in England, Schoen began this methodology with a letter he found in the papers of a British minister to the United States. He is using the letter to build on our understanding of the Civil War’s origins and the diplomacy of the secession movement.

The letter—known within the field of history as The Benjamin Letter—was an anonymous communiqué sent in August of 1860 to Sir Edward Archibald, who held the coveted position of British Consul in New York City. As one of the Crown’s most trusted advisors in the once-new world, Archibald was a powerful man.

Archibald received the letter, which was anonymous, but indicated that it was from someone who claimed to be a Southerner and a member of Congress. The letter elaborated upon how powerful circles within the South were considering their options as the election of one Mr. Lincoln became more and more imminent in the face of a fracturing Democratic party. These Southerners, the letter indicated, talked of a new partnership with their former colonial power.

The letter’s author minces no words in laying out its purpose: A preemptive attempt to diplomatically fortify the South’s standing on the world stage by creating a new alliance between the Confederacy and the Crown. Although it was anonymous, it said in the last paragraph to address any replies to Benjamin.

Archibald replied to the letter, but only to say that he would not read any more letters on the subject. It was privately forwarded to the British Minster to the United States Richard Lyons, in whose private papers Schoen discovered the letter. Eventually, an additional copy was also given to Thurlow Weed, a New York newspaper publisher and politician who pledged not to publish the letter’s contents until the death of all principle actors. Weed’s son, however, was unable to wait and published the letter in memoirs about his father, beginning transatlantic discussion and speculation about the anonymous author. Eventually, it faded into obscurity.

Over a century later, Schoen found the letter and unearthed the controversy over its

**Historians tend to combine what it is we know based on what other researchers have generated and what it is we find.”**

—Dr. Brian Schoen, associate professor of history
The difficult thing is he was kind of a mysterious guy and he took a lot of pains throughout his entire life to destroy any kind of paper record.”

— Eric Burke, History junior

initially, Schoen and Burke wanted to explore the possibility that the letter was written by a Southerner and Congressman notable for his brashness. One such man was Judah Benjamin, and other scholars have used the fact that he went on to become Jefferson Davis’ Secretary of State as evidence that the letter came from him. In order to test this hypothesis, the team wanted to create a timeline to track Benjamin’s whereabouts at the time the letter was sent.

“The difficult thing is he was kind of a mysterious guy, and he took a lot of pains throughout his entire life to destroy any kind of paper record that would suggest he was anywhere at any time,” said Burke, explaining the nature of his work. “But the one thing he didn’t have control over were public records — things in newspapers, things along those lines.”

As the research led them closer to confirming that Judah Benjamin was not the letter’s author, it led them to a new area of inquiry. Instead of asking where the letter came from, they started to ask what it meant.

To do this, they had to expand the scope

Judah P. Benjamin, the Secretary of State for the Confederate States, held three different cabinet posts under Jefferson Davis’ administration.

**BENJAMIN TIMELINE**

**FIRST WEEK OF AUGUST, 1860**
Within a few days, Panama port documents list Benjamin’s arrival and departure. He’s on a boat from the east, headed west. Burke explained that New Orleans departure documents from the 1860s all burned in fires in the 1890s. But by looking at archives from Panama ports, he and Schoen know that the boat Benjamin leaves on is bound for San Francisco.

**LAST WEEK OF JULY, 1860**
A New York newspaper announces that Judah P. Benjamin leaves New Orleans for California to take a case regarding a quicksilver mine. Burke explained that in the 19th century, newspapers would publish announcements about prominent citizens in prominent cities. Benjamin, who would achieve his greatest notoriety while working for the Confederacy, was already a noteworthy name before the war began. Burke researched archives for news of Benjamin’s comings and goings published by nosy newspaper barons who might’ve been interested in Benjamin’s half a million dollar payday.
of their study. Instead of considering the letter simply in the context of the American Civil War, they began to consider the entire war within the context of the 19th century geopolitical situation.

“It seems as if the American Civil War can be and should be situated within a particular moment in world history in which there are wars of nationalism, wars of independence, wars of domestic disputes and conflicts and wars of unification,” Schoen said, referring to the various conflicts happening across the globe, in nations like China, Italy and Germany. “And we are increasingly seeing that those connections probably matter for understanding what the American Civil War was and is.”

By considering the letter as an artifact of discourse, they can use it to understand the larger context of the world. The 19th century was a time when nations emerged as power brokers on the global stage and new forces of industrialization grew alongside them. National powers and industrial forces are still an important part of world politics, and studying the failed rebellion of the Confederacy might help us better understand them.

While it’s still important for historical purposes to verify the Benjamin of The Benjamin Letter, what’s more important is the letter’s meaning. It is an indication that even the Confederates recognized that we live in a world where isolationism is impossible and international allies can make or break a government.

“Our goal here, and our goal from the outset, is to hopefully offer some historical scholarship that will use this letter as a window into understanding the larger historical process of the time period,” Schoen said. “It’s what’s important for making history relevant.”

This is, after all, why we study history: To better understand our present and our future.

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Project funded by the Brege Family Research Apprenticeship Fund

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**AUGUST 10, 1860**

The Benjamin Letter arrives at the office of Edward Mortimer Archibald, the British Consulate in New York City. Archibald is shocked by the letter’s contents and refuses to take it seriously, ignoring it before sending copies to Lord Lyons, the British envoy in Washington, D.C. It comes before Lincoln’s election to the Presidency, before secession and the war. Benjamin is on a steamer in the middle of the Pacific Ocean.

**DECEMBER-FEBRUARY 1860**

Southern states begin to secede from the Union. The political lead up to the American Civil War reaches its climax. Benjamin resigns from his seat in the U.S. Senate after his state of Louisiana seceded in January. He joined the Confederate government’s cabinet as attorney general.

**1884**

Thurlow Weed’s family publishes a memoir of the newspaperman that includes a copy of the Benjamin letter. This publication plays into an on-going international media circus of speculation about and study of key players in the Civil War’s political landscape. Benjamin, who is in exile in Europe after the war, publicly denies writing the letter. Burke thinks this denial means a lot due to Benjamin’s circumstances. Because he was across the Atlantic and the war had been over for years, he wasn’t in immediate danger even if he had written it. Moreover, Schoen and Burke believe that this public debate over war involvement tells a larger story about honor in the global world and an obsession after the Civil War for players to attest their interpretation of the facts to a public audience.

**AUGUST 13, 1860**

According to port documents, Benjamin arrives in San Francisco. Burke and Schoen used these documents to verify that Benjamin could not have delivered the letter himself.
Appalachian history tells a story of opera houses built on the success of a booming coal economy. One theater professor is skeptical as to whether this energy-arts connection is really in the past.
Theaters and natural resource extraction sound like an unlikely duo, but Dr. William Condee discovered that the connection between the two runs deep in the history of Appalachia.

Condee’s interest started with ambitious showboat owner and businessman George Stuart who set out in the 1870s to make something of the booming coal extraction industry around him. His results were unconventional. In the foothills of Appalachia, Stuart built a space to showcase high culture in a railway-dotted coal-mining town: Nelsonville’s Stuart’s Opera House.

Stuart opened the House in 1879 during the town’s heyday, a period long since past. The House’s last century of economic instability fascinated Condee, a self-proclaimed New Yorker and professor of interdisciplinary arts and theater at Ohio University.

Condee left his Appalachian childhood home to pursue an acting degree, ultimately studying theater at Columbia University. He spent his early academic career researching theatre architecture in major American cities. But what he stumbled upon in the spring of 1994 — just days before leaving for a sabbatical in Europe — hit close to home: It was the unfinished, half-restored Stuart’s Opera House.

“I never really considered myself to be an Appalachian. I viewed myself … as a New Yorker who had been born in Appalachia, who happened to live in Appalachia and who had happened to live three-quarters of [his] life in Appalachia,” said Condee, who lived in the area nearly six years before discovering Stuart’s. “Then it was kind of at that point that I realized no, this is who I am and this is my culture.”

Condee’s fascination started small, beginning with what he believes is the most important research question, “I wonder.” He observed the dilapidated opera houses that dotted Appalachia and began composing a brief historical pamphlet for Stuart’s, which the opera house sold as a souvenir booklet.

Then in 1997 Condee’s research took an expansive turn as he began writing a book titled Coal and Culture: The Opera Houses in Appalachia. The publication explored the connection between Appalachia’s coal mining culture in the later 19th and early 20th century and the appearance of opera houses in the region. Published in 2005, the book examines over 100 opera houses in the Appalachian region, providing background information and historical context for theatrical relics.

Condee found that the identity of opera houses was not resigned to theater — and almost never entailed actual opera performances. Instead, an opera house was a symbol of culture and a practical space for hosting community activities. The opera house became an element of town development, as integral as a bank, firehouse or church.

“It was a way of sending a signal that we are a cultured town,” Condee said. “So the opera house was definitely one of those signal buildings that establishes a town as a town.”

As opera houses began to appear on the American landscape, so did coal mines. The economic activity from coal mining in Appalachia resulted in a tremendous number of opera houses in the area. But as the extraction of natural resources began to diminish, investment moved elsewhere, leaving many opera houses — and the towns themselves, such as Nelsonville — ghosts of their former grandeur.

However, 10 years later in 2013, something peculiar had Condee asking, “I wonder” once again. A couple of opera houses originally featured in Coal and Culture contacted Condee...
to tell him about recent renovations they had made. With today's sluggish economy, Condee, along with his research apprentice, sophomore Honors Tutorial College Theater major Sophie Mitchem, once again turned to the environment of the region for clues on reasons for these improvements.

Over a century after coal mining's boom, it was not difficult for the two to find a parallel between coal mining and the controversial recent process of natural extraction—hydraulic fracturing, also known as fracking.

Condee's hunch originates from theater's historical financial connection to resource extraction in Appalachia and the recent dialogue on fracking in West Virginia, Southeastern Ohio, Pennsylvania, and Kentucky, the regions of Condee's original research, Mitchem said. Utilizing her background in journalism, Mitchem rose to the challenges following up on his research presented.

"It started out with me just calling opera houses, emailing, sending them [a] survey ... It was a bit of a tricky thing to navigate because the contact information [was] all a bit outdated," Mitchem explained. "So I am kind of taking over and doing a bit of research on my own and looking into the economy of each region and seeing how fracking takes a part in that."

From the team's investigations, Condee was able to locate two opera houses in Bradford County, Pa.—Hales Opera House and Sayre Opera House—where the connection was clear.

"In this case, the natural gas industry has donated money and labor to restore two opera houses and has also made significant donations to other nonprofit agencies," Condee said, referring to Chesapeake Energy, which was called an aggressive fracking giant by multiple media sources. And while the short-term goal for this research was to provide an updated look at Appalachian opera houses for a German Association for American Studies presentation in May, Condee plans to keep investigating.

"I plan on following up this research ... to learn what lessons from the century-old coal boom might apply to the current fracking boom," Condee said.

Condee doesn't know the extent of the connection, but said the research process has been a personal journey regardless.

"It's just as much a process about me learning where I was born, where I lived, the culture I had not really paid any attention to," Condee said.

The apprenticeship has been equally personal for Mitchem. Having grown up in Morgantown, W. Va., Mitchem said the project has given her the opportunity to witness the coal mining roots of Appalachian history that she only previous experienced second-hand through friends. Ultimately, she said that this opportunity to combine both environmental science and theater history has been a fascinating one.

"A lot of people try to pigeonhole you when you say, 'Oh I want to be an acting major,' and they say, 'Ok cool, good luck in New York,'" Mitchem said. "But I think this gives me such a good background and opens my eyes, to see that I am interested in so much and there's something I can learn from so many different aspects."

**WHAT HAPPENS IN AN OPERA HOUSE?**

Opera houses began to dot the American landscape around the late 19th and early 20th century. During that time, opera was considered a sign of high culture in contrast to theater, which many viewed as a morally dangerous form of entertainment particularly for single women attending alone. In the course of his research, Dr. William Condee argues that approaching opera houses as a place for theater is less accurate than viewing opera houses as community halls. Inspired by his research, the following is a compilation of some of the activities Condee envisions a typical Appalachian opera house hosting:

- High school graduations
- Roller skating
- Basketball games
- Piano recitals
- Political rallies
- Sunday school
- Community plays
- County pig reviews
- Vaudeville productions
TOP Mozart’s Hall in Carlisle, KY is a simple, small-town opera house. Photo & caption by Condee.
LEFT Pierce Opera House in Sharpsville, Pennsylvania. View from an opera house window to the owner’s house. Photo & caption by Condee.
RIGHT Red Men’s Opera House in Shawnee, Ohio, showing an unrestored interior in which the plaster has fallen off the lathe walls and ceiling. Photo & caption by Condee.
Narrating Authenticity

For media arts professor Dr. Jenny Nelson, portraying Parkinson’s Disease is personal and multifaceted, just as she sculpts the PD Narrative Project to be.

Story by Max Cothrel
Photos Provided by the PD Narrative Project
r. Jenny Nelson, an associate professor in the School of Media Arts & Studies, is the driving force behind the PD (Parkinson’s Disease) Narrative Project. She is also a patient living with PD, so it is not a surprise that she approaches contemporary perceptions of the disease with guarded cynicism.

“A lot of what people know is about Michael J. Fox,” Nelson explained, referring to the most common source of America’s information about PD. The actor is a face for PD and the founder of The Michael J. Fox Foundation for Parkinson’s Research, which uses an online multimedia format to educate the public, fundraise for research, and create a network of people with the disease. Nelson admires what he has done and does not discount his impact on PD awareness. However, she feels that there is more to PD than what research-driven foundations like Fox’s present.

“Foundations are hard to work with. They’re too big, too needy,” she said. Nevertheless, foundations do important work contributing to research and support, and they are the opinion-makers on PD. Because of their resources, they have the power to establish the narrative in ways individuals can’t, she explained.

Nelson worries that the discourse foundations create around PD is influenced heavily by medical and health jargon and support group terminology. She feels that there are more human faces to put on the disease, so she spearheads the PD Narrative Project, an ongoing, online multimedia endeavor to change the public discourse about what it means to live with PD. And like most cynics, Nelson has a casual, pragmatic way of speaking.

“Working on this project can be like herding cats,” she said. Given the project’s interdisciplinary methods and broad scope, organizing the dozen or so rotating staff members—who have a variety of media skill sets—can be tedious and time consuming. Nelson understands and embraces the group’s power because the diverse skills fuel the PD Narrative Project’s multimedia approach. They employ any available medium, which has helped the Project evolve from conference presentations into a growing series of eight short films, a blog and a video remix contest hosted by the Project. However, the team’s work will come full circle in October when Nelson presents the Project on a conference tour, including a stop at the World Parkinson’s Congress in Montreal.

“It’s not what I was expecting,” Madison Koenig, a research apprentice, said of the films the Project produces. Koenig, a junior HTC English major, has been on a few shoots, picking up shooting and editing skills as she goes. “But one of the goals of the Project is to show the more personal side of Parkinson’s.”

—Madison Koenig, English junior

The shoots have yielded compelling narratives and featured subjects in their natural habitats, even if that means a truck or some woods. Part of the films’ power comes from an intentional strategy to provide a sense of space for their storytellers. Through Nelson’s personal network of contacts the team has had the opportunity to document good storytellers with a natural tendency to spin yarns, providing them with a lot of material to work with in the
We like to find the humor where it is and give the serious stuff its space.”

—Dr. Jenny Nelson, associate professor of media arts

“it’s already been shot and produced and Jenny and the staff have sections identified where they want animation.” From there, Ayres and Gartland use a combination of hand-drawn animation and computer-rendered puppeteering to create cartoon characters for the films.

The mix of live action and animation, and the cross-platform, audio/visual and written text approaches are all means to the Project’s end: sharing unconventional stories in order to move the larger narrative of Parkinson’s Disease past a frame of simple heroes’ journeys. The Project endeavors for something with smaller scales and greater significances. What this means in the Project’s offices is a directive to leave formality behind and establish a new tone for addressing PD.

“We like to find the humor where it is and give the serious stuff its space,” Nelson said. “We’re trying to tell smaller stories with greater significance.”

Under Nelson’s guidance, the Project is working to find new voices for addressing the issues people with PD face. At the end of their videos and slide shows is an open invitation to the audience. Below the credited media team are the words “YOUR NAME HERE,” inviting everyone to help change the narrative on Parkinson’s Disease.

Project partially funded by Scripps College of Communication

PD IN POP CULTURE

Love and Other Drugs (2010) — In the cookie-cutter romantic comedy, Anne Hathaway stars as Maggie Murdock, a woman who suffers from young-onset Parkinson’s disease and starts a relationship with drug representative Jamie Randall, played by Jake Gyllenhaal. Filmed in Pittsburgh, some local news outlets provided commentary on the film, including the movie’s hope to display the anxiety patients face, spread awareness for the disease and portray the experience of a young-onset PD patient — a condition becoming more common in the region, according to CBS.

Muhammad Ali — A former champion boxer, Ali was diagnosed with Parkinson’s in 1984 at the age of 42. While the cause of Parkinson’s generally is unknown, a report from The Guardian speculates whether brain injuries sustained from repeated blows to the head may have been a contributing factor for Ali. As a three-time World Heavyweight Champion and world-renowned athlete, Ali has become a prominent face for PD along with his daughter, Maryum Ali, a spokesperson for the Parkinson Alliance, according to U.S. News & World Report.

Michael J. Fox — A diverse actor, starring in work ranging from the Back to the Future trilogy, to ABC’s “Spin City,” to Sony Pictures’ Stuart Little, Fox was diagnosed with young-onset Parkinson’s in 1991 at the age of 30. Fox waited seven years to publically disclose his condition in 1998, dedicating himself to increased PD research, according to the Michael J. Fox Foundation. Fox opened the Michael J. Fox Foundation for Parkinson’s Research in 2000, and earned an honorary doctorate of medicine degree from Sweden’s Karolinska Institute in 2010 for his fundraising and advocating efforts. Fox still appears in guest TV roles but now is primarily an activist for PD research and awareness.
TOP Nelson and her apprentice Koenig.
LEFT Since the PD Narrative’s inception, the Project has collaborated with the College of Health Sciences and Professions’ physical therapy department, which has led to such practical results as an exercise class specific to people with PD.
RIGHT As one facet of the PD Narrative Project, animation expert Professor Ayres and his apprentice Gartland have created animated stills for the Project’s videos.
The Eye Is a Window to the Cell

The mass of a fruit fly’s 800 simple eyes may hold the key to preventing cancer metastasis — Protein X.

Story by Max Cothrel
Illustrations by Paula Welling
Science often links the microscopic and the monumental. Dr. Soichi Tanda, an associate professor of biological sciences, may connect cells in the eyes of fruit flies to a method for slowing the spread of cancer. His research focuses on the protein Moesin (Moe)—a formative conduit between a cell’s core and its membrane—and how the mysterious Protein X might impact its function.

Fruit flies have a two-week life cycle that allows for extensive study, and they have over 50 percent genetic overlap with human beings. The tiny bug's genome also includes 75 percent of the genetic diseases that humans can inherit. Thus, cellular function in humans and fruit flies is remarkably similar, but the fly — for reasons of size, physiology, and the ease of genetic manipulation—is a simpler system to study.

“Flies allow us to do a lot of things that are harder to do with mammalian systems,” said Samantha Chang, senior HTC Biological Science major and Tanda’s research apprentice. When experimenting with fruit flies' genetics, the team can perform several rounds of tests in just a few weeks. Chang has been working with the flies’ eyes, turning them into microscope slides that they can observe.

Magnification reveals a complex visual system. Fruit flies have compound eyes, in which each fly eye is actually a mass of 800 simple eyes composed of cells that act as photoreceptors to take in light from the outside world. Just as our eyes absorb an image, all 800 of the compound eye’s individual parts, called rhabdomeres, import visual data into a fly's brain for processing. Within the rhabdomeres,
The cytoskeleton is essential for holding a cell’s structure together and is made up of actin and microtubules. The cytoskeleton not only allows cells to migrate in the body, but also controls a cell’s shape, whether round or flat. The cytoskeleton also helps cells build specific surface structures, such as the microvilli that Dr. Soichi Tanda studies. Every microvillus has a core actin bundle, which is tethered to the plasma membrane with several proteins. Moesin (Moe) is one such protein indispensable to the linkage between the actin core of the microvilli and the plasma membrane.

Microvilli perform a diverse range of jobs in different cells. Aside from microvilli’s role in cell structuring, it also helps absorb nutrients in the intestinal lining and is present in a compound in the eyes of fruit flies. Within cells of a fruit fly’s eye, the microvilli are used for the reception of light.
just like a good mechanic can boost a car part’s power. And just as a boosted engine enhances a car’s gas mileage or top speed, boosting X through genetic manipulation—and thereby boosting Moe’s function of building surface structures on cells—has a practical application of its own. Moe helps epithelial cells, the lining of external and internal body surfaces, hold together. Sheet-like formations of cells are held together by the products of Moe. If Tanda and his fellow scientists can find a way to increase Moe’s function, they might be able to force cells to stay together.

And this knowledge is additionally beneficial: Tanda thinks that the ability to effectively conglomerate cells with Moe, as controlled by Protein X, could be used to stop cancer from metastasizing. The actin skeleton of cells discourages their mobilization, allowing them to travel to other tissues within the body. If the cells are forced to stick together, they won’t spread, enabling doctors to surgically remove an intact tumor.

Chang applied for the apprenticeship after working in Tanda’s lab last fall. Aside from the noble goal and the interesting day-to-day work, she likes her apprenticeship because the search for Protein X is preparing her for future lab work in graduate school and beyond.

“Especially if you’re going into grad school, the professor’s going to be more willing to work with you if you have some lab experience,” she said. So, for Chang, the search for Protein X is not just exciting research; it is formative life experience.

But despite the lessons being learned, Protein X is still just a hypothesis. Tanda and Chang are in the process of narrowing candidates in order to confirm and identify it. While that reality is a long way off, it could serve as a practical way to help treat cancer—a monumental possible outcome from the minute cells of a fruit fly’s eye.
Insulating Alzheimer’s Effects

Dr. Robert Colvin examines insulin as a possible player in the effects of Alzheimer’s disease.

It is difficult to develop a cure for a disease that nobody fully understands. However, sophomore Kim Kraus and Dr. Robert Colvin are working together on research that could help answer some baffling questions surrounding one such illness: Alzheimer’s disease.

While HTC Biological Sciences major Kraus doesn’t plan to cure Alzheimer’s disease (AD), she certainly hopes to develop innovative new ways to treat this elusive illness. She is studying new connections between the hormone insulin and the debilitating effects of AD.

“People don’t know exactly what insulin does in the brain, but it obviously has an important function because it’s there,” explained Colvin, professor of biological sciences.

The way insulin behaves in a brain afflicted with AD is closely connected to the broader questions surrounding the illness. AD is a neurodegenerative disease that is widely believed to be initiated by amyloid beta (amyloid-β), or Abeta peptide, a sequence of amino acids that...
is often found in deposits on the brains of AD patients and individuals with dementia. Insulin has been shown to have a distinct reaction to the presence of AD in the brain, but the causes for this are under investigation. Colvin said not every scientist agrees that Abeta is the cause of AD, but he stresses that AD is an elusive illness that continues to challenge scientists and doctors.

In the team’s investigations, Kraus and Colvin introduce a synthetic version of Abeta peptide into rat neurons, grown in brain cell cultures. This introduction simulates the effects of AD, ultimately causing a toxic and fatal reaction in the neurons. The team uses the reaction to study how insulin hormones interact within the afflicted brain cells.

As a result of these experiments, Kraus and Colvin are working to develop a detailed cellular model of AD to better understand the interactions of insulin within the brain. As part of their work, they are studying the academic literature on the topic. Some research has shown that increased levels of insulin may be a deterrent against the onset of AD, but the exact interaction remains unclear.

“Alzheimer’s is an interesting and intriguing problem; there are lots of scientists working on this due to the critical importance for human health,” Colvin said. “That’s the overall picture, but I’m interested in all types of neurodegenerative diseases such as Parkinson’s disease or stroke. They all have some common thread in what’s going on inside of the cell as far as what causes the cell to die.”

Colvin said that much of the academic work Kraus is doing is learning the basics of lab work, including how to perform sterile experiments, grow cell cultures, and analyze results through a process called immunofluorescence, in which light-sensitive dyes are added to cultures, allowing tiny details in cells to be studied under a microscope.

Kraus has enjoyed the independence that lab work allows and hopes that her continued work with Colvin will allow her to do similar research in the future. To her, the opportunity to do professional scientific work is an experience not many get to enjoy so early in their career.

“Personally, I want to be able to work in the lab independently, even if it’s just on basic procedures,” Kraus said. “I want to be able to go in independently, on my own, and do experiments without needing someone’s assistance or guidance.”

*I want us to come across something that’s novel in the field, something that isn’t just repeating other people’s experiments.*

—Kim Kraus, Biological Sciences sophomore

Colvin is happy to introduce motivated students to the skills necessary for independent work, as well as to share his interests as a cellular biologist. He said that this type of one-on-one education has benefits beyond what can be seen on a résumé. For him, it’s about problem-solving and critical thinking skills.

“That kind of one-on-one mentoring is unique to the research lab experience for a student,” Colvin said. “It helps them gain confidence in what they do and how they think about science problems.”

AD will continue to be a complex and confusing illness, but Kraus hopes her work in Colvin’s lab, which she will continue in the Fall Semester, will add something new to the conversation, rather than reiterating what has already been done.

“I want us to come across something that’s novel in the field, something that isn’t just repeating other people’s experiments,” Kraus said. “We need to take a different approach to some things, and I think we’re doing that with our work this summer.”
Cancer Chemistry

One novice, one tumor promoter, and one summer later Dr. Mark McMills’ lab inches closer to understanding cancer.

Housed in Ohio University’s Clippinger Laboratories among test tubes, acid baths and a sophomore HTC student, a new cancer therapy is being tested.

An associate professor of chemistry and biochemistry, Dr. Mark McMills and his research apprentice, HTC Chemistry major Ben Carnes, are in the preliminary stages of creating a cancer drug based on a known tumor promoter called phorbol. While promoting cancer seems like a backward way of treating it, the pair are studying the chemical signaling pathways of molecules involved in cancer, hoping to find places to inhibit the signals from even beginning.

Step one is to understand the signaling; step two will be to inhibit it.

Azaphorbol is a new derivative of phorbol, a molecule that McMill has been studying since his post-doctoral work at Columbia University. He has studied phorbol because the molecule is also believed to be part of the signaling pathways at play during cancer development.

The difference between phorbol and azaphorbol is the addition of a nitrogen atom in place of a carbon atom on the molecule’s ring structure. While this structural substitution may seem small, it translates to a serious procedure for McMill’s lab. Rhodium, an element Carnes...
uses in the process, was estimated to average $1,375 per ounce by September, according to a Feb. 2013 article published by Bloomberg News. Thankfully for the lab, it is only a small part of the synthesis process.

McMills hopes that the nitrogen-containing azaphorbol will work more effectively than the molecular structure of phorbol in promoting activity in the cell, ultimately allowing for more interaction in the signaling pathways of cancer development.

Carnes will be using many high-level techniques over the summer to create azaphorbol. One such technique is called chromatography. By passing a sample through a chromatography column, different components of the solution are absorbed at various lengths of the column dependent on that component’s polarity. In Carnes’ case, the chromatography column is filled with silica gel that allows the separation and purification process of the sample to occur. Chromatography is important for Carnes in separating azaphorbol and its precursors from other molecules so that he prepares a pure substance.

“It’s tedious, but so rewarding,” Carnes said, describing the process of generating azaphorbol.

As of summer 2013, Carnes only had taken the first year general chemistry series, so much of his learning is occurring as a hands-on process. McMills teaches second-year organic chemistry and is teaching his apprentice methods to synthesize phorbol, and similar, cancer-promoting molecules.

McMills appreciates the learning style that the HTC tutorial system affords students. “These are pretty high-level procedures, especially for a first-year student,” McMills said. “If [he] had not been an HTC student, I might have not taken him.”

McMills hopes to have the portion of the study Carnes is working on completed by the end of the summer to send the sample amounts of azaphorbol made by Carnes for biological testing. These biological assays, as they are called, will determine if azaphorbol is more active in signaling pathways of living cells than current anti-cancer agents used for treatment.

“There is something really different about learning in the lab,” Carnes explained. “It’s the same mindset as the one behind the tutorial process—learning theories and then being able to implement them immediately is a great opportunity.”

Carnes plans to continue his academic relationship with McMills, taking one of his courses in Fall Semester.

Project funded by the College of Arts & Sciences
Monogamous Mammals

The mating habits of science’s favorite lab subjects might be more familiar than we think.

When thinking about rodents, monogamy might not be the first trait that comes to mind. However, their monogamy rate is 10 times higher than that of mammals as a whole—30 percent as opposed to 3, according to a study conducted by biologist Dr. Donald Miles and his collaborators. Miles and his research apprentice, junior HTC Biological Sciences major Genevieve Furtner, are trying to figure out why.

Miles has developed a hypothesis based on previous studies of rodent mating systems. His research has revealed a potential link between rodents’ life history traits and their mating systems. For example, a large animal might have a small litter size because it is expending most of its energy on growth and survival. The smaller litter size decreases the amount of offspring for the male—and with it the likelihood of his sperm being spread—which drives him to...
spend more time protecting his litter and female, hence forming a pair bond and, potentially, a monogamous one. Miles hypothesizes that these kinds of life history traits may also hold true for smaller animals such as rodents.

To look for evidence, Furtner will be digging through databases, like PanTHERIA and Google Scholar, looking for published data, such as testis, litter size and life span, and trying to pair them with a mating system, whether monogamy, promiscuity or otherwise. She will consider the life history traits of 287 species of rodents in search of such correlations.

“What we want to do is have this global analysis of what drives mating systems in animals, and rodents in particular,” Miles said.

However, he explained that the project focuses on more than just monogamy. Rodents encompass a wide variety of species, but within those species, even more mating systems exist, complicating the issue.

For example, monogamous rodents form a stable, exclusive pair bond. Polygamous rodents’ males mate with multiple females but still form pair bonds. Promiscuous rodents mate freely, create litters with mixed parentage, and contain multiple males siring pups. Within one species of rodent more than one of these mating systems can appear, making for a complicated set of data and a complicated job for Furtner who must figure out how to sort through it.

Nevertheless, she is unfazed by the prospect of analyzing streams of numbers. “[Dr. Miles] told me what I have to do, what I have to get done, and it’s my job to get it done,” she said.

Her confidence possibly stems from the two tutorials she has had with Miles in the last year, one of which focused on data analysis of sharks’ life history traits.

But this didn’t prevent her from lamenting, “It’s not a very glamorous job.”

“What we want to do is have this global analysis of what drives mating systems in animals and rodents in particular.”

—Dr. Donald Miles, professor of biological sciences

It is, however, valuable and relevant experience. In her career as a biologist, she explained, there will be more literature reviews and secondary data analysis to come, making them important skills to learn. But for now, Miles and Furtner’s research will culminate in an article on which Furtner will be listed as a coauthor, of even more direct benefit to her.

“In biology, it’s a very important thing to get your name out there,” she said.

Rodents, on the other hand, already enjoy strong name recognition. Mice and rats are ubiquitous in science, particularly in the lab. An ocean of data on them exists, which made rodents a logical choice for Miles to study. If he and Genevieve can find the relationship between mating systems and life history traits in rodents, it could lead to a greater understanding of mating systems in all animals.

Not a bad start for Furtner.
Sequencing a Rare Disorder

Cracking the code to one of America’s rarest disorders has bioinformatics Professor Dr. Lonnie Welch turning to the help of computer programming.

In the lab, the long-term implications of disease research—especially for a rare disorder—can feel remote. Such could be said for Ataxia Oculomotor Apraxia Type 1 (AOA1), a neurodegenerative disorder with only two known family cases in the United States. However, for Dr. Lonnie Welch and his apprentice, senior HTC Biological Sciences major Meg Nicol, this research hits close to home. While one AOA1 family lives in Texas, the other resides in Athens.

The McCollisters are a family of five, and their two older children were diagnosed with AOA1, a progressive disease carried in recessive genes. Characterized by deterioration of muscle mass and loss of motor coordination, it is the result of the degradation of the cerebellum, the part of the brain just above the spine. As the cerebellum degrades, its ability to run the muscular system and control the body weakens. People with AOA1 can live to normal life expectancies, but they often spend much of their
lives in wheelchairs.

“Imagine that for the last 10 or 12 years, you’ve been progressively getting weaker, losing function in your legs, your arms, your muscles, and even your mind,” said Welch, a professor of electrical engineering and computer science. “And by your early 20s, you’re confined to a wheelchair, you can barely talk, and you’re slowly wasting away.”

In order to understand this unique disorder, Welch and Nicol combine the strengths of two disciplines, computer science and biology, to conduct bioinformatics research. They are using computational processing to search through the genes of three other similar genetic disorders to help identify AOA1’s cause. Welch intends to use the three hereditary ataxias, inherited diseases that are characterized by the deterioration of muscles and motor control, in order to see if they can find something. However, because of AOA1’s rarity, research on it is rare as well.

“There’s not much medical research focusing on AOA1 because it’s not cost effective,” Welch said. The government and pharmaceutical companies will not invest in it because finding a cure will help so few people. They simply have bigger fish to fry. But with the freedom of the academy around him, Welch is able to devote time to it.

“I taught a class on bioinformatics, and we did a case study on this family, the McCollisters,” Welch said, explaining the research project’s origins. He brought Brian McCollister, the family’s patriarch, into the class to discuss how his children’s disease has progressed. He thanked the class for their willingness to do the research in Welch’s course. Nicol remembers the visit well.

Welch had assigned his students to look for anything worth noting about the aprataxin (APTX) gene, the known cause of the disease. At the end of the class, he asked if anyone would like to keep working on the project, and he was approached by Nicol, who indicated that she’d like to keep working on ataxia as a prospective topic for her thesis.

“Meg’s career goal is to be a genetic counselor. She really likes this project because it allows her to deal with something that is a genetic defect, and it involves a family that she’s gotten to meet and talk with,” Welch said. Nicol’s professional aspirations are well suited to the kind of work the two researchers are doing. By mixing the personal touch of counseling with the hard science of computational biology, she has found a project that engages her.

“Bioinformatics is using computer science and programming in order to solve biological problems,” Nicol said. “It’s applying these methods that we can directly control and change for our needs to meet biological issues.”

A bit of data is all the researcher requires to begin. From there, it is all computer programming to search for patterns, make comparisons, and find specific segments of genetic code. For genetic research like Welch’s, this kind of programming takes a complex piece of information like a human genome and turns it into a rich database to which he has access.

“You’re looking for one repeat, let’s say it’s GAATC,” explained Nicol, referring to a hypothetical DNA sequence in the human genome.

By your early 20s, you’re confined to a wheelchair, you can barely talk, and you’re slowly wasting away.”

—Dr. Lonnie Welch, professor of bioinformatics

“You could either look at those millions of lines of code for that repeating segment, or you can write a computer program to find that for you and have it tell you the positions of all the occurrences of that pattern.”

This kind of ability is vital to the research Nicol and Welch are doing. As they compare the genetic pathways involved in AOA1’s progression with similar pathways affected by other common hereditary ataxias, using computers to find commonalities makes the research possible. In order to better understand this rare, debilitating disease, they can dig into the genetic codes that cause it and look to see if there’s some kind of gene acting similarly in all the ataxias.

“Basically, what we’re doing is advancing the understanding of living things through computation,” Welch said. And in a case like this, with a rare disease and a suffering family, that understanding has direct implications.

Project funded by the Russ College of Engineering and Technology
Obesity has reached epidemic levels. The Centers for Disease Control and Prevention classified 35.7 percent of American adults as obese in 2010. Being overweight is also linked to common metabolic diseases, such as cancer and type 2 diabetes. However, some researchers are challenging that relationship by separating the complexities of such diseases from the weight of those they afflict. Is it possible to be fat and healthy?

Dr. Darlene Berryman, professor of food and nutrition and executive director of the Diabetes Institute at Ohio University, is one such researcher working to disassociate the traditional causes of metabolic illnesses from their possible culprits. In Berryman’s lab, sophomore HTC Biological Sciences major Nicole Brooks worked alongside diabetes investigators and graduate students on various projects, researching the mechanisms at work in the development of diseases such as diabetes.

One of those projects examined how blood vessels form in fat tissue. Fat tissue, which stores excess fat, has a capacity to greatly expand when excess energy is taken in. For tissue to remain healthy after expansion, new blood
vessels must be formed, explained Berryman. As a result, understanding what contributes to the formation of new blood vessels could provide insight not only on the ability of fat tissue to expand, but also on how obesity contributes to numerous metabolic problems. Berryman and her researchers are studying whether there’s a connection among the formation of new blood vessels in fat tissue, growth hormone and the development of diabetes.

The research team has another project that concerns growth hormone levels and how mouse models with different levels survive over time. In the study, researchers used genetics to “knockout” a specific gene, disrupting the reception of growth hormone in a mouse’s brain. The researchers have found that lean mice—which were genetically modified to have high growth hormone content in this mouse model—live relatively short lives, whereas obese mice with stunted growth hormone levels live longer, healthier lives with little disease.

“In these mouse models the diseases that are common to obesity are not linked to obesity,” Berryman said. “We have fat, healthy mice and lean, unhealthy mice.”

Berryman explained that fat was once thought to be a very inactive and simple component of human physiology. She said that in the past two decades, scientists have found that adipose tissue, or fat tissue, is actually far more dynamic and complex than previously thought.

“They didn’t think it was doing very much,” Berryman said. “There are all these new discoveries and facts that we’re finding out about all the time that we can apply to our mouse models.”

As Berryman waded through those new discoveries, Brooks was just beginning to learn the basic skills necessary to work on the projects that Berryman is undertaking.

“Obesity is obviously a huge problem, especially in America today,” Brooks said, explaining that obesity can take a toll on the cardiovascular system, vital to our health. “I think that’s why I especially want to get involved in a project that relates to the heart and cardiovascular function. These are huge problems in health and medicine.”

Brooks has learned how to analyze adipose tissue under a microscope by measuring the size of adipocytes, as well as by determining the amount and location of vessels in the tissue. All of those skills are further developing Brooks’ interest in becoming a doctor.

“I’d never worked in a lab before. I genuinely like going to work every day. It’s exciting to me,” Brooks said. “In tutorial last year, we’d read scientific papers about research projects like this, but actually seeing it firsthand has been a really exciting process.”

Berryman’s goal for Brooks and other young researchers like her is to expose them to as many different scientific techniques as possible. She finds that even within research, students have varying tastes and interests that make them stronger on different types of projects. According to Berryman, research experience is not only beneficial but is essential to undergraduates.

Brooks hopes to one day attend medical school and specialize in cardiovascular medicine. The apprenticeship with Berryman gave her access to real scientific work that she said is only strengthening her interests. In the near future, Brooks plans to continue working in the lab into Fall Semester, potentially making a thesis project out of her work.

As far as end-game professional research goals are concerned, Berryman hopes to one day completely separate excess weight from the diseases associated with it.

“My goal is for people to be fat and healthy,” Berryman says. “If we can’t solve the obesity epidemic, at least we can disconnect obesity from all the other diseases that come with it.”

― Dr. Darlene Berryman, professor of food and nutrition

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Project partially funded by the Diabetes Institute
Good Vibrations

Dr. Mark Berryman’s study of a novel protein complex may offer practical solutions for deaf individuals.

Over the years, Dr. Mark Berryman has narrowed his research to the minute protein complexes of human cells. Recently, along with the help of research apprentice Elizabeth Mathias, his work may offer some explanation for human deafness.

Berryman, an associate professor of cell biology in the biomedical sciences department, was researching the multiple incarnations of a specific protein called CLIC5. When he found out that this protein might be one in a complex that may cause deafness, he and Mathias, a senior HTC Biological Sciences major, tried to find out what role the complex played in the disability.

The human ear has tens of thousands of microscopic hair cells, which are covered by finger-like projections called stereocilia. Acting as microsensors, the stereocilia’s movements convert sound waves into electric impulses that are then sent to the brain, allowing people to hear. CLIC5 is found at the base of those hairs, and Berryman believes that it may be partially responsible for keeping the cells’ membrane in place. If the membrane does not keep the stereocilia separate from each other, they lose sensitive and valuable surface area, which causes problems in translating the vibrations into electrical signals to the brain.
“Think of it like fingers in a glove versus fingers in a mitten,” Berryman explained.

Along the membrane surface, stereocilia are gathered in bundles that have a precise location. They are connected but still able to move on their own, which allows them to vibrate when sound waves hit them and then send those vibrations to the brain. Each individual projection is covered in a thin membrane that coats the entire bundle. If the membrane dislodges, the stereocilia lose their ability to sense sound waves, and hearing can be damaged or lost completely.

The team’s summer goal was to understand more about the protein complex that holds the membrane in place. In order to understand the individual proteins, Mathias created synthetic versions of them in the rapidly reproducing bacteria E. coli. That way, she could have multiple copies of the protein with which to work.

Mathias began the process by creating a particular DNA sequence that codes for the protein she aimed to study. To clone a sequence, she inserted the DNA strand into a DNA plasmid, a structure that can be taken up by a bacterium. The bacterium did all the heavy lifting – it not only copied the DNA strand, but also translated it into RNA and then into amino acids, which form the protein. However, Mathias’ real challenge came in isolating the specific protein she created for copying within the hundreds of proteins a bacterium generates naturally.

In this process of isolating the proteins—known as protein purification—Mathias lyases the bacterium, destroying its membrane and releasing the bacterium’s contents into an open solution—which contains all the proteins. Next, Mathias added a synthetic substance to the solution called resin: a substance made up of tiny beads that bind to the proteins Mathias hoped to observe. The resin could distinguish those proteins from the other proteins present in a bacterium because of a DNA tag Mathias placed within the protein’s DNA sequence before cloning.

The goal of the process was to study how the isolated proteins bind together in the CLIC5 complex. The team hoped it would help people to better understand the technical problems that cause deafness and one day aid in developing a treatment to prevent or reverse hearing loss.

Mathias has worked with bacteria before, but the process of cloning and protein purification was new to her. Although Berryman was always available for assistance, Mathias said that one of the highlights of the project was the autonomy and personal responsibility she had as an apprentice.

On Berryman’s end, he aimed to give Mathias the full experience of doing scientific research, from the exciting aspects of discovering new techniques to the “boring but important” elements of bookkeeping and tracking labels. As a collaborator on the project, regardless of the task, her contributions were crucial to the future of the research.

“She is making essential tools for the project,” Berryman said, referring to Mathias’s role in working on the kinks in the bacteria cloning process.

In the short term, Berryman hopes that the research will lead to a better understanding of how the membrane on the stereocilia works. In the long term, the research could contribute to a more complete awareness of the causes of hearing loss. If CLIC5 turns out to be one of the main reasons that the membrane pulls away from the hair cells, the research could help prevent deafness.
Stories of Healing

The act of narration may offer trauma victims a promising healing therapy.

With dreams of being a doctor, Amanda Dunson took a course her junior Spring Semester that made her think twice. The class covered trauma.

Fascinated by the subject but unable to find a follow-up class, Dunson, an HTC Biological Sciences major, decided to apply for an apprenticeship with Dr. Joseph Bianco, an assistant professor of social medicine and adjunct professor of communication studies. He was interested in furthering the interdisciplinary possibilities of trauma research. Their research undertakes the study of trauma narratives: how people tell stories of their trauma and how the act of telling can help them reclaim their experiences.

Bianco’s path to this research topic began at Ohio University during a postdoctoral fellowship in clinical health psychology at the O’Bleness Family Practice Residency Clinic. He found that narrative therapies, which use a story-based approach to healing, were especially relevant for patients with trauma histories.
goal of this type of therapy, Bianco explained, is to assist patients in rediscovering their own agency. He added that it is the difference between an individual being a passive recipient of a traumatic experience and being an active author telling his or her story.

“Narratives are dynamic,” Dunson said. “Just by telling your story, you’re changing it.”

This summer, Bianco and Dunson are collecting trauma narratives, as well as academic literature about trauma physiology and treatment. Bianco said that although many psychologists use narrative therapy, there has been little research on its larger impact. He said that many stories have been published, and he hopes to create an overview of practices. One of his long-term goals for this project is to create a manual on narrative therapy to help psychologists use the technique more effectively.

As a part of this research, Dunson is conducting literature reviews from diverse disciplines, including her own. In a biology article, Dunson discovered one interesting tidbit that related trauma to gene regulation. Research in mice has found a correlation between traumatic experiences and whether certain genes are turned on or off.

However, the bulk of Dunson’s research has looked specifically at narrative-based therapy accounts and physiological aspects of trauma, such as the response of hormones in the body. One such area has concerned Adverse Childhood Experience (ACE) studies. These studies look at the correlation between traumatic experiences in one’s childhood and the likelihood of negative behavior or illness in adulthood. Dunson points out that after four ACES, a person’s risk for disease or behavior alterations increases dramatically. In other words, there is a possibility that traumatic experiences can affect not only one’s behavior, but also health, for the rest of one’s life.

Bianco noted that with her background in lab research, Dunson brings a different perspective to the project, contributing ideas that he had not considered. Bianco has been impressed with the level of dedication and thoughtfulness that Honors Tutorial College students bring to their work and, although he considered working with a student in the humanities with a background in narratives, he decided to go with someone outside the field.

For Dunson, the apprenticeship has made her reconsider a premedical track in the immediate future, by showing her alternative paths she might take to help people.

“When you think about becoming a physician, you think about the good parts, you think about helping people. But there’s so much more to it than that,” she said, admitting that she did not want to be the one to give individuals bad news. She is pursuing public health administration in order to look at health issues on a societal level. Through her apprenticeship, Dunson has been able to do that by studying how large groups of people have responded to trauma, and as a public health administrator, she would be able to spread information about useful therapeutic techniques.

“[The apprenticeship] applies my major to something that I normally wouldn’t be able to experience,” Dunson said. “It will put me in a better position for working with people.”

Dunson considers this one of the biggest rewards of the apprenticeship. She said that doing this kind of work has taught her to pay more attention to people’s stories and has given her insight into how individuals deal with traumatic experiences. She realized that trauma is a widespread aspect of people’s lives and advocates the universal importance of her research.

“The stuff that I’m learning here, I feel like everyone should learn,” she said. Everyone will experience reactions to trauma, either their own or others’, and she believes that the research she is doing will help others understand how to cope and overcome.

Project funded by the Vice President for Research
Dr. Robert Brannan’s pawpaw research offers local fruit a potential debut on the national market.

A cross between a mango and a banana ... It almost has the aftertaste of an orange rind.”

That is how Katie Black describes the pawpaw, a tropical-like fruit native to Southeastern Ohio. Black, an HTC sophomore studying Biological Sciences, is working alongside Dr. Robert Brannan, and several graduate students on research that focuses on the antioxidant properties of the pawpaw.

Antioxidants are a class of molecules that prevents the oxidation process in other molecules. Too many oxidation reactions can be harmful to living tissue—a reason antioxidants have been marketed as health supplements in recent years. Antioxidants similar to those found in the pawpaw have been shown to be particularly effective at preventing harmful oxidation reactions.

Brannan, an associate professor of applied health sciences and wellness, has completed various research studies of the pawpaw, especially concerning its health benefits, but he is now turning his attention to the viability of the antioxidants found in the fruit to be used as an inhibitor of lipid oxidation – the cause of reduced shelf life in meat products. Currently, the meat industry uses synthetic antioxidants to prevent lipid oxidation, but Brannan believes antioxidants in the pawpaw could provide a
“Regardless of whether one is dealing with health and wellness or shelf-life of meat products, the chemistry of oxidation is very similar, and in both cases is detrimental,” Brannan said. “As a meat scientist, my interest is whether these antioxidants can be used as a natural additive to extend the shelf life of meat.”

Black spent much of her time on the project working on that hypothesis. By infusing pawpaw extract into raw turkey, and then comparing it to a control sample without the pawpaw, Black was able to determine how well the pawpaw antioxidants prevented the turkey from spoiling, she said.

Initial research done by Brannan suggested that the antioxidants in the pawpaw would be effective—now the goal is to determine which of the nine genetic varieties of the fruit have the stronger antioxidants, Black said. The team must also determine how to store them.

Grape seed extract is another natural source of antioxidants that is more widely used in commercial industries and health applications, like dietary supplements, Brannan said.

“There is much research on grape seed extract in the literature, so we are using it as a benchmark against which we can compare the antioxidant power of the pawpaw,” he said.

For Black, researching the pawpaw provides a stronger sense of connection to the Athens community.

“The thing that really drew me in was the fact that the pawpaw is so local to Athens,” she said. “It's not something that you would find in any other lab at any other school, really. I just liked that it was something so unique to Athens and it brought out even more of a sense of the community I live in.”

Since Brannan’s arrival at Ohio University, he has become well known in the pawpaw growers’ community. In 2011, the National Pawpaw Foundation elected him president, and he has authored three studies on the pawpaw and its physical and chemical properties in recent years.

“When I arrived at Ohio University, my predecessor performed pawpaw research,” Brannan said. “I had some familiarity with the fruit, but initiated my own research at that time.”

His work ranges from chemical analyses of the pawpaw’s antioxidants, to sensory analysis panels of the different genetic varieties of the fruit. In 2011, he gave a presentation raising the possibility that the pawpaw might follow the path of the pomegranate, which has been successfully commercialized in the United States.

“I think it’s really important that what Dr. Brannan is doing as president of the Ohio Pawpaw Foundation is trying to highlight some of their nutritional superiority—the stuff in the pawpaw that’s so good for you,” said County Commissioner Chris Chmiel. “That helps the whole industry.”

*Project funded by the College of Health Sciences & Professions*
last look

Ben Carnes, an HTC Chemistry student, aids in the preliminary stages of creating a cancer drug.