Title: Towards Fully Automated CAR-T Cell Manufacturing: Continuous, Label-Free, Sampling-Free Quality Control Using White Light Spectroscopy

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Abstract

CAR-T cell therapy has revolutionized cancer treatment, but its large-scale implementation remains constrained by the high cost and complexity of manufacturing. These high costs are mainly due to the extensive quality control required throughout the production process. Conventional monitoring relies on repetitive sampling from the bioreactor, which is not only complex but also introduces a risk of contamination.
Addressing these limitations requires a new paradigm for process monitoring: a closed, label-free, real-time strategy that eliminates the need for sampling while enabling the immediate detection of culture quality change and rapid corrective action.
White light spectroscopy offers a promising solution to this challenge. Recent advances in miniaturized spectrometers and embedded data processing now make it possible to perform continuous, non-invasive monitoring directly within the culture, without labelling, sampling, and/or sophisticated analytical infrastructure.
In this conference, we will present our latest advances in the real-time assessment of T-cell concentration and viability, together with the detection of contamination events and cell death. Most importantly, we will describe the first proof of concept of a fully automated cell culture platform integrating continuous, label-free, sampling-free quality controls which, in addition, can trigger an alarm when cell quality deteriorates. This allows production to be stopped early and/or appropriate corrective measures to be taken. This represents an important step toward safer, more reliable, and more affordable manufacturing of CAR-T cell therapies.

Biography

Dr Bruno Wacogne is a CNRS Research Director at the FEMTO-ST Institute (one of the biggest Science and Technologies laboratory in France) where he was the head of the "Photonics for medical instrumentation" team before to join the BioMicroDevices group. He works now in the BIND group. He created and has led the Biom'@x transversal axis "Science et technology for personalized medicine" within this Institute for 15 years.
In 2010, at the request of Besançon University Hospital, he applied and has been awarded a Translational Research Fellow position from the National AVIESAN Alliance. This is a supplementary position that allows him to be at the interface between the health activities at the FEMTO-ST Institute and the Clinical Investigation Center in Technological Innovation at Besançon University Hospital. At the hospital, he is the vice-coordinator of the Technological Innovation unit. His research interests concern translational research, science and technology for health and more precisely immuno-combined medical devices, biological qualification devices and biomedical optics. He now focuses on automated CAR-T cells culture systems.
He is the author or co-author of over 250 communications among which about 40 invited conferences and keynote lectures and 10 patents. He is regularly chairman in international conferences. He has been awarded several times: Gold Micron at the International MICRONORA Workshop in 2006, Best Poster Award at the 2nd International Conference on Bio-sensing Technology in 2011, and Best Paper Award at the 13th International Conference on Biomedical Electronics and Devices in 2020.