CLINICAL AND EXPERIMENTAL VACCINE RESEARCH

A national project to build a business support facility for plant-derived vaccine

Clin Exp Vaccine Res 2019;8:1-3
https://doi.org/10.7774/cevr.2019.8.1.1
pISSN 2287-3651 • eISSN 2287-366X

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Received: January 25, 2019
Accepted: January 28, 2019

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No potential conflict of interest relevant to this article was reported.

For the first time in South Korea, a facility to produce plant-derived vaccines and support bio-venture companies will be built in Pohang, Gyeongbuk Province (Fig. 1). The facility will be located in Pohang Fusion Technology Industry Zone by investing 13.5 billion won from the Ministry of Agriculture, Food and Rural Affairs, Gyeongbuk Province and Pohang city from November 2018 to October 2021 including an enclosed plant and plant cell culture facility, a plant-derived vaccine production facility, an animal efficacy assessment facility (Fig. 2) and equipment to support bio-venture companies.

Plant-derived vaccine is a recombinant protein (antigen) produced by introducing disease-causing gene to plant organism or plant cells, and it has been reported to be more safe, economical, and fast-paced compared to the existing vaccine production platforms such as egg white and/or mammalian cells [1-3].

In 2006, a chicken Newcastle disease vaccine made from carrot cells was first approved by the U.S. Department of Agriculture (USDA) and in 2012 a human Gaucher disease treatment from carrot cells was first approved by the U.S. Food and Drug Administration (FDA). In 2013, Japan developed a dog periodontal treatment using interferon-producing genetically modified strawberries, and in 2014, ZMapp, a treatment for Ebola disease was produced in tobacco, greatly increased the world's interest in plant-derived pharmaceuticals [4-6].

Especially, plant-derived vaccines are emerging as a way to prevent and treat rapidly spreading epidemic, including livestock diseases. For example, if you produce a flu vaccine, it takes about six months with egg white, while a plant-derived vaccine can be produced within a month, so you can respond quickly to a rapidly spreading epidemic. And there is no risk of spreading pathogens because plant-derived vaccines are produced through the introduction of recombinant genes, and it is possible to produce about 50 doses of flu vaccine per tobacco plant.

In addition to the plant-based livestock vaccine market, the world is striving to developing core technology to dominate the market for plant-derived vaccines and plant-derived pharmaceuticals [7-10]. Over the past 20 years, Korea has supported more than 45 billion won in research fund to secure core technology for developing plant-derived pharmaceuticals. According to a survey conducted by domestic plant biotech researchers in 2018, the level of industrialization lags behind that of advanced countries, though there is not much difference in the level of technologies for plant-derived pharmaceuticals. Thus, the plant-derived vaccine business support facility that supports industrialization is highly meaningful in providing an opportunity to

Fig. 1. Plant-derived vaccine facility.

Fig. 2. Plant (*Nicotiana benthamiana*) breeding facility.

strategically foster the domestic plant-derived vaccine industry in the future.

This facility, which will be built on a three-story scale (gross floor area 3,966 m^2), is scheduled to be completed in March 2021. The facility will be equipped with plant incubating facilities such as tobacco and rice cell culture, which can be used by bio-venture companies, and will secure air pressure facilities, air conditioning facilities and sterilization facilities to prevent the outflow of genetically modified materials. In addition, the vaccine production facility will establish industrial facilities for production of plant-derived vaccines such as protein extraction, protein purification equipment, and others. It will also have animal bleeding facilities and efficacy assessment facilities to verify the effectiveness and toxicity of the vaccine developed, as well as offices, research labs, and conference rooms that bio-venture companies can use starting at June 2021.

Pohang Techno Park Foundation, which is in charge of this project, plans to strengthen its customized support for each company through 1:1 Project Manager (PM) designation, plan R&D and non R&D projects by government and local governments, and support for clinical trials, licensing and certification of plant-derived pharmaceuticals in order to concentrate domestic bio-venture companies in Pohang Fusion Technology Industry Zone. In addition, Gyeongbuk Province and Pohang city are planning national projects, attracting companies, and raising funds for bio-venture companies in order to foster plant-derived vaccine industry, as well as plant-derived pharmaceuticals and recombinant protein industries. In the future, Pohang city plans to strategically foster a promising bio-industry that will contribute to the future safety community through the creation of a regional cluster of plant-based Bio-venture Town Complex.

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