

Exploring the UNKNOWN

With her first microbiology course, Dr. Joan Wilson's career path was set. Now she is a senior scientist at the Marshall Institute for Interdisciplinary Research.

In the science-fiction novel and hit movie *Jurassic Park*, make-believe scientists manage to clone giant, menacing dinosaurs.

"We're not hiding a cloned Tyrannosaurus Rex in our building," says Dr. Joan Wilson. Nevertheless, she describes her job as "like coming to work in a Jurassic Park every day."

"I'm working in a brand-new field with lots of exciting surprises all the time," she says. "That's my Jurassic Park. I work in a field that, 10 or 20 years ago, most scientists hadn't seen, hadn't even glimpsed."

An expert in molecular biology, Wilson is a senior scientist and group leader at the Marshall Institute for Interdisciplinary Research (MIIR), a key vehicle in the university's efforts to produce patent-worthy scientific breakthroughs and spawn new high-tech businesses. Interviewed in her office at the Robert C. Byrd Biotechnology Science Center, Wilson explains a bit about her work.

Article by James E. Casto

Photos by Rick Haye & Rick Lee

Dr. Joan Wilson, senior scientist at the Marshall Institute for Interdisciplinary Research, conducts research to develop noncoding RNA-based tools and technologies.





MIIR Adds Third Scientist

Dr. Jingwei Xie joined the Marshall Institute for Interdisciplinary Research (MIIR) in January, becoming its third senior scientist.

Xie has more than 10 years' experience in biomaterials, tissue engineering, micro-/nanofabrication, biosurfaces, formulations, drug delivery, biotechnology and nanotechnology. In his most recent appointment as a post-doctoral research associate at Washington University in St. Louis, he developed a number of projects related to biomedical applications, including neural tissue engineering, tendon-to-bone insertion site repair and drug delivery.

At Marshall, Xie will focus on bionanotechnology and will collaborate with researchers at Marshall's new Center for Diagnostic Nanosystems, where scientists are working to apply advances in nanosensor technology to improve the accessibility and capabilities of rural health care resources.

Prior to joining Washington University in 2007, Xie was a post-doctoral research associate at the University of Washington in Seattle and a research fellow at the National University of Singapore. He is the co-inventor on two patents, was co-investigator of a National Institutes of Health-funded pilot project and has co-authored more than 30 peer-reviewed journal articles.

Xie has bachelor's and master's degrees from Nanjing University of Technology in China. He earned his doctorate in chemical and biomolecular engineering from the National University of Singapore.

"We have found that the protein coding genes in the human genome comprise only two percent of it," she says. "There's a lot of interest in studying the remaining 98 percent. The molecules I work in are one of the components of this remaining mysterious part of our genomes. I study a class of molecules called the noncoding RNAs. They're sometimes called the 'dark matter' of the genome. We didn't even know they existed until recently, but we have since found there are thousands of these small noncoding RNAs, which I refer to as microRNAs. They have been shown to regulate every known cellular pathway we have looked at so far. They represent potential new markers and potential new therapeutics for treatment of a number of diseases and developmental disorders."

Wilson was the second scientist to join MIIR since it was created with funding from the state's "Bucks for Brains" research trust fund. The first was Dr. Eric Kmiec, director and lead research scientist of MIIR. It was Kmiec who recruited Wilson.

"She's exactly the kind of person I want to attract to the organization," he says, "someone with both an academic and biotechnology corporate background, who has taken basic discoveries and made them successful in the marketplace."

Wilson came to Marshall in 2009 from System Biosciences, a California company, where she managed a fast-growing product portfolio that contributed 40 percent of the company's sales revenue. Prior to that, she was a senior applications scientist and product manager with Panomics (now Affymetrix) and a research fellow at the Harvard Institute of Proteomics.

Growing up on a farm in Virginia, Wilson originally thought she wanted to be a veterinarian – until, that is, she found herself pressed into service to help a vet stitch up one of the family's injured horses.

"I had to walk away and sit down, green and totally pale," she recalls. "I can't do this," I realized. But I loved science so much there was no question that I was going to major in biology. That's what I did at the College of William and Mary, and the first time I took a microbiology course, my career path was set. I was so excited by DNA and the molecules that control genes, I was absolutely determined to be a research scientist, absolutely determined to be a molecular biologist."

She went on to earn a doctorate in biological sciences at Stanford University, following that with post-doctoral work at Stanford and Harvard.

In addition to her own research, Wilson is collaborating with the Marshall College of Science, which recently



Dr. Wilson joined the Marshall Institute for Interdisciplinary Research in 2009. An expert in gene regulation, Wilson's research at MIIR may lead to the discovery of new drugs and treatments for a variety of diseases, including breast cancer and AIDS.

was awarded a National Science Foundation grant that included funds to establish a genomics research program. The grant enabled Marshall to purchase West Virginia's first next-generation DNA sequencing machine.

"With this revolutionary technology, we can now determine the exact sequence of every single gene in an organism's genome," explains Wilson.

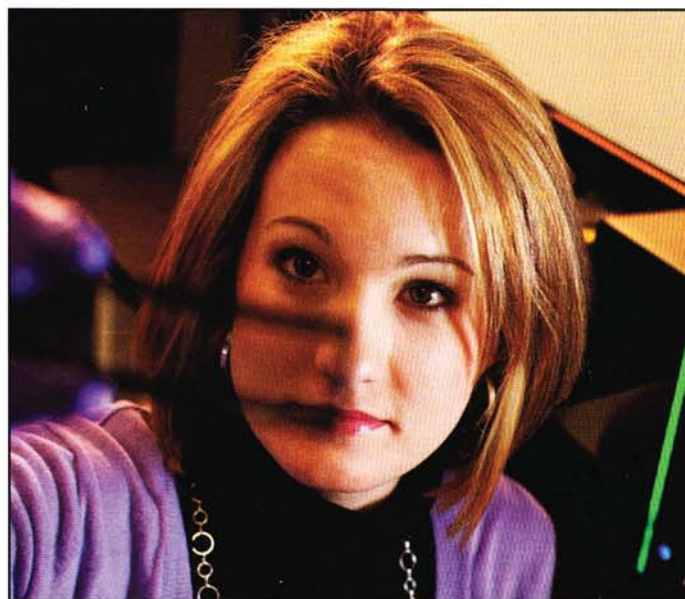
The sequencer's first task was to solve a long-standing research question for Dr. Wendy Trzyna, an associate professor in Marshall's Biology Department, who works on *Acanthamoeba*, a free-living, single cell microbe. Trzyna has identified one strain in particular that infects humans. After more than a decade of research, however, it remains unclear why this strain in particular is pathogenic. She believes that the secret may lie in the organism's genome.

"After only our very first sequencing," says Wilson, "we now have in hand complete genome sequences for the infectious strain as well as two closely related but non-infectious ones."

The sequencer's next challenge, she says, will be – in a single-run, "shotgun" approach – to characterize the genomes of all of the organisms in multiple local water

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-Dr. Eric Kmiec
MIIR Director



Dr. Wilson's research team includes graduate assistants Mindy Applegate (left) and Cassie Vickers (right). The team focuses on identifying noncoding RNA disease biomarkers and developing noncoding RNA-based tools for gene regulation and genome manipulation. Partnerships between the MIIR research team and leading biotechnology companies provide funding for the research and open the door for biotechnology-related businesses to emerge throughout the entire region.

samples, taken from the Ohio River or area streams. The goal, Wilson says, is "to produce new insights into the effect of environmental conditions on biodiversity."

If she's not at work in her campus lab, you're likely to find Wilson perched on her bicycle. She often pedals from her South Side home to Beech Fork State Park and back.

Her passion for cycling prompted her at one point to put her scientific career on hold and devote herself to bike racing. As a member of the U.S. National Cycling Team from 2000 to 2003, Wilson competed nationally and internationally, including such prestigious events as the Tour de France and Giro d'Italia.

She says she thought long and hard before undertaking her cycling venture.

"It was enormously disruptive to my career," she says, "but I know that I was at a point in my life that if I didn't do it then, I would never have that opportunity again."

Catching up on what had happened in her field when she returned to it was difficult, she says, "but it was also fun."

"I left at a time when there were things we didn't understand very well. When I came back there was a whole new framework and I was able to jump right in. What followed was a period of exponential growth. So the timing worked out really well."

"These days I find myself cycling less and running more," she says. "I love running in the hills here."

Wilson says she also enjoys taking her dog, a Rhodesian Ridgeback named Kariba, to Ritter Park every day, and she describes herself as a "voracious" reader.

"Obviously, I have to read a great deal to keep up with the literature in my field," she says. "But at night, when I'm ready for bed, I have to read something else – a novel or maybe a biography – for a while. Otherwise I would be doing science in my head all night and would never get any sleep."

Her love of reading has made the Cabell County Public Library one of her favorite places. "I truly love it," she says.

Some people consider *Jurassic Park* a cautionary tale on unconsidered biological tinkering. As might be expected, Wilson has little patience with such fears.

"You can't fear the unknown," she says. "When you ask questions about the unknown, you're not sure what the answers are going to be. You don't know the answers, and that's why we do it. When you explore the unknown, you have to accept that some of the answers you find are going to take you places you never anticipated. That's one of the wonderful things about discovery research." □

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