Beyond the classroom

Biochemistry student works on molecular switch to kill cancer cells

By Marcia Locke

Kierra Holloman knew before she enrolled at Kansas State University that she wanted to work with DNA. The ambitious Fort Worth, Texas, native has been working in a laboratory since her freshman year at K-State. Now, the junior in biochemistry is directing her research toward fighting cancer.

Holloman works in the laboratory of Michael Kanost, university distinguished professor of biochemistry and molecular biophysics, under the supervision of Neal Dittmer, research assistant professor in the same department. She was excited to join this team because they work with DNA.

Holloman started out studying the use of double-stranded RNA to alter gene expression. Now, with a Cancer Research Award from the Johnson Cancer Research Center at K-State, she is zooming in on proteins involved in cancer.

Specifically, Holloman is studying proteases and serpins. Proteases are enzymes that break down proteins, and serpins are a type of protein that can inhibit proteases. This is important to cancer research because a protease in humans, called granzyme B, can promote programmed cell death, or apoptosis, in various types of cancer cells. And a protein called SerpinB9, which regulates granzyme B, can interfere with that process, allowing the cancer cells to survive.

The function of SerpinB9 can be blocked, however, by disulfide bonds formed through oxidative stress. So, in her study, "Regulation of protease inhibitors by oxidation of cysteine residues," Holloman is investigating how a serpin can be turned on or off by oxidation reactions. Using an insect serpin similar to human SerpinB20, she is studying how oxidative stress can cause formation of disulfide bonds between serpins and other molecules.

"What's especially exciting is that our method for forming the bonds between the serpin and cysteine or glutathione — if it can translate to human serpins — would be a discovery of a new mechanism for regulating serpins that have a role in cancer cell survival," Holloman said.

Holloman is grateful for this extensive research experience.

"I think the way this most helps me is in my classes," Holloman said. "I'll find myself in class thinking, 'Oh, I've done this in my lab' or 'my mentor talked to me about this.' It has helped my grades a lot, getting that hands-on experience. I also think it gives me a step up in my future because I want to work in a lab and I'm already getting experience using the equipment."

She is also grateful for the financial support of the Cancer Research Award.

"Doing all these classes and exams and lab work is stressful; I don't know how I'd be able to have another job," Holloman said. "And this is nice because it's an academic job, so you're learning at the same time as getting help paying for rent and food."

Making Holloman's research even more meaningful is that her mother is a cancer survivor. A few years ago she had a thymoma, a rare cancerous tumor in the thymus, an organ of the immune system.

"My mom is super-excited about my project," Holloman said. "She said it makes her proud to know I'm working on cancer research."

Holloman attributes much of her interest in laboratory research to her Richland High School forensics teacher.

"Mr. Sanders' class helped me figure out that I liked DNA analysis, which led me to do biochemistry and now cancer research," Holloman said. "I still thank him to this day."

After she graduates from K-State, Holloman plans to go to medical school to study biomedical forensic science. Until then, she'll be working hard to kill cancer cells in the lab.

$200,000 a year is dedicated to training students to do research.

$1,741,000 has been invested in undergraduate research training since 1980.