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Cancer research gets physical

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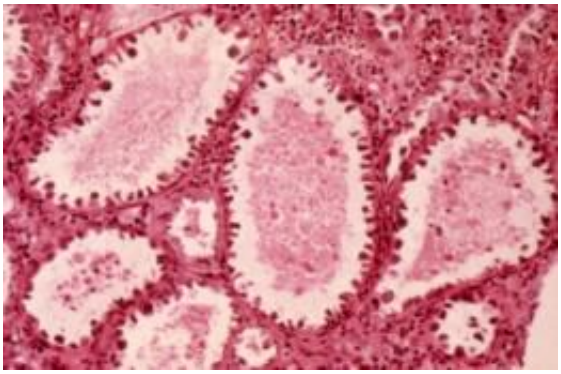

Shown here is an image of a clear cell adenocarcinoma composed of tubles lined by hobnail cells. Courtesy of the National Cancer Institute

(PhysOrg.com) -- Cancer research has traditionally been the realm of biologists, and, more recently, engineers. Now, physicists are getting in on the action.

MIT has been awarded a five-year grant from the National Cancer Institute (NCI) to start a new Physical Science-Oncology Center. The funding, approximately $3.5 million per year, will support four cancer research projects led by MIT physical scientists.

"The overall goal is to use principles and techniques from physics to attack important problems in cancer biology," says MIT physics professor Alexander van Oudenaarden, who will direct the center. "We want to develop tools to really look at how single cells change as they

progress in cancer."

The NCI announced yesterday that 12 institutions, including MIT, will host the new centers. The Physical Science-Oncology Centers will take new, non-traditional approaches to cancer research by studying the physical laws and principles of cancer, and applying those principles to understanding the evolution of cancer and unraveling cancer's complexity.

"By bringing a fresh set of eyes to the study of cancer, these new centers have great potential to advance, and sometimes challenge, accepted theories about cancer and its supportive microenvironment," said NCI Director John E. Niederhuber. "Physical scientists think in terms of time, space, pressure, heat and evolution in ways that we hope will lead to new understandings of the multitude of forces that govern cancer — and with that understanding, we hope to develop new and innovative methods of arresting tumor growth and metastasis."

MIT's new center will also include investigators from the Whitehead and Broad institutes, Harvard Medical School, Brigham and Women's Hospital and Boston University, as well as the University of California at San Francisco, Stanford, and the Hubrecht Institute in the Netherlands.

The projects bring an array of physical sciences techniques to bear on cancer research, including computational modeling, statistical analysis, and novel sensors that can track the activities of single cells.

Van Oudenaarden will be working with Tyler Jacks, director of the David H. Koch Institute for Integrative Cancer Research at MIT, to study how colon stem cells become cancerous. Van Oudenaarden has already developed a technique to follow single cells and observe how their gene expression changes over time.

The grant will also fund a project by associate professor of biological engineering Scott Manalis, who is collaborating with Harvard Medical School professor Marc Kirschner and with Koch Institute professor Angelika Amon to measure single cells over time. Manalis has built a sensor that weighs cells with unprecedented accuracy, which could allow the team to figure out the growth patterns of normal and cancerous cells.

Arup Chakraborty, professor of chemical engineering, chemistry and biological engineering, will collaborate with cancer biologists Jeroen Roose, Kevin Shannon and Benjamin Braun of the University of California at San Francisco Medical School, to study how signaling networks in T cell lymphomas are altered by cancer-promoting mutations that result in overactivation of Ras proteins. They will use computational methods rooted in statistical physics to complement in vitro and in vivo experimentation.

Leonid Mirny, associate professor in the Harvard-MIT Division of Health Sciences and Technology, will collaborate with Shamil Sunyaev of Brigham and Women's Hospital to study cancer as a micro-evolutionary process that takes place inside an organism. This project aims to test a novel approach for cancer treatment using cancer's intrinsic weakness — mutations accumulated during the micro-evolutionary process — to bring the population of cancer cells down.

Key to the projects' success is the inclusion of traditional cancer biologists, who will help guide the physicists in their new approaches, according to van Oudenaarden. "To be honest, the physicists in our center are not cancer biologists, at least not yet," he says. "Having the bread-and-butter cancer biologists involved will really allow us to make a big impact."

Provided by Massachusetts Institute of Technology (news : web)