RAIS: Scalable, point-of-care and label-free microarray platform for rapid detection of Sepsis
Partners List
RAIS Concept

Low-cost
< 30 minutes
Sepsis diagnostic

Patient blood

Disposable cartridge

+ Microfluidics

+ Sepsis biomarkers receptors

+ Plasmonics

Patented optical reader
+ Software
Sepsis

- Sepsis is a potentially fatal whole-body inflammatory reaction caused by severe infection
- 35% mortality
- > 7 million deaths/year
- The cost of Sepsis is high, and rising. In 2008, > €10 billion were spent on hospitalizations for Sepsis in both Europe and the USA.
During the course of a Sepsis infection, the blood of patients will contain specific **biomarkers**.

In The RAIS project, we will initially focus on the following Sepsis biomarkers:

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Comments</th>
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<tbody>
<tr>
<td>C-reactive protein</td>
<td>Sepsis 170 to &gt;200 µg/ml</td>
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<tr>
<td>Procalcitonin</td>
<td>Sepsis &gt;0.5 ng/ml</td>
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<tr>
<td>Interleukin-6</td>
<td>Sepsis &gt;120 pg/ml</td>
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<tr>
<td>MR-pro-Adrenomedullin</td>
<td>Sepsis &gt;1.1 nmol/L</td>
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<tr>
<td>miRNA146a, miRNA223, miRNA15a, miRNA16</td>
<td>Sepsis Low fM range (broad range 0.1fM-pM)</td>
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<tr>
<td><strong>Antimicrobial resistance mechanisms</strong></td>
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<td></td>
<td>CTX-M-type betalactamase, CMY-type betalactamase, VIM-type carbapenemasa, OXA-48-type carbapenemasa, Penicillin binding protein 2a (PBP2a)</td>
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<tr>
<td><strong>Bacteria</strong></td>
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<td></td>
<td>Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa</td>
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</table>
Cartridge

- The Sepsis biomarkers can be captured by specific receptors deposited on a transparent micro-array plate.

- A disposable cartridge combining the microarray plate and microfluidics will be used to bring the patient blood into contact with the specific receptors.
Cartridge

- **Plasmonic** nano-structures will be designed to facilitate the detection of Sepsis biomarkers in the micro-array reader, by enhancing the light interaction with the protein array.
• The RAIS platform will use an optical **microarray reader** based on interferometric lens-free microscopy and large-area CMOS image sensing.

• Thanks to the large field-of-view of the image sensor, potentially > 1 million targets can be probed at the same time, allowing **high-throughput**, rapid detection of many proteins or pathogenic microorganisms.
Contrary to ELISA tests, the RAIS technology is based on a very high-sensitivity interferometric configuration, which means it can do without protein amplification → very short time to result.

The proposed system will have a very small form factor, be battery powered and manufacturing will cost around €1000, making it very suitable for point-of-care applications.
Acknowledgements

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www.rais-project.eu