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Janes Uses Engineering Approach to Investigate Cancer's Biology

December 3, 2009 — In the past year, University of Virginia biomedical engineer Kevin Janes has won $2.6 million in no-strings-attached funding for his innovative research to better understand how cells "make decisions" for good or ill. The work has implications for new ways to diagnose, prevent and treat cancers.

Most recently, Janes earned a Packard Fellowship with an unrestricted grant of $875,000 over five years. In September, the National Institutes of Health awarded him a $1.5 million, five-year New Innovator Award to study the behavior of a cancer-causing protein. In the spring he was named a Pew Scholar, which came with a $240,000 award for four years.

And Janes is still very early in his career. So why are funding agencies so interested in his work?

"I think it's because I'm bringing a different perspective, as an engineer, to biological research," he said. "I use an engineering-systems approach, like an electrical engineer or a chemical engineer would use for studying a circuit board or a refinery, to understand signaling processes within cells."

What Janes learns about these processes could lead to new diagnostics and treatments for an array of cancers, including breast cancer, colon cancer and melanoma.

Inside cells, there are a number of pathways involving proteins that together tell a cell what to do – whether to just sit there, or to divide or differentiate or die; or, when something goes awry, to replicate "mistakes" that can grow uncontrollably into lethal tumors.

Janes focuses on understanding how networks of signaling pathways function within cells and how they coordinate cell decisions. This has important implications for understanding how cancers arise as a result of malfunctioning signals, which "turn on" to instruct cells to grow abnormally, evade cell death or spread to other sites in the body.

The problem, Janes said, is that, "intracellular signaling is highly dynamic, interconnected and context-dependent, making it difficult to predict how any one signal contributes to the control of a cell's fate."

To improve predictive ability, Janes is using a quantitative and multipronged approach. He is developing biochemical techniques that can be used with statistical modeling to monitor the activation of signaling networks. He also is performing experiments within cells to directly manipulate signaling pathways.

"Cancers are examples of abnormal signal processing – it's as if the circuits have suddenly become hardwired to be on all the time – where something says 'proliferate, proliferate, proliferate.' We want to understand why this happens so we can learn how to instruct the cell to say 'no' and behave normally."

Janes holds a doctorate in biomedical engineering from the Massachusetts Institute of Technology, and did his postdoctoral fellowship in cell biology at Harvard Medical School. He came to U.Va. in 2008.

— by Fariss Samarrai

Kevin Janes (click for high-res version)

(Photo: Dan Addison)

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