Bioreactors might solve blood-platelet supply problems

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It might be possible to grow human blood platelets in the laboratory for transfusion, according to a new study at The Ohio State University Medical Center.

The findings, published in the January 1, 2009 issue of the journal *Experimental Hematology*, might one day enable blood banks to grow platelets continuously and in quantities that can ease the chronically tight supply of these critical blood components.

About 13 million platelet concentrates are collected annually in the United States at a cost of about $1 billion. They are needed by people who lack platelets or whose platelets function improperly, such as certain cancer chemotherapy patients, bone marrow transplant patients, trauma patients given massive blood transfusions and people with aplastic anemia.

The concentrates from volunteer donors are expensive to make, require 10 or more tests for pathogens and have a shelf life of only five days. As a result, 20 to 40 percent of platelet concentrates are discarded. Red blood cells, by contrast, last 56 days.

The short shelf life means platelets cannot easily be shipped from an area of surplus to one of scarcity, and hospitals occasionally experience shortages that require surgeries to be postponed.

Attempts by others to grow platelets have produced only small numbers for a short time, says principal investigator, Larry C. Lasky, associate professor of pathology at Ohio State and a specialist in transfusion medicine and blood banking.

"We were pleasantly surprised to achieve continuous production for a month," Lasky says. "It is easy to imagine a series of these chambers producing platelets. It would be ideal for clinical use and possibly solve the short shelf-life problem. Using good manufacturing practices would prevent bacterial contamination."

Currently, platelets are collected either from donated blood or by apheresis. Apheresis is an expensive and time-consuming process that involves taking blood from one arm, passing it through a machine that isolates the platelets, and then returning it to the other arm. The method yields four to six platelet units per donor.

For this study, Lasky and his colleagues isolated hematopoietic stem cells, which produce blood cells, from blood taken from umbilical cords following normal, full-term deliveries. The stem cells were grown to greater numbers, then added to the bioreactors – chambers with several layers for gas and growth-media control. Control cells were grown in culture flasks. Other attempts to grow platelets have usually used culture flasks or similar two-dimensional systems.

After a few days of growth, a solution of growth factors was added to both groups to stimulate the cells to form large, bone-marrow cells called megakaryocytes, which shed bits of themselves as platelets.

The three-dimensional bioreactor produced up to 1.2 million platelets per day, with production continuing for more than 32 days, while the two-dimensional system generated a maximum of about 350,000 platelets per day over a ten-day period.

Lasky and his colleagues are now modifying the process to increase the yield of platelets.

Source: Ohio State University Medical Center