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Potential of Silkworm in Biotechnology

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Silkworms have been in use for human needs for centuries. The silk derived from the silkworm is of great economical value. Lately insects and in particular silkworms have attracted the attention for expressing proteins of high value, which need post-translational modifications for human applications or research. At 1985 Dr. Maeda demonstrated that silkworm larvae could produce functional interferon [1]. Since then, to express desired protein of interest in silkworms various techniques have been developed, and among them Baculovirus based expression system (BES) comes foremost. Baculovirus being the ideal vector carrying desired cDNA of interest does not infect nor cause any known disease to humans or other livestock other than its host, thus dismaying any biohazard concerns. Thus it suits the purpose and with the advent of bacmid technology, the ability to produce recombinant baculovirus has grown many folds; both Autographa californica multiple nucleopolyhedrovirus (AcMNPV) and Bombyx mori nucleopolyhedrovirus (BmNPV). BmNPV based expression system for expressing proteins was improvised using BmNPV bacmid [2]. BmNPV bacmid is capable of replicating in both Escherichia coli and expressing protein of interest in Bombyx mori derived cell lines or silkworms. This method utilizes the advantage of a bacmid, it can be easily prepared and screened in E. coli to produce sufficient DNA for subsequent expression in silkworms.

Today's biotechnology based industry faces a bottleneck towards further advancement owing to the lack of proper gene expression systems. In spite of rapid growth of bioscience, there are still many proteins of which structures are unidentified. Scientists concerned in the field of life science desired technique, which can express protein in large quantities, and purify protein in form having a biological function quickly. Thus said, with the completion of Human Genome Project, we have come across a herculean task of trying to understand the function of the proteins being coded by the genes. Many researchers proved silkworm biotechnology is one of solutions. Up to now, α-interferon, HBeAg, sugar-modified eukaryotic proteins, such as carbohydrate transferases and cell surface receptors, have been produced using B. mori silkworm larvae. This work demonstrates great potential advantages of the BmNPV bacmid system for the large-scale expression of foreign genes in the silkworm. Furthermore, recent reports showed that the recombinant baculovirus containing mammalian cell-active promoter can exhibit efficient gene transfer of potential vaccines into mammalian cells. This would be a great breakthrough in production of recombinant eukaryotic proteins and viruses, which will be a powerful tool in a new proteome era.

This special issue aims at contributing in the field of life science, for example gene expression system, silkworm research directionality, and commercialized proteins from silkworm expression system, and focusing on genetics of the silkworm, developing new specialized silkworm for protein expression, application of proteins to medicine, transgenic silkworm, and the commercialized proteins in Japan.