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Biotech in Korea

Bioeconomy
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Cover illustration

Biotech in Korea. This special issue of BTJ is edited by our new co-Editor-in-Chief Sang Yup Lee from the Korea Advanced Institute of Science and Technology in Daejon. Featured are all aspects of bioeconomy, bioindustry and biotech research in Korea.
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Editorial: Biotechnology in Korea – the next generation growth engine

From mobile phones to HDTV, cars to large ships, semiconductor chips to laptop computers, it is not difficult to find products "Made in Korea" around the world. Korean economy has been one of the fastest growing in the world, now reaching a *per capita* GNP of about $20 000. Heavy industry and IT industry have been the two major drivers of Korean economic growth. Korea is now considering biotechnology as its next generation growth engine.

생명공학

In a broad sense, biotechnology has been around during the past 4341 years of Korean history. Koreans love fermented food, and have been enjoying signature foods such as Kimchi (fermented cabbage), fermented fish, and fermented soybean soup. Of course, fermented alcoholic beverages have been around for a long time. Koreans also have a long history of own therapeutic methods and medications, as nicely described in the medical textbook "Dong-Eui-Bo-Gam" by Jun Heo, published in 1610.

Compared to these old Korean traditions, the history of modern biotechnology in Korea is rather short. In 1982, the Ministry of Science and Technology has selected biotechnology as a core strategic technology, which led to the launching of the Biotechnology Promotion Act, passed into law in 1983. A large concerted effort on developing biotechnology has only begun in 1994 when seven government ministries collaborated to launch a program called 'Biotech 2000', run from 1994 to 2006. One of the visible aims of this plan was to make Korea one of the seven top biotechnology countries by the year 2010. In 2005, Korea ranked 13th in number of papers published in SCIE-listed publications, which is a big jump from the 29th place in 1994. The number of patents also increased to rank Korea at the 14th place globally. In 2006, the second phase plan for biotechnology promotion was established under the name 'Bio-Vision 2016', which will be in operation until 2016. Bio-Vision 2016 encompasses not only technical, but also social, economic, and environmental considerations. Catch phrases are "healthy life-oriented society" and "prosperous bio-economy". Detailed plans are outlined to promote strategies for advancing the following five key biotech fields: lifesciences; healthcare and medicine; food, agriculture and livestock; industrial processes, environment and maritime industry; and bioconvergence industry.

"New discoveries of high impact reside at the boundaries of multi-disciplines", Nam Pyo Suh, KAIST President

In this BTJ special issue on Biotechnology in Korea, 5 review papers and 8 original papers by leading Korean biotech researchers are presented to showcase some of the recent developments in Korean biotechnology. The review by Dr. Byung-Hwan Hyeon and his colleagues describes in detail the Korean biotechnology strategies represented by 'Bio-Vision 2016' [1]. Readers will be able to catch up with the developments in the field of biotechnology being made in Korea. Dr. Jihyun Kim and his collaborators present recent progress in microbial genome projects in Korea [2]. In addition to the summary on the published genome projects on *Mannheimia* and *Zymomonas* performed by other Korean research teams, the authors' own genome projects including *Hahella, Leuconostoc, Paenibacillus, E. coli* B, *Bifidobacterium, Streptomyces*, and *Donghaeana* are described.

Systems biology and its applications are hot research topics in Korea as in other countries. My own research group reports on the detailed strategies for systems-level metabolic engineering of microorganisms with specific examples. Systems biological approaches towards developing improved strains by integrating omics and computational analyses are described [3]. Two research groups working on systems biology also present their recent results. Professor Kwang-Hyun Cho reports on the dynamic analysis of the calcium signaling pathway in cardiac mycocytes [4]. Professor Do Han Kim reports on his transcriptome network analysis of mouse heart in relation to heart diseases [5]. Professor Gyun Min Lee gives his expert opinion in

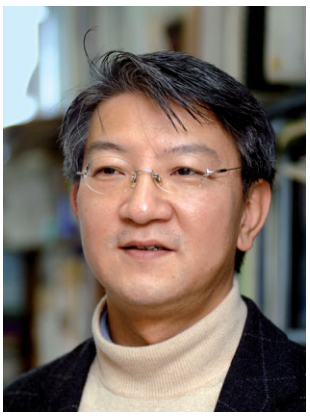
the review paper on the strategies for cellular engineering of CHO cells for the enhanced production of therapeutic proteins [6].

Hansenula polymorpha is a biotechnologically important methylotrophic yeast capable of producing large amounts of recombinant proteins. Dr. Hyun-A Kang and her colleagues report their recent results on glycoengineering of *H. polymorpha* for the production of glycoproteins [7]. Once the therapeutic proteins are developed, a suitable delivery method becomes important. Professor Tae Gwan Park presents his recent work on the development of an injectable and sustained system for delivering human growth hormone using chemically modified pluronic copolymer hydrogels [8].

Other than therapeutic proteins, structural proteins such as spider silk protein and mussel glue protein are of great interest for industrial applications. Professor Hyung Joon Cha reviews his work performed over the past years on the cloning of new genes encoding mussel glue proteins, the production of bioadhesive proteins and applications [9]. Professor Byunggee Kim reports on the strategies for improving and diversifying aminotransferases with respect to their substrate specificities by profile analysis and protein-ligand docking studies [10]. This approach should be useful in improving enzymes for diverse biocatalysis applications.

Finally, Professor Sang Jun Sim reports on the development of an interesting pathogen detection system using a polydiacetylene-based fluorescence chip [11]. Using the waterborne pathogen *Cryptosporidium parvum* as a model organism, they show that their system allows non-labeled detection of this pathogen.

It is by no means possible to cover in this single special issue of the *Biotechnology Journal* all the exciting developments made in the field of biotechnology in Korea. Nonetheless, these papers will provide our readers with a good sense on how Korean biotechnology is advancing in some of the key biotech areas. In addition to the rapid advances in biotechnology itself, Korea is highly encouraging fusion research. According to the KAIST President Nam Pyo Suh, "new discoveries of high impact reside at the boundaries of multi-disciplines". Integration of biotechnology with information technology and nanotechnology is advancing rapidly in Korea. Another BTJ special issue focusing on these exciting biotech developments "Made in Korea" is planned for the future. Until then, I hope that this special issue will serve as a starting point to get closer to understanding Korean biotechnology.



Sang Yup Lee

Biotechnology – it is the next generation growth engine in Korea!

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