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MODELLING THE FUTURE

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SENTINEL Novel injectable biosensor for continuous remote monitoring of cancer patients at high-risk of relapse

ADVANCED COMPUTING | NANOTECHNOLOGIES

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CONCEPT AND GOALS

SENTINEL aimed to develop a minimally invasive and biocompatible implantable biosensor to be used in early tumour surveillance of post-operative prostate cancer patients, and the concept relies on 3 core technologies: **implantable biosensors**, **surface-enhanced Raman spectroscopy** (SERS) for optical reading **and data processing algorithms** for remote patient monitoring. The biosensor comprises plasmonic gold nanoparticles (GNS) embedded into biocompatible, injectable gellan gum-based hydrogel formulations. The diffusion of biomolecules through the hydrogel and their interaction with the GNS results in a specific Raman signature that is measured with a Raman handheld device. After signal acquisition, machine learning algorithms are applied to analyse/identify the presence of cancer biomarkers.

OUTCOMES

SENTINEL achieved its goal of developing remote monitoring tools for high-risk cancer patients and enhancing cancer screening and surveillance. Biocompatible hydrogel formulations and encapsulation protocols for plasmonic particles were developed along with low-risk implantation procedures suitable for clinical use and widespread usability. A handheld device was designed to acquire transdermal signals, enabling real-time data collection, which is processed and classified using machine learning algorithms. The use of computational predictive diagnostic protocols allowed comprehensive biosensor spectra classification and *in vitro* and *in vivo* confirmed biosensor's safety. The *in vivo* study was the first demonstration of the performance of an implantable SERS based sensor for assessing cancer recurrence

CONCLUSION

The generated IP hold promise for more sensitive and specific diagnostic tools. Overall, the SENTINEL project's outcomes (Figure 1) have the potential to improve healthcare diagnostics and contribute to the advancement of biotechnology, ultimately benefiting society and the economy..

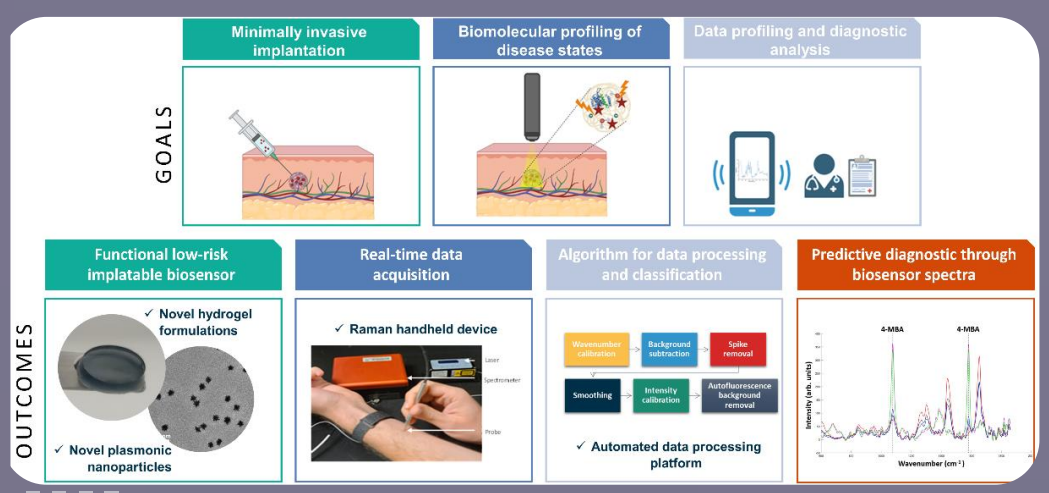

Figure 1- SENTINEL's main initial objectives (top) and principal achieved outcomes (bottom).

SENTINEL CONSORTIUM PARTNERS

SENTINEL project resulted from the collaboration between the Portuguese partners Stemmatters, the International Iberian Nanotechnology Laboratory, the Life and Health Sciences Research Institute of the University of Minho, the Clinical Academic Center-Braga, and the University of Texas at Austin in the USA.

1 Stemmatters
2 INL International Iberian Nanotechnology Laboratory
SENTINEL
3 ICVS Life and Health Sciences Research Institute
5 TEXAS The University of Texas at Austin
4 2CA Braga Centro Clínico Académico

INL International Iberian Nanotechnology Laboratory
fct Fundação para a Ciência e a Tecnologia
TEXAS The University of Texas at Austin