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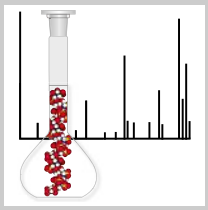

Highlights of Analytical Sciences in Switzerland

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Detecting Heparin in Whole Blood for Point of Care Anticoagulation Control During Surgery

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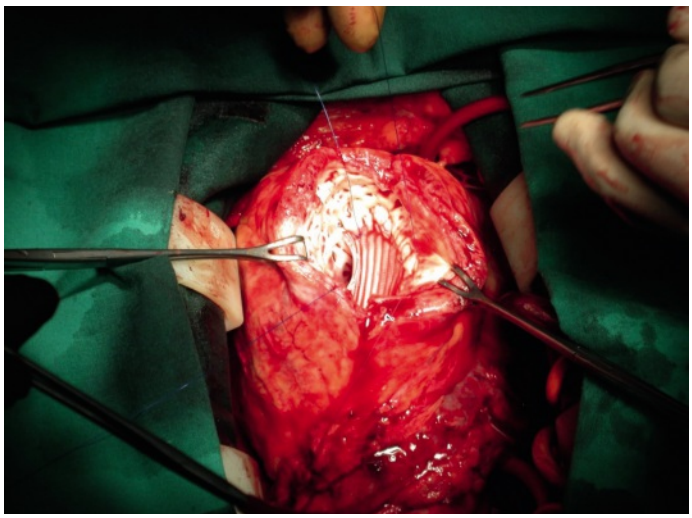
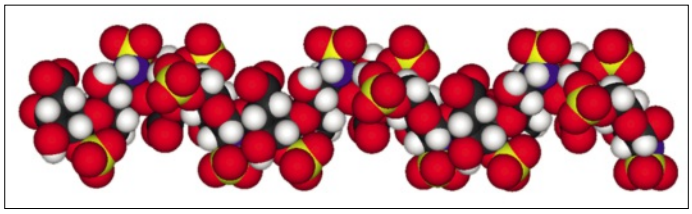


Cardiac surgery, where the heparin detection principle will be applied (Photo A. Kühn, Bad Oeynhausen).

High molecular weight polyanionic heparin (standard heparin) is the anticoagulant of choice in many surgical procedures because of its fast onset of action and since its effects can be effectively and rapidly reversed by its antidote, the polycationic protamine. Accurate reversal of heparin requires knowledge of its concentration after surgery, which is accomplished on the plasma sample with a colorimetric assay performed centrally in the clinical laboratory. Unfortunately, this assay is not available around the clock and exhibits a long turnaround time of more than one hour, during which time the heparin concentration in the patient may no longer reflect the reported value. A direct and rapid detection of heparin at the point of care would hold great promise for delivering better anticoagulation care to millions of patients around the world.

Our group has recently reported on an electrochemical approach to detect the antidote protamine in whole blood samples with a precision of the order of 1%. A supported liquid membrane containing dinonylnaphthalene sulfonate partially paired with tetradodecylammonium is used to detect protamine in blood. An applied cathodic current forces the extraction of protamine from the blood sample into a membrane, and the potential at the same membrane is monitored over time. As protamine is depleted at the membrane surface in a diffusion-limited process, the potential changes at a precise transition time. This time is taken as the analytical signal and gives a linear calibration curve when plotted as square root of transition time *vs.* concentration.



Substructure of the highly charged heparin.

Heparin is quantified by adding a known concentration of protamine to a sample aliquot and measuring the excess protamine that is not lost by interacting with heparin. The binding between heparin and protamine is diffusion-controlled, allowing for a rapid measurement time in the order of seconds after mixing. The liquid membranes exhibit excellent reproducibilities for repeated measurements. Work is currently underway at the University Hospital of Geneva to validate the technology in clinical settings. **In conclusion, we present here a new and convenient electrochemical methodology to quantify heparin in blood that may improve on the current state of the art in patient care.**

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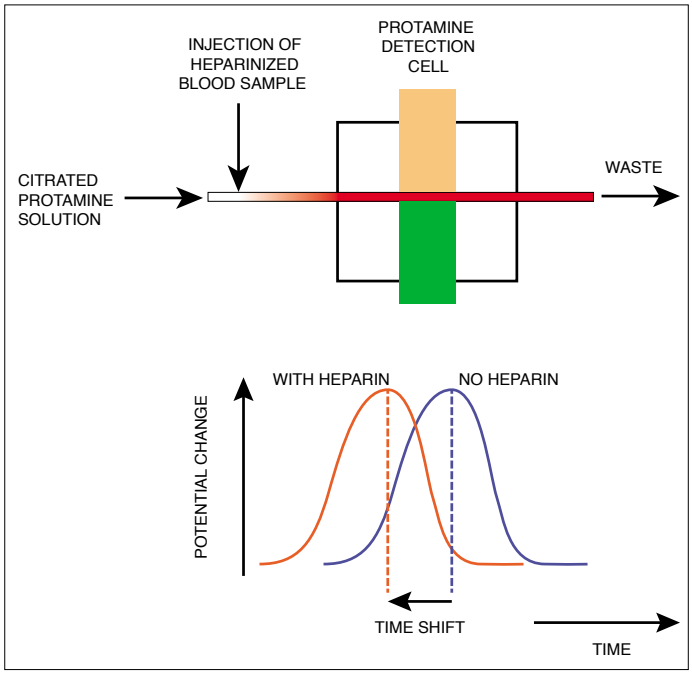
Reference

G. A. Crespo, M. G. Afshar, E. Bakker, *Angew. Chem. Int. Ed.* **2012**, *51*, 12575.



Schematic of the measurement and detection signal.

Can you show us your analytical highlight?

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