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BACTERIAL RESISTANCE TO ANTIBIOTICS – NEW COMBAT STRATEGIES INTRODUCTION

Enormous progress was made in the field of microbiology at the turn of XX and XXI century. We have switched from an analysis of individual genes or proteins to global analysis of bacterial cells such as genomics, transcriptomics or proteomics. The first bacterial genome sequence, from *Haemophilus influenzae*, was published in 1995. Now, twenty years later we have reliable information on genetic materials of thousands of bacterial strains, what allow us to study many aspects of complex molecular processes in microbial cells. The progress is unimaginable. Based on new sequencing and bioinformatics methods we have taken up a challenge to understand the correlation between humans and their symbiotic microorganisms. The aim of research is to get knowledge about our microbiome (set of genes of “our” bacteria). Many projects such as the interdisciplinary HMP (Human Microbiome Project) addressed some fundamental scientific questions and the data emanated thereupon help in implementation into practice of various new therapies against human diseases like inflammatory bowel diseases, diabetes, obesity and many others metabolic or even nervous system’s diseases.

However, at the same time globally about ten million people die every year of pathogenic bacterial infections. Majority of premature deaths arises from infections by pathogenic bacteria against which effective drugs are available, so their occurrence is due to economical or political reasons. However, more and more premature deaths result from infection by bacterial strains resistant to many antibiotics. Antibiotics were one of the greatest discoveries of the 20th century and still are considered to be the key anti-

bacterial drugs. However, the observed over the past decades dramatic increase in resistance to antibiotics of many pathogenic bacteria constitutes a global public health threat. According to the European Centre for Disease Prevention and Control (ECDC) in 2009 infections caused by a subset of resistant bacteria were responsible for about 25000 deaths in Europe. Although microbiologists understand the mechanisms which facilitate the formation of highly resistant bacteria and their fast spread, so far we are not able to stop the process. The speed at which bacteria have evolved to become resistant to antibiotics has surpassed the speed of new antibacterial drug discovery.

This issue of KOSMOS presents a set of review articles devoted to various aspects of bacterial resistance to antibiotics. The mechanisms determining antibiotic resistance displayed by several vital to human health pathogens (*Staphylococcus aureus*, *Mycobacteria* or *Pseudomonas aeruginosa*) are described. Additionally, some problems connected with the presence of antibiotic resistant bacteria in the environment are discussed. Three articles concern recent advances toward the development of an alternative to classical antibiotics such as antivirulence drugs and silver nanoparticles.

The authors hope that the presented reviews will provide the readers with broader knowledge and understanding of the urgent need for development of new antibacterial weapons.

