Journal of Nanomedicine & Biotherapeutic Discovery

Hai-Feng et al., J Nanomedine Biotherapeutic Discov 2015, 5:3
DOI: 10.4172/2155-983X.1000e138

Editorial Open Access

Nanomedicine and Biotherapeutics for Antiobiotic Resistance Bacteria

Hai-Feng Ji[1,2*], **Zhengduo Wang**[2], **Qiang Chen**[2] **and Yen Wei**[3]

[1]*Department of Chemistry, Drexel University, Philadelphia, PA 19104, USA*

[2]*Laboratory of Printing and Packaging Material and Technology, Beijing Institute of Graphic Communication, Daxing, Beijing 102600, China*

[3]*Department of Chemistry, Tsinghua University, Beijing 100084, China*

[*]**Corresponding author:** Hai-Feng Ji, Department of Chemistry, Drexel University, Philadelphia, PA 19104, USA, Tel: 01-215-895-2562; Fax: 01-215-895-1265; E-mail: hj56@drexel.edu

Received date: July 16, 2015; **Accepted date:** July 20, 2015; **Published date:** July 25, 2015

Editorial

Based on the result from a joint study in 2014, the Prime Minister David Cameron announced that now 50,000 English and American die of antibiotic-resistant "superbugs" every year [1]. Now the worldwide spending on the treatment of 'superbugs' are more than 20 billion US dollars annually. If no measures are taken, according to the current pace of development, by 2050, every year more than ten million people worldwide will die of 'superbugs'. The 2050 GDP of the world will contract by 2% to 3.5% due to the drug-resistant bacterial infection. This problem is regardless of region, color, and ethnicity. Any affected person may die due to lack of medicine.

The number of new antibiotic-resistant bacteria and viruses continued to rise significantly every year [2,3]. There is a strong demand to fight against growing antibiotic-resistant bacteria. In March 2015, the white house had initiated an aggressive plan aimed at cutting the fatal infections by half in the USA without five years. This is quite a challenge because of the widespread use of antibiotics, which is the main cause of bacterial and viral resistance to antibiotics. About 80% of antibiotics produced in the USA are used for disease prevention in agriculture. In general, when animals are treated with antibiotics, the antibiotic residues and their metabolites were directly discharged out into sewers along with excrement without any treatments [4-6]. In addition, expired antibiotics and other antibiotic wastes from farms, hospitals, laboratories, and pharmaceutical companies were also directly poured into the sewers or underwater. Studies showed the numbers of drug-resistant bacteria in farm and hospital sewers are more than 10 times higher than those in regular household sewers [7-9]. Bacteria have more opportunities to grow their capability to resist drugs since the antibiotics have a long residence time in aquatic environments [10-11].

The national strategies, published by CDC [12], to combat antibiotic resistance include four areas *A) Slow the development of resistant bacteria and prevent the spread of resistant infections. B) Strengthen national one-health surveillance efforts to combat resistance. C) Advance development and use of rapid and innovative diagnostic tests for identification and characterization of resistant bacteria. D) Improve international collaboration and capacities for antibiotic resistance prevention, surveillance, control and antibiotic research and development.* Based on these strategies, the white house seeks to fund discovery of new antibiotics and new diagnostic tools, and stop of the unnecessary use of antibiotics. The discovery of new antibiotics and new diagnostic tools has been slow in the last century. The goal to stop the unnecessary uses of antibiotics is quite a task because there is no alternative cost-effective approach to replace the use of antibiotics, thus the initiative may not go far enough to curb the use of the antibiotics for disease prevention in healthy farm animals. It is believed that antibiotics will continue to be extensively used until one or more practical solutions are employed. These topics had been intensively reviewed recently [13-15]. Readers are recommended to read those literatures for in depth discussions. Intensive investigations are obviously required to combat antibiotic resistance. The journal of Nanomedicine and Biotherapeutic Discovery welcomes any articles, reviews, or communications in this area.

We would also point out that one fact about the cause of antibiotic resistance is that the threat to humans from excessive use of antibiotics is not only because of the use of antibiotics, but also and maybe more due to the lack of treatment of antibiotic wastes. Thus an approach to cost-effective removal of antibiotics in wastewater is also significant in fighting the growth of superbugs.

While in the past decade antibiotic waste has been recognized is a new class of water pollutants [16-18], there is no standard and effective solution to treat the waste of antibiotics. Treatment of wastewater typically relies on biological processes [19-20] to remove chemicals, including antibiotics. The most commonly used method is the conventional activated sludge (CAS), elimination of antibiotic depends on their sludge adsorption and degradation. However, this method is far from sufficient to remove antibiotics. There is a need to develop a single or combined method, such as membrane, chlorination, UV, oxidation, and others to efficiently remove antibiotics from the waste. The requirements of the method include highly efficient, cost effective, practical, less toxic, does not cause bacterial resistance, simple, and safer to use.

References:

1. http://psychomotor4.rssing.com/browser.php?indx=3809892&last=1&item=12
2. Kemper N (2008) Vetererinary antibiotics in the aquatic and terrestrial environment. Ecological Indicators 8: 1–13.
3. Cantas L, Syed QA, Shah LM, Cavaco CM, Manaia F, et al. (2013) A brief multi-disciplinary review on antimicrobial resistance in medicine and its linkage to the global environmental microbiota. Front Microbiol 4: 96.
4. Diaz-Cruz MS, Lopez de Alda MJ, Barcelo D (2003) Environmental behavior and analysis of veterinary and human drugs in soils, sediments and sludge. TrAC-Trends in Analytical Chemistry 22: 340-351.
5. Brown KD, Kulis J, Thomson B, Chapman TH, Mawhinney DB (2006) Occurrence of antibiotics in hospital, residential, and dairy effluent, municipal wastewater, and the Rio Grande in New Mexico. Sci Total Environ 366: 772–783.
6. Czekalski N, Berthold T, Caucci S, Egli A, Bürgmann H (2012) Increased levels of multiresistant bacteria and resistance genes after wastewater

treatment and their dissemination into Lake Geneva, Switzerland. Front Microbiol 3: 1–18.

7. Rosal R, Rodríguez A, Perdigón-Melón JA, Petre A, García-Calvo E, et al. (2010) Occurrence of emerging pollutants in urban wastewater and their removal through biological treatment followed by ozonation. Water Research 44: 578–588.
8. Schwartz T, Kohnen W, Jansen B, Obst U (2006) Detection of antibiotic-resistant bacteria and their resistance genes in wastewater, surface water and drinking water biofilms. FEMS Microbiology Ecology 43: 325–355.
9. Froehner K, Backhaus T, Grimme LH (2000) Bioassays with Vibrio fischeri for the assessment of delayed toxicity. Chemosphere 40: 821–828.
10. Backhaus T, Grimme LH (1999) The toxicity of antibiotic agents to the luminescent bacterium Vibrio fischeri. Chemosphere 38: 3291–3301.
11. Thomulka KW, McGee DJ (1993) Detection of biohazardous materials in water by measuring bioluminescence reduction with the marine organism Vibrio harveyi. Journal of Environmental Science & Health Part A 28: 2153–2166.
12. http://www.cdc.gov/drugresistance/federal-engagement-in-ar/national-strategy/index.html
13. Davies J, Davies D (2010) Origins and Evolution of Antibiotic Resistance. Microbiol Mol Biol Rev 74: 417–433.
14. Okolo MI (1986) Bacterial drug resistance in meat animals: a review. Int J Zoonoses 13: 43-52.
15. Blair JMA, Webber MA, Baylay AJ, Ogbolu DO, Piddock LJV (2015) Molecular mechanisms of antibiotic resistance. Nature Rev Microbio 13: 42–51.
16. Kolpin DW, Furlong ET, Meyer MT, Thurman EM, Zaugg SD, et al. (2002) Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999–2000: a national reconnaissance. Environmental Science and Technology 36: 1202–1211.
17. Kümmerer K (2009) Antibiotics in the aquatic environment – a review – Part II. Chemosphere 75: 435.
18. Fatta-Kassinos D, Meric S, Nikolaou A (2011) Pharmaceutical residues in environmental waters and wastewater: current state of knowledge and future research. Analytical and Bioanalytical Chemistry 399: 251–275.
19. Mudge S, Morrison AM (2010) Tracking Sources of Sewage in the Environment by Environmental. Forensics 9.
20. Rogers HR (1996) Sources, behaviour and fate of organic contaminants during sewage treatment and in sewage sludges. Science of the Total Environment 185: 3–26.