Nanotherapeutics for antibiotic resistant emerging bacterial pathogens

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Increase in antibiotic resistance is a global concern worldwide. The portfolio of available last-resort antibiotics for treating antibiotic resistant bacterial infections is very limited and encompasses molecules inducing severe side effects and/or difficult to administer. New formulations of known drugs that provide better efficacy are urgently needed for a faster, more efficient, and less impairing treatment.

In this context, the NAREB project aims to propose nanotechnology solutions to the problem of Multi-drug resistant (MDR) *Mycobacterium tuberculosis* (TB) as well as methicillin resistant *Staphylococcus aureus* (MRSA), by the design, the preparation and the optimisation of several nanoformulations of current and novel antibacterial drugs. The successful use of nanoparticles for delivering and concentrating antimicrobial molecules to the site of infections should allow the use of antibiotics that have proved their efficiency *in vitro* but that show poor *in vivo* bioavailability.

To reach its objectives, the project NAREB brings together 15 partners (including 4 SMEs and 1 industry) from 8 EU member and Associated States with outstanding complementary expertise, ranging from material engineering to molecular biology, pharmacology and medicine.

The NAREB project main achievements so far include:

- Selection for nano-encapsulation of:
    - 3 drugs currently used for the treatment of MDR TB and 2 drugs currently used for the treatment of MRSA infections
    - Five novel different lead compounds from GSK based on their biological profile against TB and their physico-chemical properties
    - Transcription Factor Decoys (TFDs) constructed and tested *in vitro* for their antibacterial activity against MRSA and TB
- Development of the appropriate analytical methods to properly quantify drug content inside the particles.
- Identification of several formulations in which antibiotics/leads retain their antimicrobial activity upon encapsulation
- Identification of drug target or escape mechanisms of some of the leads