



Cardiac Troponin I Detection with a Chemiluminescence Biosensor



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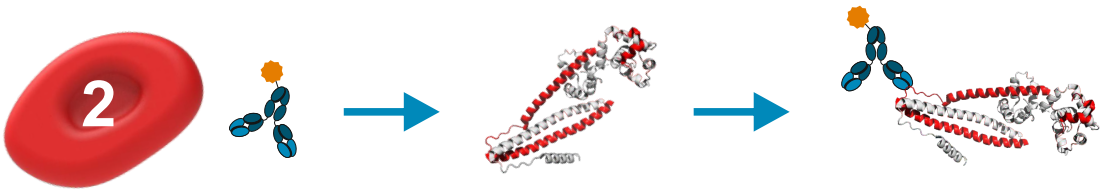
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Importance of cardiac Biomarkers

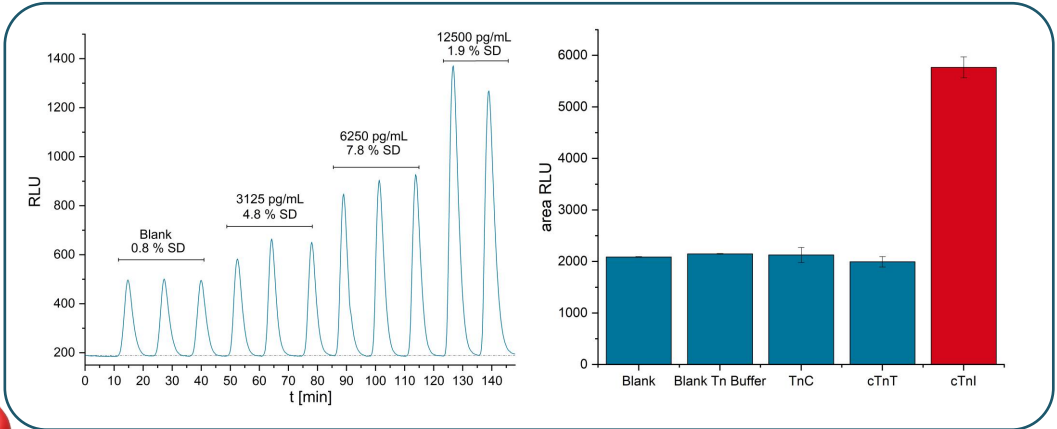
Cardiovascular diseases are the number one cause of death worldwide and responsible for 3.9 million deaths in Europe and over 1.8 million deaths in the European Union (2017) [1]. Cardiac Troponin I (cTnI) is part of a triple protein complex and the most important biomarker for acute events such as heart attacks. Once a heart attack occurs, the blood stream within the heart is interrupted and further oxygen supply cannot be maintained. As a result, heart cells undergo apoptosis and their proteins will be released into the blood stream. Within the project CardioMet of the European Metrology Program of Research and Innovation (EMPIR) a biosensor for online-monitoring of acute myocardial infarction by detecting cTnI is being developed.

Biosensor Design and cTnI Detection



Release of specific protein biomarkers like cardiac troponin I (cTnI) after a myocardial infarction and corresponding cell death. An increased cTnI level indicates cardiovascular damage. Protein structure of cardiac troponin triple complex (cTnI red, cTnT and TnC in gray) and specific recognition by monoclonal anti-cTnI antibodies labelled with horseradish peroxidase (HRP).

Continuous data points over time through the evaluation of recorded image files (15 seconds exposure time, left). Antibody specificity against cTnI (right).

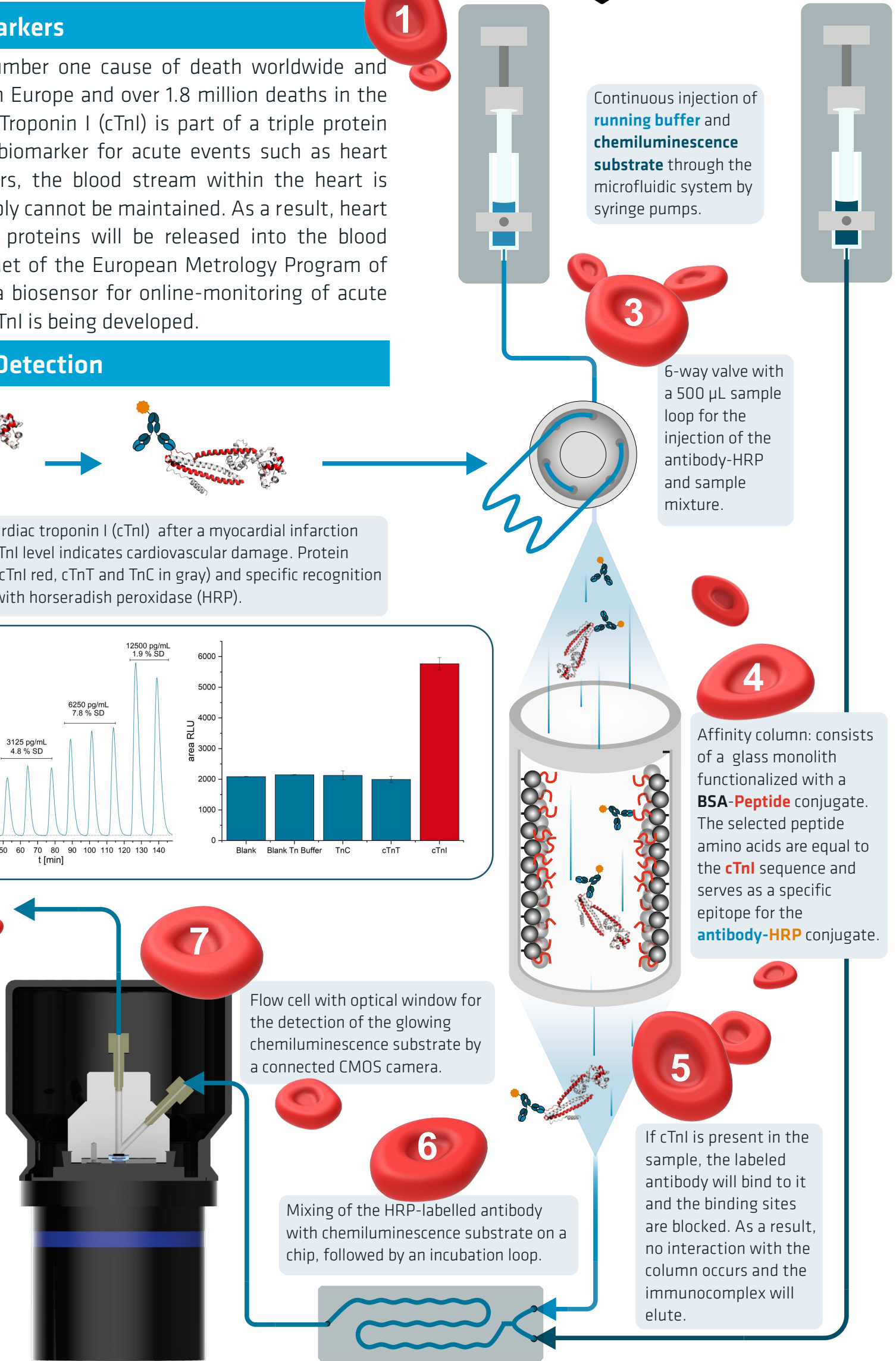


Outcome

A new microfluidic setup and flow cell-based detection system was developed and tested. To overcome autofluorescence of blood components by using laser-induced fluorescence [2], a chemiluminescence assay was designed. With this prototype of the biosensor, recombinant cTnI can be detected up to 3 ng/mL or around 125 pmol successfully. In further experiments, it was shown that no cross-reactions with the sample buffer, cTnT or TnC occurred.

Acknowledgements

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[1] European Cardiovascular Disease Statistics, European Heart Network, 2017.



[2] Paul, M.; Tannenbergs R.; Tscheuschner G.; Ponader M.; Weller, M. G. Cocaine Detection by a Laser-Induced Immunofluorometric Biosensor. Biosensors, 2021.



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