H. LIN

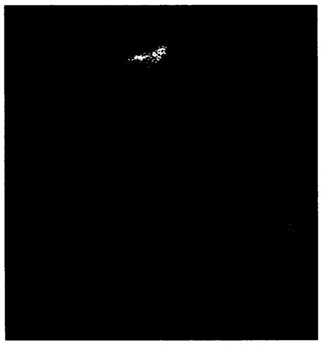
at the Beijing meeting, cell biologist Haifan Lin reported that his team at Duke University Medical Center may have identified a key element for at least one type of stem cell division. They've cloned a new gene that is necessary for the asymmetric division of the cells that produce the eggs in the fruit fly ovary. The discovery may have wider significance as well, because other organisms, ranging from plants to humans, have related genes that might also be involved in stem cell division.

The Lin team's discovery is an outgrowth of previous work by his group and others on the anatomy of the *Drosophila* ovary. This has shown that the germ line stem cells are located in a tubular structure called a germarium, where they are in contact with the terminal filament cells at one end. There the cells divide asymmetrically. The daughter cell formed adjacent to the terminal filament cells becomes a stem cell, while the daughter formed at the opposite pole of the stem cell eventually develops into the oocyte and its associated cells. For this asymmetric division to occur, Lin's group found, the stem cells have to be properly aligned and in contact with the terminal filaments of the germarium for successful asymmetric division into stem cells and egg cysts.

The Duke team then went on to clone one of the genes thought to be responsible for producing this alignment. They began by generating mutants, randomly inserting disruptive DNA fragments into the genome and then screening for flies in which germ line stem cells had lost their normal position in contact with the terminal filament cells. Tracing the location of the inserted elements then allowed the researchers to identify and clone the disrupted gene that caused the abnormality. They confirmed the role of the gene, which they called *piwi*, by inserting wild-type *piwi* into mutant embryos and showing that it restored the normal stem cell alignment and division.

They also found that *piwi* is expressed in the terminal filament cells during stem cell division. They inactivated *piwi* in the germ line stem cells and still got normal asymmetric division. Lin says, "*piwi* is only required to be active in the terminal filament cells [for germ line stem cell division]." This implies that *piwi* is involved in some cell-to-cell signaling that serves to align the germ line stem cells with the terminal filament cells.

The bigger question, however, is whether *piwi* homologs are involved in similar mechanisms in other organisms. Lin and his colleagues believe they are. They have found that *piwi* codes for a novel protein and have identified structurally similar genes in species as diverse as the roundworm *Caenorhabditis elegans*, the plant *Arabidopsis*, and in human testes. "These structural similarities suggest functional homology," he says.



Following orders. An asymmetrically dividing germ line stem cell in *Drosophila* showing the spectrosome (red sphere), which orients the stem cell in relation to a terminal filament cell during division.

Scott Emmons, a molecular geneticist who studies *C. elegans* at Albert Einstein College of Medicine in New York City, says the results are interesting and important. But he cautions that *piwi*'s activity "may be particular to [*Drosophila*'s] germ line."

Lin admits they have yet to prove that *piwi* has a wider role. Although homologous genes in *Arabidopsis* are known to be involved in division of cells in the meristem, which contains plant stem cells, their role in that division is not clear. For their part, the Duke workers want to see whether *piwi* is expressed in *C. elegans*, and if so where, as a first approach to determining whether it's involved in stem cell division. Ultimately, he adds, "we also have a lot of hope about [verifying] this function in mammals."

–DENNIS NORMILE

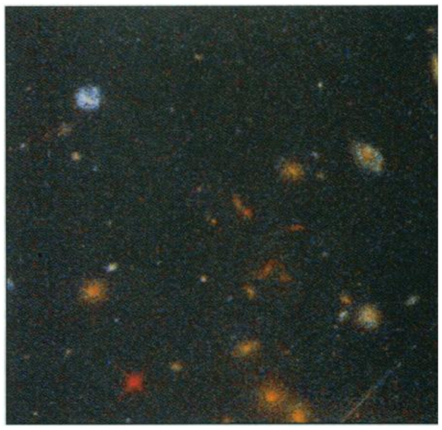
ASTRONOMY

Early Start for Lumpy Universe

A survey of the early universe just completed with the Hubble Space Telescope reveals a cosmos that looks strikingly mature considering its youth. In today's universe, gravity has swept galaxies together into vast clusters. The new survey, by a team from Carnegie Mellon University, suggests that millions of clusters could have already formed when the universe was half its current age.

The findings, reported in a paper to appear in the *Astronomical Journal*, are not the first or even the strongest evidence that giant structures had formed in the early universe. But while earlier observations had identified single clusters or at most a handful of them, the Carnegie Mellon team has found 92 cluster candidates. "This is the largest sample available," says Rogier Windhorst of Arizona State University in Tempe, opening up the possibility of carrying out detailed comparisons with theoretical predictions. And like other observations of primordial structures, the finding suggests that the universe has a lower density of matter than cosmologists once suspected, because structure formation in a dense universe would be "retarded" by the gravitational attraction of surrounding material.

Using Hubble's Wide Field and Planetary Camera, Carnegie Mellon's Richard Griffiths, Kavan Ratnatunga, Eric Ostrander, and Robert Nichol photographed more than 800 small patches of sky over the past 6 years. The project, known as the Medium Deep Survey, found 92 "overdensities" of galaxies in the vicinity of large elliptical galaxies, which are known to populate the cores of dense clusters. Based on the colors of the elliptical galaxies—the expansion of the universe reddens light from distant objects—the team believes a quarter of these cluster candidates are at distances of more than 7 billion light-years. Because the Medium Deep Survey covered a mere 0.00125% of the sky, the sample implies that the total number of distant galaxy clusters must be more than 7 million.



Heart of a cluster? A gathering of young galaxies.

K. RATNATUNGA, R. GRIFFITHS (CARNEGIE MELLON UNIVERSITY); AND NASA

While Windhorst calls the results "an important piece of work," others are cautious. "One has to be quite careful to ensure that these are 'real' clusters," says theorist Neta Bahcall of Princeton University. Because the team has not measured all the galaxies' redshifts, a clearer indicator of distance, some of the "clusters" could actually be chance juxtapositions of nearer and farther galaxies. "Redshift observations of many galaxies are needed, which will show if each cluster is real and will yield … its mass," she says. Griffiths and his colleagues have made their sample publicly available so that others can begin measuring redshifts and determining whether the universe was as precocious as it looks.

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.