RESEARCH WYOMING

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UW UNIVERSITY OF WYOMING

Frog eggs may be key to possible cancer treatment

American Cancer Society awards $792,000 grant to continue research

University of Wyoming molecular biologist Dan Levy uses frog eggs to study cell regulation and its cancer implications.
UNIVERSITY OF WYOMING PHOTO

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Some people look at frogs and see slippery, croaking amphibians who inhabit lily-covered ponds. When University of Wyoming researcher Dan Levy looks at frogs, he sees an opportunity to expand the understanding of how the nucleus in animal cells becomes corrupted. And when the American Cancer Society looks at Levy's research, it sees an avenue to creating a possible cure for a menacing disease.

Levy, a UW College of Agriculture and Natural Resources Department of Molecular Biology assistant professor, is a recipient of a $792,000 grant from the American Cancer Society. He is examining the DNA in cell nuclei and what triggers the nucleus to enlarge, something that is recognized in diagnosing cancer.

Levy said he's had a longtime interest in cancer-related research.

"On the one hand, I am fascinated by the basic cell biology that underlies the formation of cancer," Levy said. "I am really motivated by the challenge of trying to figure out what is going wrong in a cell so that it starts to divide inappropriately to form a tumor and trying to learn why some of those tumor cells become capable of spreading throughout the body."

> "Reducing the size of the nucleus in a cancer cell might be a new way to treat cancer."
>
> Dan Levy, University of Wyoming molecular biologist

While the work is fascinating, it means more to Levy than just scientific inquisitiveness.

"On a more personal level, several of my family members and friends have been affected by cancer, as I am sure is true for most people," he said. "It is important to me to be contributing in some way to improving our understanding of cancer with the hope that this may lead to new treatments and ways to prevent cancer."

It's not just a whim that Levy's laboratory features a poster of a grinning Kermit the Frog, seemingly giving approval to the work by he and his colleagues. Inducing frogs to produce eggs, researchers spin the eggs in a centrifuge to break the eggs down. They then extract the proteins, membranes and cytoplasm and assemble nuclei in a test tube.

Researchers found the concentration of particular proteins -- the nuclear lamins -- appears to play a part in controlling the size of the cell nucleus.

"In almost all cancers, the nucleus, the structure present in most of our cells that contains our DNA, becomes enlarged," Levy said. "In fact, increased nuclear size is a key parameter used by pathologists to diagnose and stage many different cancers. What is not known is if this change in nuclear size is important for the growth of the cancer."

In Levy's laboratory, researchers are trying to understand why the nucleus becomes bigger in cancer cells.

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situations, (2) continue to function even when damaged, (3) deal with unreliable data from their sensors, and (4) generally become smarter, measured as the ability to solve challenges of varying complexities.

"We think that encouraging the evolution of structurally organized computational brains could help improve the ability of robots to do all of these desirable things, but we have to conduct the experiments to find out," Clune said.

Education is an essential outreach component of a CAREER award. Clune's grant will enable him and his students to continue to run and further improve the Laramie Robotics Club. Free to attend, the club teaches children a love for programming, science, technology, engineering and math (STEM).

Each week, students in the club get together and play with robots (see pictures and videos at www.LaramieRoboticsClub.org). They get to design their own challenges, such as having robots solve mazes or play robot tag. Because they want their robots to do something fun, they learn the programming and math required to accomplish their goals. Thus, they get to learn how exciting programming and robotics can be. Within the first year, one former member is now an engineering student at UW, and a former mentor is at the Massachusetts Institute of Technology on a full-ride scholarship.

Clune's educational goals extend beyond Laramie. His grant helps fund his plan to create a turn-key guide to "How to create a robotics club" that will be free for any community in Wyoming or beyond.

"People in Laramie and elsewhere in Wyoming are extremely excited about the Laramie Robotics Club. We have had many parents tell us it is their child's favorite activity," Clune said. "Overall the response has been heartwarming, encouraging, and very positive."

Computer programming and robotics represent a huge segment of the current and future economy. As the Seattle Times reports, there is a well-documented shortage of graduates in computer science nationwide. The Bureau of Labor Statistics projects that 70 percent of all newly created jobs across all STEM fields during this decade -- across engineering, the physical sciences, the life sciences and the social sciences -- will be in computer science.

"Any efforts to teach Wyoming children a love for programming, science, technology, engineering and math will ready them for the world they will grow up and work in, and it is rewarding to help them be able to be the leaders and innovators in a fast-paced, technology-driven economic and scientific world," Clune said.

"[The grant] also funds important outreach activities, mainly allowing us to continue to run the Laramie Robotics Club."

-Jeff Clune, UW computer science assistant professor

Jeff Clune works with members of UW's Robotics Club. Clune is one of the world's leaders in the study of artificial intelligence. UNIVERSITY OF WYOMING PHOTO

Clune has a bachelor's degree in philosophy from the University of Michigan, a master's degree in philosophy and a Ph.D. in computer science from Michigan State University, and was a postdoctoral fellow at Cornell University funded by an NSF Postdoctoral Fellowship. His research is frequently covered by the international media, including National Public Radio, NBC, *Discover,* the BBC, *The Economist, Wired, National Geographic and The Atlantic.*

For more about Clune's research, visit www.evolvingai.org/videos

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"Reducing the size of the nucleus in a cancer cell might be a new way to treat cancer," Levy said. "While changes in nuclear size are observed in most cancers, in my lab we are currently studying prostate cancer and melanoma cell lines."

The nuclear lamina appears to provide the structural support for the cell's nuclear membrane and by adding or removing specific proteins, researchers observe how those manipulations affect nucleus size. Research results were reported in the Nov. 13 edition of The Journal of Biological Chemistry, published by the American Society for Biochemistry and Molecular Biology Inc.

The process appears to be the same in human cells, as Levy's laboratory grew cells and found the same results, in that increasing lamins enlarged nuclei size and reducing lamins decreased nuclei size.

The American Cancer Society grant provides funds for the phase of the research focusing on reducing the size of the nucleus in cancer cells.

Levy's research funding also has a direct relationship to Wyoming residents who help raise money for a cancer cure, said Lindsay Kowalski, Relay For Life senior manager for the American Cancer Society.

"That's cancer research happening right in their backyard," Kowalski said, adding it's uncommon that major grants are awarded to institutions without medical schools.

Since 1946, the American Cancer Society has funded research and training of health professionals to investigate the causes, prevention and early detection of cancer, as well as new treatments, cancer survivorship and end-of-life support for patients and their families.

"I am very excited that funds raised in Wyoming by the American Cancer Society are coming back into the state to support cancer research," Levy said. "The American Cancer Society is the largest nonprofit cancer research funder in the United States. Most of this funding comes from individual donations, so knowing that donations made by Wyoming residents are being used to support cancer research in Wyoming is wonderful."

To view a video about Levy's work, visit https://youtu.be/7P2UPGTO-64.