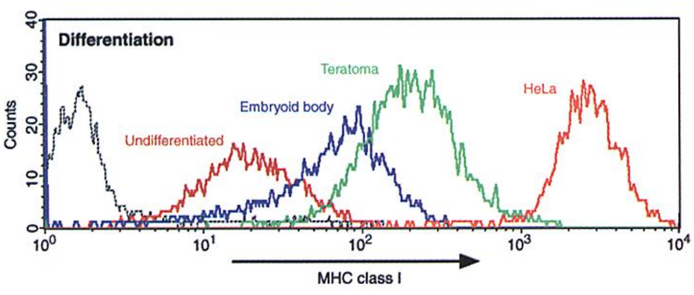


Out of hiding. As they differentiate, human ES cells express increasing levels of immune system proteins.

Auchincloss, a transplant surgeon at Harvard Medical School in Boston, who notes that he has frequently heard scientists claim that MHC proteins aren't expressed in ES cells. "As simple as the data are here, it's something that we didn't know before," he says.

Graduate student Micha Drukker, cell biologist Nissim Benvenisty, and their colleagues at the Hebrew University of Jerusalem looked for MHC molecules in three human ES cell lines. Two were derived at the University of Wisconsin, Madison, and the third at Monash University in Melbourne, Australia. The team used a fluorescent-tagged antibody that attaches to MHC molecules and measured the amount of fluorescence that showed up in three stages of ES cell development: undifferentiated ES cells; so-called embryoid bodies that form as ES cells begin to differentiate; and teratomas, which are tumors formed by differentiated ES cells. As a control, they also tested a non-ES human cell line called HeLa.

The team found very low, but consistent, expression of MHC class I molecules on the undifferentiated ES cells. However, as the cells differentiated, they produced higher levels of the proteins. Although the levels are not as high as in the HeLa cells, they are high enough that they would probably trigger an immune reaction, says J. Andrew Bradley, a transplant surgeon at Cambridge University, U.K.

Even though ES cells aren't invisible to the immune system, scientists have several potential avenues around the problem of transplant rejection. They could genetically alter ES cells so that MHC proteins would not be expressed, build up a cell bank—similar to a blood bank—of cells with a range of MHC profiles, or use nuclear transfer techniques—better known as cloning—to create genetically matched ES cells for individual patients.

But each approach has its drawbacks. "It is hard to imagine an ES cell line bank that would have a match for all patients," Auchincloss says. Genetically altering ES cells to develop a "universal donor" cell that would not express MHC proteins is not only technically difficult but could leave the resulting tissue more susceptible to infections and tumors—two things MHC molecules help the body fight against. And deriving genetically matched stem cell lines for individual patients using nuclear transfer techniques is not only controversial but would likely be too expensive for treating large numbers of patients, says Bradley.

The news is not all bad, Bradley notes. The relatively low levels of MHC expression might at least mean that tissues derived from ES cells would be less prone to rejection than today's whole-organ transplants.

–GRETCHEN VOGEL

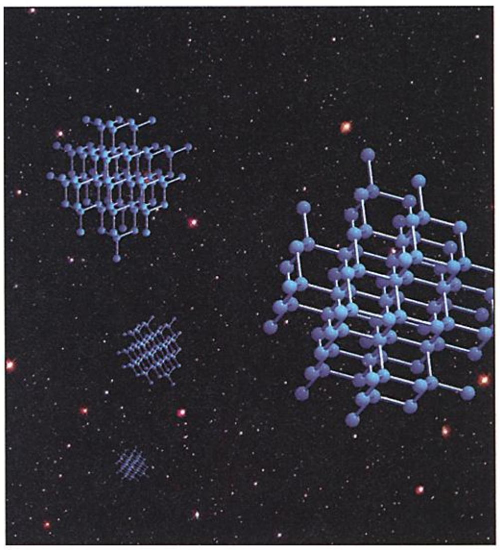
SOLAR SYSTEM ORIGINS

Diamond Dust Dearth Raises Doubts

Most experts agree that the solar system's most ancient rocks from asteroids and comets should be sprinkled with microscopic diamond dust, a remnant of ancient stars. The less altered the rock since the gas and dust of the solar nebula came together, the more star dust should survive. But a group of researchers reported this week that at least some of the most primitive, unaltered rock in the solar system contains no diamond star dust at all. The finding raises questions about just how star stuff came to form the solar system. "It really was an unexpected result," says microscopist Lindsay Keller of NASA's Johnson Space Center in Houston, who was not in on the (non)discovery. "Why nanodiamonds are not there is uncertain."

During the past few decades, researchers have found interstellar dust grains in some less altered meteorites by doing what one cosmochemist called "burning down the haystack to find the needle": dissolving a meteorite until only the hardy mineral bits condensed in the atmospheres of stars long ago—silicon carbide, graphite, and diamond—remain. The diamond flecks are so small (3 nanometers in diameter, on average) that a single grain might contain just a couple of thousand carbon atoms. Three years ago, microscopist Zurong Dai of Georgia Institute of Technology in Atlanta and his colleagues decided to extend the diamond hunt to microscopic interplanetary dust particles (IDPs) that flaked off asteroids and comets and now sift down through the stratosphere.

IDPs are too small for the "burn down the haystack" approach, so in an analytical tour de force Dai and his colleagues exposed the nanodiamonds by careful acid dissolution and identified them by measuring their distinctive atom-to-atom distance under high-resolution transmission electron microscopy. As they reported in this week's issue of *Nature*, they found plenty of nanodiamonds in two famous primitive meteorites—Murchison and Orgueil—as well as in two primitive micrometeorites retrieved from antarctic ice and four large, "cluster-type" IDPs from the stratosphere. But they found none in five smaller IDPs, although they were just as compositionally primitive as the cluster IDPs—and therefore also presumably came from the outer parts of the solar system, where stellar nanodiamonds are most likely to have survived. "We should have found nanodiamonds in every [sample] we looked at, but we didn't," says cosmochemist John Bradley of Lawrence Livermore National Laboratory in California, a co-author on the Dai paper. "That's puzzling."



Sky with diamonds. Rather than star dust, nanometer-sized diamonds may be a product of the newborn sun.

The absence of nanodiamonds in half the IDPs examined has "no easy explanation," says Bradley. The simplest answer, the group writes, would be that most nanodiamonds were not formed around ancient stars at all but in the inner parts of the disk-shaped solar nebula as the solar system formed. That could leave detectable numbers of nanodiamonds in IDPs that formed closer in but not in more distant ones. The catch is that, if popular theories about chemical conditions in the early solar system are correct, diamonds shouldn't have been able to form there.

Alternatively, the asteroids or comets that produced the smaller IDPs might have been altered enough to have lost their nanodiamonds. If such bodies turn out not to be primitive, meteoriticists will lose one of their main sources of information about the formation of the solar system—a sacrifice they would hate to have to make.

–RICHARD A. KERR

CREDITS: (TOP TO BOTTOM) M. DRUKKER AND N. BENVENISTY/THE HEBREW UNIVERSITY; Z. DAI ET AL.