MMSL Military Medical Science Letters Since 1925

Mil. Med. Sci. Lett. (Voj. Zdrav. Listy) 2018, 87(supplementum 1)
ISSN 2571-113X (Online)

MEETING ABSTRACTS

INNOVATIVE BIOCATALYSTS AS TOOLS TO DETECT AND INACTIVATE NERVE AGENTS

Elena Porzio [1*], Francesca Bettazzi [2*], Luigi Mandrich [1], Immacolata Del Giudice [1], Odile F. Restaino [3], Serena Laschi [4], Ferdinando Febbraio [1], Valentina De Luca [1], Maria G. Borzacchiello [3], Teresa M. Carusone [1], Franz Worek [5], Antonio Pisanti [6], Piero Porcaro [6], Chiara Schiraldi [3], Mario De Rosa [3], Ilaria Palchetti [2], Giuseppe Manco [1#]

[1] Institute of Protein Biochemistry, National Research Council of Italy.
[2] Department of Chemistry, University of Florence, Italy.
[3] University of Campania "Luigi Vanvitelli", Italy.
[4] Ecobioservices and Research srl, Italy.
[5] Institute of Toxicology, Germany.
[6] Technobios srl, Italy.

[#]correspondence to: g.manco@ibp.cnr.it., Institute of Protein Biochemistry, National Research Council of Italy, Via P. Castellino 111, 80131, Naples, Italy.

[*]means equal contribution

Pesticides and warfare nerve agents are frequently organophosphates (OPs) or related compounds. Their acute toxicity highlighted more than ever the need to explore applicable strategies for the sensing, decontamination and/or detoxification of these compounds. Herein, we report the use of two different thermostable enzyme families capable to detect and inactivate OPs. In particular, mutants of carboxylesterase-2 from *Alicyclobacillus acidocaldarius* and of phosphotriesterase-like lactonases from *Sulfolobus solfataricus* and *Sulfolobus acidocaldarius*, have been selected and assembled in an optimized format for the development of an electrochemical biosensor and a decontamination formulation, respectively. The features of the developed tools have been tested in an *ad-hoc* fabricated chamber, to mimic an alarming situation of exposure to a nerve agent. Choosing ethyl-paraoxon as nerve agent simulant, a limit of detection (LOD) of 0.4 nM, after 5 s of exposure time was obtained. Furthermore, an optimized enzymatic formulation was used for a fast and efficient environmental detoxification (>99%) of the nebulized nerve agent simulants in the air and on surfaces. Crucial, large-scale experiments have been possible thanks to production of grams amounts of pure (>90%) enzymes.