How cells' sensing hairs are made

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(PhysOrg.com) -- Body cells detect signals that control their behavior through tiny hairs on the cell surface called cilia. Serious diseases and disorders can result when these cilia do not work properly. New research from UC Davis published this week in the journal *Nature Cell Biology* provides new insights into how these cilia are assembled.

"It's a basic discovery, but with implications for understanding disease," said Jonathan Scholey, professor of molecular and cellular biology at UC Davis and senior author of the study. Understanding how cilia are assembled and function can help scientists understand how conditions such as polycystic kidney disease and some growth and development disorders arise.

Cilia are built from bundles of microtubules made of a protein called tubulin. Scholey's team discovered how two subunits of tubulin are winched into place by a type of protein motor belonging to a family of proteins called kinesins.

Scholey's laboratory works with the soil roundworm Caenorhabditis elegans, whose cilia are essentially the same as those of humans and other mammals. Postdoctoral scholar Limin Hao, Scholey and their colleagues screened a collection of worms for those with mutations that affected the cilia.

They found two genes which, when mutated, caused worms to lose the tips of their cilia. Both genes turned out to be subunits of tubulin that are assembled into different parts of the microtubule: one is found all along

the microtubule, and the other is concentrated at the tip.

The UC Davis team used a combination of microscopy, molecular biology and computer modeling to study these two proteins. They found that both are moved into position by so-called kinesin-2 motors.

At one time, researchers had seen cilia as purely for movement, either moving a swimming cell through a fluid or moving fluid and suspended particles over the cell's surface, Scholey said.

But in the late 1990s, researchers discovered that cilia were also involved in detecting signaling molecules that control gene expression and cell behavior. This signaling is vital for coordinating cell growth and the orderly development of tissues, for example in establishing left/right asymmetry in developing embryos.

"Recent work shows that cilia are ubiquitous in signaling," Scholey said. In earlier work, Scholey's lab linked a defect in the kinesins that assemble cilia to Bardet-Biedl disease, which causes blindness, kidney disease and learning difficulties.

Provided by University of California - Davis