The era of nanotechnology and omics sciences

Wen Li

IHRC, Inc. Atlanta, GA, USA
Email: ejbmr-editor@frenchsciencespg.com

Received: 6 April 2015; Accepted: 8 April 2015; Published: 9 April 2015

Editorial

In the statistic report of “Top 10 Unnatural Causes of Death” from World Health Organization, Ischemic heart disease, stroke, lower respiratory infection, cancers and HIV/AIDS infections are the major causes of death worldwide in 2012 (1). Among these diseases, cardiovascular diseases top the list with about 17.5 million death each year. Communicable diseases, such as HIV/AIDS, malaria or tuberculosis are responsible for 23% of global death, while noncommunicable diseases, such as cancers, diabetes and chronic diseases, cause 68% death. American Cancer Society has released the report of “Cancer Facts and Figures in 2015”, in which they predicted that about 589,430 American people will die from cancers this year, or 1,620 per day. The leading cancer type for women is breast cancer (29%) and male is prostate cancer (26%) (2). Center for Disease Control and Prevention (CDC) has estimated that in United States, about 2 million people are sicken with antibiotic-resistant infections each year, among which about 23,000 people died (3).

Due to the increasing mortality of various diseases mentioned above, medical cost for inpatients has been doubled or tripled over a decade. With the increase of multidrug resistance (4), most of the patients relapse from initial treatment and have to take much higher dosage of drugs and therefore higher burden of healthcare expenses (5). All of these stimulate the development of more advanced, personalized and accurate molecular methods to fight against various medical problems.

With the progress of biomedical science and bioengineering, we now enter the era of ‘nano’ and ‘omics’ sciences (6-8). ‘Nano’ sciences or nanotechnology, refers to the manipulation of matter with at least one dimension sized from 1 to 100 nanometers. In cooperation with surface science, organic chemistry, molecular biology and biomedical/chemical engineering, thousand types of nanoparticles have been designed to deliver various anti-cancer and anti-microbial drugs. Examples of such nanoparticles include polymeric nanoparticles, micelles, gold nanoparticles and quantum dot (6, 9). These nanoparticles have solved the problem of multidrug resistance; and possess higher specificity, stronger potency and lower cell toxicity than traditional method. Meanwhile, nano-chips and nano-devices have emerged with their unique character of drug delivery, gene transfection, living cell interrogation by fabricating an engineered extra-cellular environment. The ‘omics’ science was raised from the fast growth of genomics technology and extended to four general areas: genomics, transcriptomics, proteomics and metabolomics. Each individual patient is digitalized into ‘big data’ and the biomedical information could be specified to each single cell or organ (10).

Besides the basic cancer treatment, such as surgical removal of tumor, radiology and chemotherapy, new advanced molecular technologies have been extensively applied to the diagnosis and treatment of cancer. One example is the identification and validation of biomarkers. Biomarkers are the signature of cancer diseases, containing crucial information for personalized cancer diagnosis, treatment or prevention. Oncologists have been working for decades to identify biomarkers that drive tumor initiation or progression (11). Several well-studied inhibitors, such as tyrosine kinase inhibitors (TKI), anaplastic lymphoma kinase (ALK) and epidermal growth factor receptor (EGFR) are widely used to inhibit cancer development (12).

Genomics studies extend the limitation of biomarkers discovery and clinical validation (13,14). Next generation sequencing (NGS) is among the most advanced technology developed during the last decade. It has been applied to the sequencing of bacteria, virus, parasite, yeast and human cells and proved to be fast, low cost and highly accurate. After the initial whole genome sequencing, more specific analysis, such as targeted sequencing, functional sequencing, parallel sequencing and RNAseq have been developed to locate the exact gene mutations and furthermore identify specific biomarkers in each cancer patients (15).

To further identify disease-associated proteins or novel drug transporter or cell surface antigens, transcriptomics and proteomics analysis are required to characterize proteins in a large-scale. Due to the high variations of protein expression, structure and functions at different time period, proteomics work brings double or triple complexity than genomics analysis. By using MALDI-TOF MS (matrix-assisted laser desorption ionisation time-of-flight mass spectrometry), LC-MS/MS (nano-capillary reverse phase HPLC column with a mass spectrometer) and data analysis (Mascot, MaxQuant or DeepQuanTR), we can not only quantify the protein expression level at different stages and detect the post-translational modification, but also identify the feedback mechanism in the regulatory pathways (16).

These advanced techniques, combined with bioinformatics, material science and traditional biochemistry, have been used globally to overcome multiple medical obstacles. Due to the large volume and high complicity of personal medical database, proper management of individual’s ‘big data’ could be also essential for the development of more personalized medicine, drug binding target or biomedical therapies.

European Journal of BioMedical Research (EJBMR) is devoted to provide an excellent communication plat-
form for all the medical-related research scientists in the world. EJBMR welcomes primary research articles, protocols, review articles, mini-reviews and short reports. The journal is dedicated to publish high quality, original and novel studies in multiple research areas, including cancer research, infectious diseases, cardiovascular diseases, chronic lung diseases, diabetes, genetic diseases in both clinical report and basic research. We strongly encourage submissions of multidisciplinary studies that combine the experimental and computational analysis that address biomedical problems.

As a growing journal, we do not let the criteria to limit the creation, passion and imagination of our scientists as every scientist’s idea and effort should be appreciated. A final decision on publishing a particular paper will be made based on the editor’s opinion on the impact of the paper in its specific field and an evaluation of its existing and potential values. We also highly respect the readers evaluation and comments from our previously published papers and will make decisions based on their interests or needs.

References