

# Development of an innovative tool for rapid detection of broad-spectrum $\beta$ -lactamases: the BL-DetecTool

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## BACKGROUND

Antimicrobial resistance causes 25,000 deaths in the EU per year. The extra costs associated with the treatment of these infections are estimated at 1,500 million euros, only in Europe. **The increase in the number of infections caused by extended-spectrum  $\beta$ -lactamase-producing Enterobacteriaceae (ESBL) and the emergence of carbapenemase-producing Enterobacteriaceae represent an immediate public health threat that requires urgent actions.**

Normally, the traditional bacterial culture techniques require between 16 and 32 hours to isolate and identify the pathogenic organism as well as the resistant determinants. In contrast, real-time detection would permit adapting immediately the treatment to the bacteria concerned. This would not only result in better treatment, but also in the reduction of unnecessary use of wide-spectrum antibiotics that promote resistance. Molecular biology tools are rapid but quite expensive. **New, rapid and easy-to-use diagnostic tools to detect ESBL and carbapenemases are urgently needed.**

## THE BL-DETECTOOL

For the first time, **a new detection system will allow for a fast detection of  $\beta$ -lactamases in clinical samples.** The detection system corresponds to a strip, which allows the immunological detection, enclosed in a plastic device, which carries out sample treatment in a very simple way (filtration, concentration, extraction, incubation) and deposits it onto the strip. The concept of the device and the different steps involved in the test are being evaluated in different media (urine, blood), with different bacteria.

At this stage of the project the devices, produced by 3D printing, are ready to be optimized and validated with real clinical samples (blood, urine and rectal swab). In order to achieve its objectives, the operational procedures will be improved to fit with clinical habits and analytical specifications (specificity, reproducibility and sensitivity). At one point, the procedures and the detection system should be perfectly adapted to the hospital practices.

One device  
Two functions

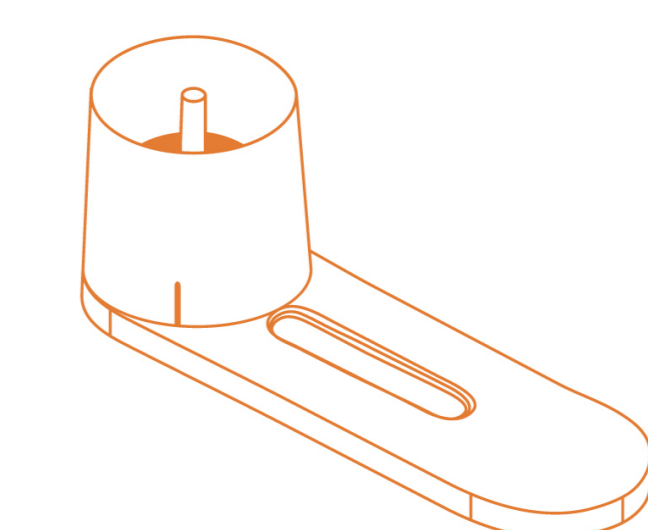
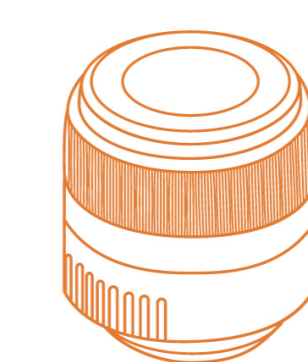
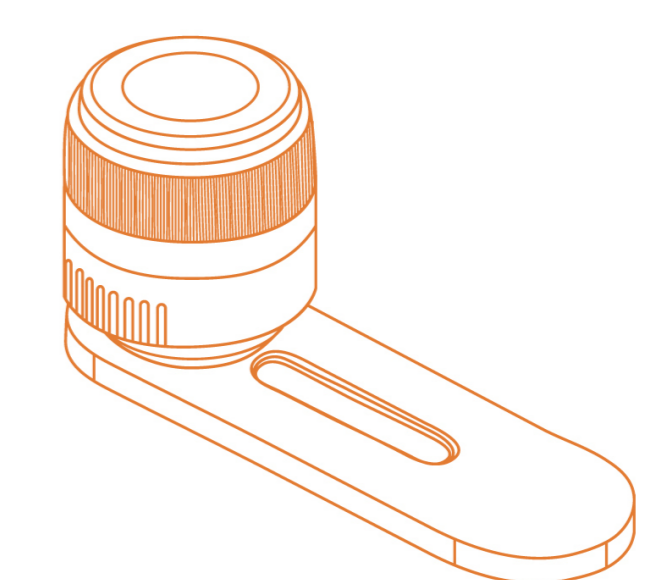
- Improves the sensitivity
- Concentrates bacteria from sample
- Eliminates media interferences
- Decreases the time to result to 30 minutes

### A Sample processing

- Filtration
- Incubation
- Extraction
- Deposition

### B $\beta$ -lactamases Detection

- Lateral Flow immunoassay (similar to pregnancy test)
- Single use
- No specific equipment
- Patent pending

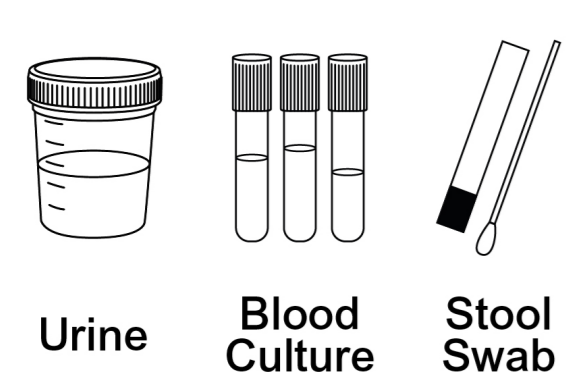


## RESULTS

Using the BL-DetecTool, the workflow for identification of multi-drug resistant bacteria is shortened to 30 minutes:

### Current Workflow

#### Sample Reception and processing



#### Culture on selective or non selective media



#### MDR bacteria Detection/ Characterization

- Rapid immunoassays
- Biochemical test
- PCR
- MALDI - TOF

5 minutes

16 - 24 hours

20 min. - 6 hours

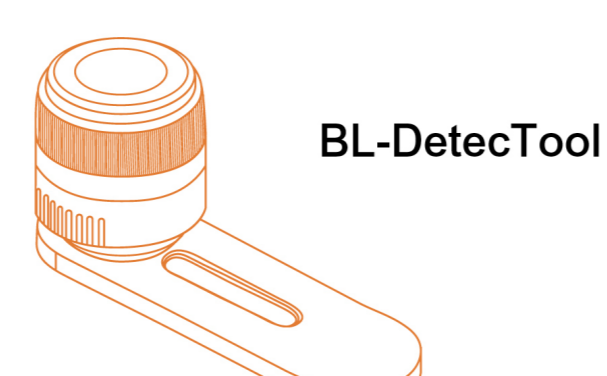
Time to result between 16h and 30h

### Workflow with BL-DetecTool

#### Sample Reception and processing



#### MDR bacteria Detection/ Characterization



5 - 10 minutes

15 minutes

Time to result 20 to 30 min.

## THE PROJECT

The BL-DetecTool development is funded by EIT Health.

### Target group

The main market for this product facilities where fast detection with the device can be used for more targeted treatment of patients, and for efficient and cost saving treatments, including:

- Intensive care units
- Surgical units
- Patient admissions unit of hospitals
- Clinical microbiology laboratories
- Nursing homes

The target audience is:

- Clinicians
- Clinical microbiologists
- Hospital managers
- Device users (health professionals)
- All partners globally

### Partners of the project:

- Assistance Publique – Hôpitaux de Paris, Paris, France
- Commissariat à l'énergie atomique et aux énergies alternatives (CEA), Gif sur Yvette, France
- Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain
- IESE Business School, Barcelona, Spain
- Semmelweis University, Budapest, Hungary
- University of Barcelona, Barcelona, Spain
- Industrial partner: NG Biotech, Guipry, France