

Secrets of gentle touch revealed

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Stroke the soft body of a newborn fruit fly larva ever-so-gently with a freshly plucked eyelash, and it will respond to the tickle by altering its movement—an observation that has helped scientists at the University of California, San Francisco (UCSF) uncover the molecular basis of gentle touch, one of the most fundamental but least well understood of our senses.

Our ability to sense gentle touch is known to develop early and to remain ever-present in our lives, from the first loving caresses our mothers lavish on us as newborns to the fading tingle we feel as our lives slip away. But until now, scientists have not known exactly how humans and other organisms perceive such sensations.

In an article published online this week in the journal *Nature*, the UCSF team has identified the exact subset of [nerve cells](#) responsible for communicating gentle touch to the brains of *Drosophila* larvae—called class III neurons. They also uncovered a particular protein called NOMPC, which is found abundantly at the spiky ends of the nerves and appears to be critical for sensing gentle touch in flies.

Without this key molecule, the team discovered, flies are insensitive to any amount of eyelash stroking, and if NOMPC is inserted into neurons that cannot sense gentle touch, those neurons gain the ability to do so.

"NOMPC is sufficient to confer sensitivity to gentle touch," said Yuh Nung Jan, PhD, a professor of physiology, biochemistry and [biophysics](#) and a Howard Hughes Medical Institute investigator at UCSF. Jan led

the study with his wife Lily Jan, PhD, who is also a UCSF professor and a Howard Hughes Medical Institute investigator.

The work sheds light on a poorly understood yet fundamental sense through which humans experience the world and derive pleasure and comfort.

Jan added that while the new work reveals much, many unanswered questions remain, including the exact mechanism through which NOMPC detects [mechanical force](#) and the identity of the analogous human molecules that confer gentle touch sensitivity in people.

The discovery is a good example of basic brain research paving the way toward answering such questions. UCSF is a world leader in the neurosciences, carrying out research that spans the spectrum from fundamental questions of how the brain works to the clinical development of new drugs and precision tools to address brain diseases; educating the next generation of neuroscientists, neurologists and neurosurgeons; and offering excellent patient care for neurological diseases.

Why is Touch Still Such a Mystery?

Though it is fundamental to our experience of the world, our sense of gentle touch has been the least well understood of our senses scientifically, because, unlike with vision or taste, scientists have not known the identity of the molecules that mediate it.

Scientists generally feel that, like those other senses, the sense of touch is governed by peripheral nerve fibers stretching from the spine to nerve endings all over the body. Special molecules in these nerve endings detect the mechanical movement of the skin surrounding them when it is touched, and they respond by opening and allowing ions to rush in. The

nerve cell registers this response, and if the signal is strong enough, it will fire, signaling the gentle touch to the brain.

What has been missing from the picture, however, are the details of this process. The new finding is a milestone in that it defines the exact nerves and uncovers the identity of the NOMPC channel, one of the major molecular players involved—at least in flies.

Jan and his colleagues made this discovery through an unusual route. They were looking at the basic physiology of the developing fruit fly, examining how class III neurons develop in larvae. They noticed that when these cells developed in the insects, their nerve endings would always become branches into spiky "dendrites."

Wanting to know what these neurons are responsible for, they examined them closely and found the protein NOMPC was abundant at the spiky ends. They then examined a fly genetically engineered to have a non-functioning form of NOMPC and showed that it was insensitive to gentle touch. They also showed that they could induce touch sensitivity in neurons that do not normally respond to gentle touch by inserting copies of the NOMPC protein into them.

The article, "Drosophila NOMPC is a mechanotransduction channel subunit for gentle-touch sensation" appears as an Advanced Online Publication by the journal *Nature* on December 9, 2012.

Provided by University of California, San Francisco

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