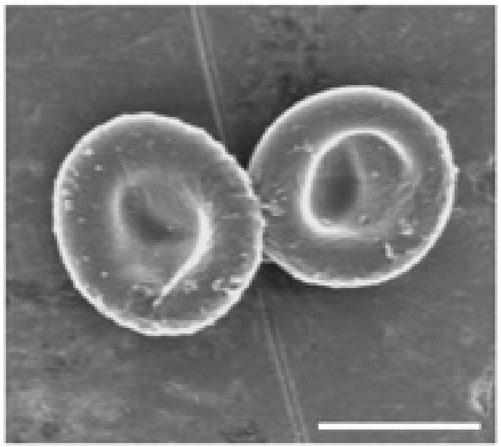
December 14, 2009

Synthetic Red Blood Cells Developed

Soft and synthetic red-blood-cell-like particles carry oxygen, drugs, and more?



Biocompatible synthetic red blood cells (sRBCs) synthesized by the UCSB team, where the shell is composed of alternate layers of hemoglobin and BSA. (Scale bar, 5 microns)

Santa Barbara, California, December 14, 2009?Scientists at UC Santa Barbara, in collaboration with scientists at University of Michigan, have developed synthetic particles that closely mimic the characteristics and key functions of natural red blood cells, including softness, flexibility, and the ability to carry oxygen.

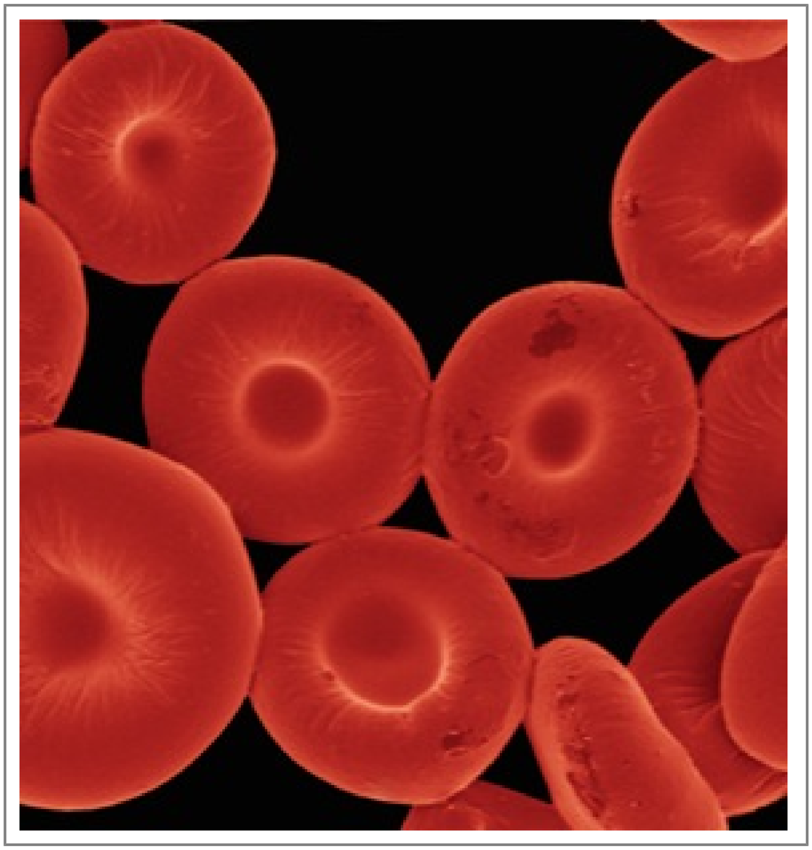
The primary function of natural red blood cells is to carry oxygen, and the synthetic red blood cells (sRBCs) do that very well, retaining 90% of their oxygen-binding capacity after a week. The sRBCs also, however, have been shown to deliver therapeutic drugs effectively and with controlled release, and to carry well-distributed contrast agents for enhanced resolution in diagnostic imaging.

"This ability to create flexible biomimetic carriers for therapeutic and diagnostic agents really opens up a whole new realm of possibilities in drug delivery and similar applications," noted UCSB chemical engineering professor Samir Mitragotri. "We know that we can further engineer sRBCs to carry additional therapeutic agents, both encapsulated in the sRBC and on its surface."

Mitragotri, his research group, and their collaborators from the University of Michigan succeeded in synthesizing the particles by creating a polymer doughnut-shaped template, coating the template with up to nine layers of hemoglobin and other proteins, then removing the core template. The resulting particles have the same size and flexibility, and can carry as much oxygen, as natural red blood cells. The flexibility, absent in "conventional" polymer-based biomaterials developed as carriers for therapeutic and diagnostic agents, gives t he sRBCs the ability to flow through channels smaller than their resting diameter, stretching in response to flow and regaining their discoidal shape upon exiting the capillary, just as their natural counterparts do.

In addition to synthesizing particles that mimic the shape and properties of healthy RBCs, the technique described in the paper can also be used to develop particles that mimic the shape and properties of diseased cells, such as those found in sickle-cell anemia and hereditary eliptocytosis. The availability of such synthetic diseased cells is expected to lead to greater understanding of how those diseases and others affect RBCs.

The discovery is described in the current online edition of *Proceedings of the National Academy of Science*, and will be published in the print version of the journal in the near future. UCSB graduate student Nishti Doshi was the lead author of the paper; former post-doctoral researcher Alisar Zahr (now at Harvard Medical School's Schepens Eye Research Institute), Mitragotri, and their University of Michigan collaborators Srijanani Bhaskar and professor Joerg Lahann were co-authors.



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Related Links

Paper online at PNAS

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