

MICROSCOPIC RESEARCH FOCUS

EXPANSIVE RESEARCH VISION

BY JEANNE SOKOLOWSKI

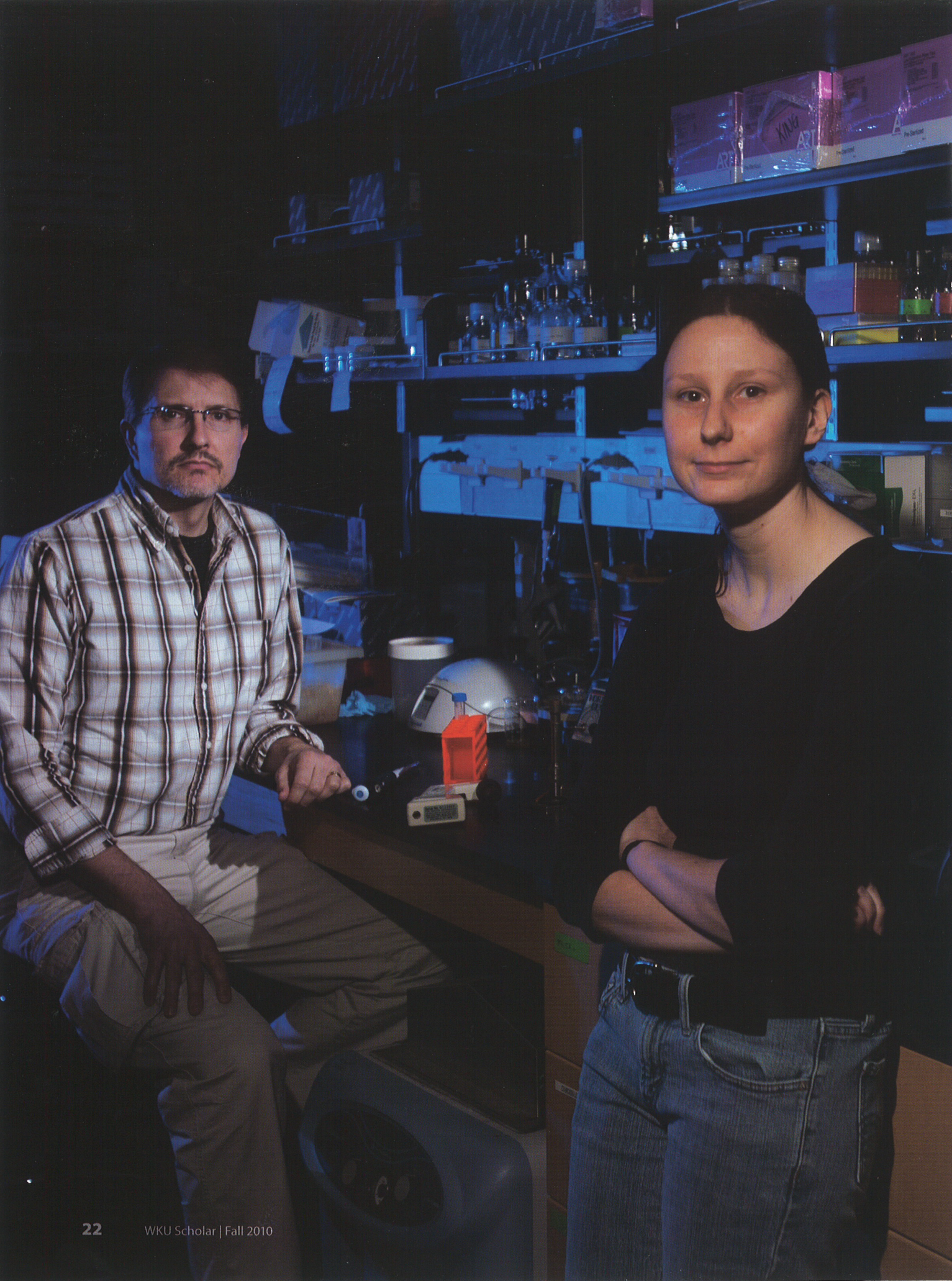


Dr. Rodney King

AS YOU TALK TO DR. RODNEY KING, IT BECOMES INCREASINGLY DIFFICULT TO BELIEVE THAT IT WAS ONLY EIGHT YEARS AGO THAT HE MADE THE TRANSITION FROM FULL-TIME RESEARCHER WITH THE NATIONAL INSTITUTES OF HEALTH (NIH) TO TEACHING IN THE BIOLOGY DEPARTMENT HERE AT WESTERN KENTUCKY UNIVERSITY. IN THAT SHORT PERIOD OF TIME, NOT ONLY HAS HE SUSTAINED A PRODUCTIVE INDIVIDUAL RESEARCH AGENDA, BUT HE HAS ALSO BEEN TIRELESS IN MENTORING AND ENCOURAGING NUMEROUS UNDERGRADUATE AND GRADUATE STUDENTS ON CAMPUS. LIKE THE UNIVERSITY, DR. KING CLEARLY PLACES A PREMIUM ON TEACHING AND STUDENT LEARNING, ASPECTS OF HIS JOB AS A FACULTY MEMBER THAT OCCUR WITHIN AND ARE COMPLEMENTED BY HIS OWN RESEARCH EXPERTISE AND INTERESTS.

After his undergraduate career at Virginia Tech, during which he took his first Microbiology class and got hooked on the field, King continued on for a Masters degree at the Medical College of Virginia/Virginia Commonwealth University. Originally, a Ph.D. wasn't in the works, but King fell in love with graduate school, and received, he says, great mentoring there and during his post-doctoral years with the NIH. "I've been very fortunate with my mentors," King said, describing them as individuals who gave him independence, but were always there to answer questions.

King's research involves the relationship between viruses and their hosts, specifically, how bacterial viruses, called bacteriophage, exploit the molecular machinery of their host to express their own genes. The organisms he looks at are small (an electron microscope is necessary for viewing), but their impact is profound. Bacteriophage are ubiquitous. It is estimated that there are 10^{31} bacteriophages in the biosphere — admittedly, King says, this number is hard to wrap your head around. "But if you appreciate that they're the most numerous biological entities on the planet," King adds, "then you can start to appreciate their impact."





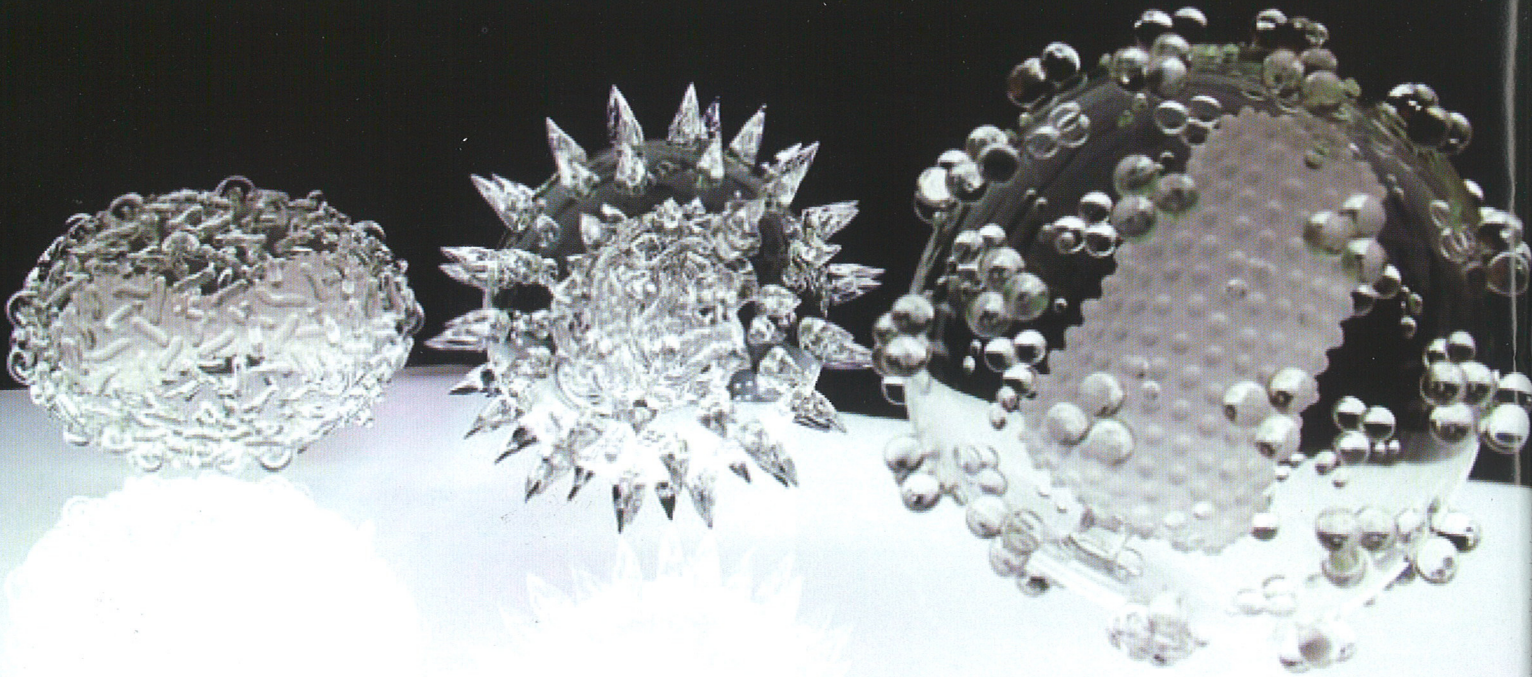
Bacteriophage do not infect humans, King points out. But in some cases, bacteria that carry certain bacteriophage do result in human or animal diseases, like diphtheria or cholera, for example. “Many of these familiar bacterial diseases,” King explains, “are due to toxins that these bacteria make. Well, it turns out that the genes for those toxins are actually carried on the viruses.” In other words, there is a kind of cyclical relationship among viruses, bacteria, and humans. King expounds on this: “Bacteriophage biology affects the biology of the host, that is the bacteria, which can contribute to its pathogenicity in us, the human population.”

King’s work is primarily on gene expression in bacteriophage — research at the molecular level. But the work that microbiologists like King do can have significant practical applications for humans, such as in the field of bacteriophage therapy, in which viruses are used to destroy their host bacteria — specifically, the bacteria which are potentially dangerous to human health. The virus becomes a weapon that humans can use to defend against the threat of harmful bacteria. Research in the former Soviet Union, for example, has resulted in the creation of “phage cocktails” that can be applied to an open wound. The viruses in the cocktail attack the targeted pathogen and thus help defend the human body against possible infection.

As much as he enjoyed the pure research he was doing at the NIH, King eventually decided that it was time to shift gears. “The transition into academics was always something I thought I would do,” King says, “I just didn’t know when it would happen.” To facilitate the move into teaching, King mentored summer students at the NIH, and also taught a laboratory course at Marymount University in Virginia. Additionally, he built his teaching experience by giving presentations of his research to other scientists at the NIH.

“It was a transition,” King admits of coming to WKU to begin his career as a college professor. “Going from total research to actually having my time split up and divided into other responsibilities was a challenge.” But King speaks with enthusiasm of the rewards of the job, particularly the opportunity to recruit and work with undergraduates and graduate students here at WKU. “I’ve had a tremendous group of undergraduate and graduate students come through,” King enthuses.

His mentoring success is apparent with Ali Wright, one of the first students with whom Dr. King worked. Wright has received recognition as being the first WKU student to complete the entire DNA sequence of an organism — the genome of a bacterial virus. She calls King a great mentor, but acknowledges that he has high standards. “He does demand that students know the material,” Wright says, “but he also makes sure the students know that he is available to help if there is a point they are struggling with.”



Ali Wright

When asked about his role in developing Wright, and other students, as young scientists, King focuses on an approach that is supportive, but based on continually querying students about the research choices they make. At every step, King says, he is asking questions of the decisions that they make in conducting experiments. He also highlights interpretation of results as one of the key areas in which students need supervision and guidance. "I can show a student how to do a technique," King says, "and they can do it right away. But then they need to start thinking more deeply about that, and that takes time. That's where it takes closer mentoring to make that transition and get that deeper understanding."

King's teaching and mentoring efforts have extended beyond the WKU student body. He is currently assisting with a Research Experiences for Undergraduates (REU) program, underwritten by the National Science Foundation (NSF). With assistance from WKU's

Office of Scholar Development, King and another member of the Biology Department, Dr. Shivendra Sahi, co-wrote the three-year grant to set up a program that will bring in students from across the United States to engage in intensive research, but also to help educate these students about graduate school, funding opportunities and

in students, give them an intensive research experience and get them excited about research," King notes. The program is open to students who are early in their undergraduate careers because, according to King, "we want them to go back and build upon this experience and get involved in research at their own institutions."

"The idea is to bring in students, give them an intensive research experience and get them excited about research."

the process of taking their education further. He and the other REU mentors will work with the students for a total of ten weeks. There are several Gatton Academy students participating, as well as students from other schools across the state, including one from Kentucky's Community and Technical College System (KCTCS). Students have also come from as far away as Texas and California to participate in what is an interdisciplinary experience: the REU program includes faculty from Biology, Mathematics, Chemistry, and Bioinformatics. "The idea is to bring

King's approach to his work with the REU students — facilitating hands-on learning that gets them excited about science and about research — is the hallmark of other classes that he teaches, including the wildly popular "History and Science of Beer and Brewing," which he has co-taught twice with Dr. Andrew McMichael of the History Department. For those inclined to dismiss the class as lightweight, geared toward attracting less serious students, King says drily, "Let them take a look at the syllabus, and take one of the tests." (It's also the case that

this course is only offered to Honors College or Honors-eligible students, another factor ensuring the rigor of the course.) Brewers themselves, King and McMichael walk students through the process of making their own beer, while educating the students on the biochemistry of the fermentation process and the rich history of beer in American culture. Though there is definitely a sense of fun in experimenting with recipes to get a desired taste or texture, King also emphasizes the science behind the process. "I'm using a living organism (yeast) to get a product. And I am using the biochemistry of that organism to give me something that has a great taste and has these different properties." Students emerge with a much greater appreciation of how and why a lager or a wheat beer tastes the way it does, and the science behind the production of the beverage.

It should come as no surprise that Dr. King is the current chair of the Student Research Council at WKU. A large part of his efforts focus on helping plan the annual Student Research Conference, a task complicated, he says, by efforts to be inclusive of a range of disciplines, and because of the various forms which research presentations can take, from posters to performance to video. In the past year, the Student Research Council has been particularly involved in an initiative to integrate college-wide efforts to encourage research. King mentions specifically the website which acts as a clearinghouse for listing various research and funding opportunities. And not just in the sciences, he is quick to point out; this initiative encompasses all the various departments on campus.

King's current teaching passion is the National Genomics Research Initiative. This project helped establish the WKU Genome

Discovery and Exploration Program, which he teaches with Dr. Claire Rineheart. WKU is one of thirty-six universities nation-wide chosen to participate in the program, which is sponsored by the Howard Hughes Medical Institute's Science Education Alliance. Genomics, King explains, is "the study of the genomes of the entire DNA sequence of an organism." Working with bacteriophage is especially suitable for the classroom, as its single piece of DNA makes it very manageable

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to isolate during the course of a semester. King's enthusiasm for the Genome Discovery and Exploration Program stems, he says, from the excitement it generates among students, particularly those with no prior research experience. "They can do authentic research in the classroom setting," King says. "This program allows them to experience the thrill of discovery because they're going to isolate the virus, they're going to go out and retrieve the soil sample. So it gives them also a sense of ownership." The process also, he notes, mimics the unexpected nature of research. "Here, we don't know what's going to happen, and we tell them that right off," King says. As a result, students get a sense of how research really occurs.



Sarah Schrader

Sarah Schrader, a Gatton Academy and Chinese Flagship student who took King's Genome Discovery and Exploration course this past year, was able to experience the thrill of isolating her own unique

bacteriophage from a soil sample while in the class. Schrader was appreciative of King's teaching style, saying, "He not only explained the processes to us very clearly, but also told us why each step was necessary and what was happening during each part of our experiments." She goes on to describe King as a knowledgeable, patient and helpful teacher, but not, she observes, the type to hand-feed students. "He rarely gives a direct answer to a question," Schrader comments. "Instead, he helps guide

your thinking until you discover the answer yourself." From her experiences in the Genome Discovery class, Schrader became interested in working with Dr. King outside of class; she hopes to continue to work on the phage she isolated, and to identify all the genes in the genome of the virus. After graduating from the Gatton Academy in 2011, Schrader's intention is to remain at WKU to pursue an undergraduate degree before embarking on a PhD program, most likely in genetics or a related field.

Looking forward, King anticipates continuing to work with the many promising students at WKU, and broadening his own research to take advantage of the bacteriophage sequencing occurring here on campus. King expresses an interest in moving into the area of whole genome expression analysis, and in looking at how multiple genes work together with each other. His research may focus on life at some of the most microscopic levels, but Dr. Rodney King has no trouble seeing the big picture, and helping students move seamlessly between these two worlds. ■