MedicalXpress

Researchers develop improved means of detecting mismatched DNA

September 15 2014

Researchers at Johns Hopkins have identified a highly sensitive means of analyzing very tiny amounts of DNA. The discovery, they say, could increase the ability of forensic scientists to match genetic material in some criminal investigations. It could also prevent the need for a painful, invasive test given to transplant patients at risk of rejecting their donor organs and replace it with a blood test that reveals traces of donor DNA.

In a report in the September issue of *The Journal of Molecular Diagnostics*, the research team says laboratory tests already show that the new analytical method compares favorably with a widely used DNA comparison technique. The researchers have applied for a patent.

The current method for comparing DNA to determine paternity and advance criminal investigations counts the number of repeats in certain highly repetitive blocks of DNA that are not part of genes. But, says James Eshleman, M.D., Ph.D., a professor of pathology at the Johns Hopkins University School of Medicine, "Repeat testing will only detect DNA that makes up at least 1 percent of a DNA sample, so it's not great for situations in which results depend on small amounts of material within a larger sample."

Making comparisons based on common "point mutations," or variations within actual genes, was long considered impractical because of the high costs of DNA sequence testing. But the cost of sequencing has fallen so low in recent years that Eshleman's team revisited the idea.

Choosing a block of DNA with 17 common point mutations in close proximity along the genome, Marija Debeljak, a technician in Eshleman's laboratory, looked for mismatches in various mixtures of lab-grown human cells. "We could detect cells when they made up just .01 percent of the mixture, which is a big improvement over the current method, which can only detect DNA that makes up 1 to 5 percent of a sample," Eshleman says.

In addition to forensic and paternity testing applications, the new method could also potentially be used to monitor the health of bone marrow transplant patients, Eshleman says. Testing transplant patients' blood for low levels of leukemia blood cells could theoretically be used as an early warning system, but current analysis based on the standard repeat testing is not sensitive enough to detect low levels of recurring leukemia DNA in blood.

In contrast, when the researchers tested bone marrow recipients' blood with their new system, they found that it could detect patient DNA. "If we're able to develop this test for commercial use, it could also free some solid-organ transplant recipients of the invasive biopsies that are currently used if rejection is suspected," Eshleman says.

Provided by Johns Hopkins University School of Medicine