“OMG” MICROSCOPE LIVES UP TO ITS NAME

By Dr. Francis Collins, on March 21st, 2013

The scientists at the IU School of Medicine-Bloomington nicknamed their new microscope the “OMG” for good reason—the images it produces are showstoppers. The DeltaVision OMX imaging system (its official title) is a $1.2 million dollar microscope that can peek inside a cell and image fluorescent proteins in unprecedented detail.

Jane Stout, a researcher in the NIH-funded lab, used the OMG to create this spectacular image that won her first place in the high- and super-resolution microscopy category of the 2012 GE Healthcare Life Sciences Cell Imaging Competition.

What you’re looking at is a cell in the midst of dividing into two identical copies—a process called mitosis. Here, the chromosomes (in blue) are aligned at the cell’s equator. Microtubules (red) from opposite poles of the cell attach to the chromosomes using the kinetochores (green) and pull them to opposite ends of the cell, which then splits in half. But sometimes cells do not divide properly—a common problem in cancer. Understanding the mechanics of cell division could help us correct this process when it goes wrong.

Jane Stout’s prize: her mitosis image will light up a billboard in Times Square in New York City in April. That is a wonderful celebration of science!

NIH Funding: National Institute of General Medical Sciences

REPROGRAMMING GENES TO KEEP JOINTS HEALTHY

By Dr. Francis Collins, on March 19th, 2013
Our joints are pretty amazing marvels of engineering, but they don’t last forever. As we age, or if we suffer certain injuries, the smooth, slippery white cartilage covering the ends of our bones begins to fray and degrade. This causes osteoarthritis (OA), or ‘wear-and-tear’ arthritis. As the cartilage thins and disappears, the bones can even grow spurs that grate against each other, causing swelling and pain. It’s a major cause of disability, and there’s currently no cure—other than joint replacement, which is a pretty big deal and isn’t available for all joints. About 27 million Americans already have osteoarthritis; about 1 in 2 will suffer from some form of the disease over their lifetime. Those are lousy odds.

Continue reading “Reprogramming Genes to Keep Joints Healthy” »

PROTEIN MACHINES AT WORK

By Dr. Francis Collins, on March 14th, 2013

This video shows a molecular view of the reactions that take place inside the pyruvate dehydrogenase complex, a protein machine found in the cell’s powerhouse, the mitochondria. 3D imaging of this machine by high-resolution electron microscopy reveals how the different components essential for the reaction are organized. Watch the flexible arms move inside the protein machine as pyruvate (an essential compound made from glucose) gets converted into acetyl-CoA (a precursor to the cell’s energy supply).

Credit: Jacqueline Milne and Sriram Subramaniam, Laboratory of Cell Biology, National Cancer Institute; Donald Bliss, National Library of Medicine; NIH

References:

Molecular architecture and mechanism of an icosahedral pyruvate dehydrogenase complex: a multifunctional catalytic machine. Milne JL, Shi D, Rosenthal


**NEW INSIGHT INTO PARKINSON’S DISEASE**

By Dr. Francis Collins, on March 12th, 2013

Caption: *(LEFT)* A healthy neuron with the alpha-synuclein (green) protein diffusely spread in the cell. The bright reddish dots are the garbage disposal lysosomes with alpha-synuclein entering, which gives them an orange hue. *(RIGHT)* This is a sick neuron from a LRRK2 brain. The lysosomes are enlarged and puffy because the alpha-synuclein is stuck outside and unable to enter the trash.

**Credit:** Samantha Orenstein and Dr. Esperanza Arias, Department of Developmental and Molecular Biology, Albert Einstein College of Medicine, Bronx, New York

I’m blogging today to tell you about a new NIH funded report [1] describing a possible cause of Parkinson’s disease: a clog in the protein disposal system.

You probably already know something about Parkinson’s disease. Many of us know individuals who have been stricken, and actor Michael J. Fox, who suffers from it, has done a great job talking about and spreading awareness of it. Parkinson’s is a progressive neurodegenerative condition in which the dopamine-producing cells in the brain region called the substantia nigra begin to sicken and die. These cells are critical for controlling movement; their death causes shaking, difficulty moving, and the characteristic slow gait. Patients can have trouble swallowing, chewing, and speaking. As the disease progresses, cognitive and behavioral problems take hold—depression, personality shifts, sleep disturbances.

Continue reading “New Insight into Parkinson’s Disease” »

**MICE LEARN BETTER WITH HELP FROM HUMAN BRAIN CELLS**

By Dr. Francis Collins, on March 7th, 2013
What happens when you implant human glia—a type of brain cell that protects and nurtures neurons—into the brains of newborn mice? Well, it turns out these glia mature into multi-talented astrocyte cells that provide nutrients, repair injuries, and modulate signals just like they do in a human brain. They even assume the same complex star shape!

We know the cells in question are indeed human astrocytes because they produce a group of specific proteins, which are tagged with a combination of dyes that together appear yellow in this image. In contrast, the mouse cells are blue.

This all looks very pretty, but you might wonder what impact these human astrocytes have on mouse cognition. Researchers found mice that received the implants were better able to learn and remember than those that didn’t. In short, the human cells seem to have made the mice smarter.

Interestingly, human astrocytes are larger, more complex, and more diverse than their counterparts in other species. So, perhaps these cells may hold some of the keys to our own unique cognitive abilities.

NIH funding by the National Institute of Mental Health and the National Institute of Neurological Disorders and Stroke

Reference: