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Coating could help prevent blood clots associated with implanted biomedical devices

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A team of researchers from UCLA and the University of Michigan has developed a material that could help prevent blood clots associated with catheters, heart valves, vascular grafts and other implanted biomedical devices.

Blood clots at or near implanted devices are thought to occur when the flow of nitric oxide, a naturally occurring clot-preventing agent generated in the blood vessels, is cut off. When this occurs, the devices can fail.

Some researchers have sought to solve this problem with implantable devices that gradually release nitric oxide, but their supply of the agent is necessarily limited. Instead, the UCLA–Michigan team focused on an ultra-thin coating for the devices that acts as a chemical catalyst, generating clot-preventing molecules that can mimic the function of blood vessels.

The researchers suggest this could offer a long-lasting and cost-effective solution to the problem of these blood clots. The study was published online this month in the journal *Nature Communications*.

For the device coating, the team used sheets of graphene, a one-atom-thick layer of graphitic carbon, into which they integrated two components—haemin and glucose oxidase. Both work synergistically to catalyze the production of nitroxyl, which can be used inside the blood like nitric oxide, although it contains one less electron. Nitroxyl has been

reported as being analogous to nitric oxide in its clot-preventing capability.

"This may have interesting applications in a wide range of biomedical device coatings," said Teng Xue, the study's lead author and a UCLA graduate student.

"This work demonstrates how the exploration of nanomaterials, combined with knowledge in chemical catalysis and biochemistry can lead to unique functional structures benefiting biomedical research and beyond," said principal author Yu Huang, an associate professor of materials science and engineering at the UCLA Henry Samueli School of Engineering and Applied Science. "We will continue to explore molecular assemblies and conjugated catalytic systems as analogs to the functional proteins that can facilitate chemical transformations under mild conditions, like nature does."

More information: "Integration of molecular and enzymatic catalysts on graphene for biomimetic generation of antithrombotic species." Teng Xue, et al. *Nature Communications* 5, Article number: 3200 DOI: 10.1038/ncomms4200. Received 30 June 2013 Accepted 06 January 2014 Published 11 February 2014

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