Fly Brain Filters
A cluster of neurons help flies make sense of a visual scene.

WHAT GOES ON in a fly’s brain as it buzzes around a room? Does it recognize every object, or does it take cues from general lines and shapes? Using two-photon laser scanning microscopy and calcium imaging, Vivek Jayaraman, a lab head at Janelia Farm Research Campus, probed the brains of fruit flies to find out.

An area deep in the fly brain, called the central complex, lets flies recognize visual landmarks while they’re moving and use that information to orient themselves, locate safe places, and avoid not-so-safe ones. Until recently, however, scientists didn’t know how the fly central complex takes in and processes visual information. Fly brains are very tiny, and the only way to study them was by immobilizing the flies, which prevents any sort of mobility study. A few years ago, however, Vivek’s team figured out how to immobilize a fly’s head in a two-photon microscope, while its wings and legs move freely.

Vivek’s postdoctoral researcher Johannes Seelig used the technique to look at a cluster of neurons in the central complex called ring neurons. When flies were placed in a small virtual-reality arena and presented with simple patterns of light, their ring neurons responded more strongly to vertical bars than horizontal bars projected on the walls. This made sense, since flies have an innate tendency to walk or fly toward vertically oriented stimuli. The neurons were, in effect, extracting, or filtering out, visual information.

“These input neurons seem to help break down the visual scene around the fly into particular features that flies care about,” Vivek says. “Later, neurons in the central complex presumably use these features to decide what to do in their surroundings.” As the duo reported in *Nature* on November 14, 2013, this orientation preference mirrors what scientists have found in mammals—that certain neurons in the visual cortex tune in to an object’s orientation.

Next, Vivek plans to look deeper into the central complex. “By marching through these networks, we hope to begin to understand how sensory information is integrated to make motor decisions,” he says.—Nicole Kresge

IN BRIEF

A CREAM FOR PARKINSON’S
An ingredient in anti-wrinkle cream may soon be a potent weapon in the fight against Parkinson’s disease. HHMI Investigator Kevan Shokat has shown that kinetin, a plant hormone with anti-aging properties, stops the nerve cell death associated with the disease.

Some cases of inherited Parkinson’s are linked to mutations in a protein called PINK1. Normally, when the mitochondria that power nerve cells become damaged, PINK1 comes to the site and recruits other proteins to remove the mitochondria before they release toxic compounds. Mutated PINK1, however, is inactive and unable to signal its helper proteins. As a result, the damaged mitochondria are never removed, and the nerve cell dies.

Shokat and his colleagues at the University of California, San Francisco, wanted a way to ramp up PINK1 activity. As they reported August 15, 2013, in *Cell*, they found that kinetin activates both normal and mutant PINK1 and decreases nerve cell death. Because it also affected normal PINK1, the researchers hope kinetin may slow disease progression in those without a family history of the disease as well.

The researchers are testing kinetin in animal models of Parkinson’s. “[It’s] a great molecule to pursue because it’s already sold in drugstores as a topical anti-wrinkle cream,” says Shokat. “So it’s a drug we know has been in people and is safe.”

STOPPING SYSTEMIC SCLEROSIS
Systemic sclerosis is a slow and painful hardening of the body’s tissue. People with a mild form of the disease develop thick patches on their skin. More serious cases involve trouble breathing and swallowing, and can lead to death. “[It’s] a very mysterious disorder,” says HHMI Investigator Harry Dietz of the Johns Hopkins University. “There’s been a lot of descriptive work on what happens to patients, but very little information about what causes it.”

Until now.

Dietz and his colleagues had traced a less severe form of scleroderma, called stiff skin syndrome, to mutations in the protein fibrillin-1. When they engineered mice with the same gene mutation, however, the mice showed symptoms of the more aggressive systemic sclerosis. As Dietz reported November 7, 2013, in *Nature*, the symptoms were caused by an immune reaction triggered by the protein’s inability to do its job. As part of the extracellular matrix—the material that exists between cells—fibrillin-1 provides structural support and helps cells communicate with the matrix via molecules called integrins. Mutant fibrillin-1 can’t interact with integrins. To compensate, more integrins are produced, causing an autoimmune reaction and fibrosis—the excessive production of connective tissue that results in scleroderma.

By interfering with the immune response, Dietz’s team prevented fibrosis and even reversed the disease in mice. “This is one of the first, and the most dramatic, illustrations that fibrosis can be reversed,” says Dietz. “I was quite surprised and quite thrilled.”

WHEN CANCER SPREADS TO BONE
Tumors constantly shed cancer cells, yet only a few of these stray cells manage to survive and colonize distant organs. The rest succumb to the stress of the journey. HHMI Investigator Joan Massagué of Memorial Sloan-Kettering Cancer Center has found evidence that some breast cancer cells can turn on genes that increase their chances of