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BIOSYNTHESIS OF RECOMBINANT INTERFERONS IN TRANSGENIC PLANTS
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The production of recombinant cytokines with transgenic plants may solve the problem of high demand on drugs against severe diseases, such as hepatitis, AIDS, chronic granulomatous disease, etc. Microorganisms, mammal cell cultures and even plants may be involved in interferon (IFN) production. Considering an array of disadvantages of microbial and mammalian cell cultures, transgenic plants become an object of interest as a perspective producer of interferon.

There are many genera of plants, which can be used as interferon producer (Table). It is important that interferon, which is expressed on the same level in different plants, may have different activity due to variety of biosynthesis conditions. Therefore, the most significant parameter for comparison of recombinant plants is the activity of synthesized interferon. According to data, presented in table, the most efficient producers are lettuce (3.1×10^4 IU/g of fresh weight) and cucurbits (4.3×10^5 IU/g of fresh weight).

Table 1.

Transgenic plants – producers of interferon

<i>IFN type</i>	<i>Producer</i>	<i>IFN expression level</i>	<i>Reference</i>
IFN - α 2	Cucurbits	4.3×10^5 IU/g of leaves	[Arazi T. et al., 2001]
IFN- β	Lettuce leaves	3.1×10^4 IU/ml	[Li J. et al., 2007]
IFN- α 2b	Tobacco	$(2.1 \pm 0.8) \times 10^3$ IU/g of leaves	[Sindarovska Y.R. et al., 2010]
	Carrot	26.8×10^3 IU/g of leaves; 8.56×10^3 IU/g of root	[Luchakivskaya Y. et al., 2011]
IFN - α 2	Aloe vera	9.53×10^2 IU/g of leaves	[Lowther W. et al., 2012]
IFN- α 2b, IFN- α	Potato	560 IU/g of tissue	[Ohya K. et al., 2001]
IFN - γ	Rice cell culture	11.1 – 17.4 ng/ml (exogenous); 131.6 – 699.79 ng/g of cells (endogenous)	[Chen T.L. et al., 2004]
	Zucchini leaves	1.0 – 1.2 mg / 100 g of fresh weight	[Hosseini S. et al., 2012]

It is possible now to obtain reliable and profitable interferon preparations using transgenic plants. For example, there is exists a commercial preparation of recombinant IFN- α 2b, which is now passing its' clinical tests. The biosynthesis of interferon was carried out in *Lemna minor* [L.G. de Leede et al., 2008].

Thus, plants are perspective class of biological systems which can be used for recombinant cytokine production, including interferon. Involving plants into biotechnology of cytokines possesses an array of advantages, such as absence of human viruses in plant cells, similar to human mechanisms of expression and processing of proteins, absence of dangerous bacterial endotoxins. Also, plants are simple to grow and do not require specialized equipment and fine techniques like the majority of recombinant microorganisms and mammal cells, so far as interferon is being synthesized and accumulated during whole lifecycle of plant, which can be grown in field conditions or in a greenhouse.

Considering presented data it can be concluded that transgenic plants are perspective class of biological producers of recombinant cytokines, including interferon. Due to increasing requirements

for technological features and safety of drugs, it is possible that *in planta* technologies of cytokine producing may be involved in biotechnology in a line with existing methods.

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IMMUNOBIOTICS AND FUNCTIONAL FOODS FOR THE CORRECTION AND PREVENTION OF IMMUNE SYSTEM DISORDERS

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Considering the negative impact of external and internal factors on the human immune system bacteriatherapeutic drugs based on the microflora with immunomodulation properties – immunobiotics and functional food products based on the microflora with immunomodulation functions is relevant area of the modern food industry. Recent studies of composition and functions of human intestinal microflora caused interest in the target application and development of functional food and probiotics for the prevention and treatment of somatic illness. Disturbance of the microbiota are associated with inflammatory diseases, namely with the disorder of communication between cells of the immune system and the microbiota. Balanced immunoregulation and inhibition of the inflammatory response of the immune system facilitates restoration of disturbed microbiota composition. Effective factor of the microbiota restoration is probiotics and functional food products enriched probiotic microorganisms.

There are many reasons a disturbance of intestinal microflora, diet high in polyunsaturated fats, antibiotics, stress, local and systemic inflammatory diseases and others. In many cases, several factors acting simultaneously. The consequences of intestinal microflora disturbance are complex and can cause both local (bowel disease) and systemic (metabolic disease) pathological conditions (Crohn's disease, diabetes, obesity, atopic dermatitis, allergies, etc.). Biological effects of probiotic microorganisms are strain-specific. Depending on the type, species, strain probiotic bacteria can have immunostimulatory, immunodeviatory (bipolar) and immunoregulatory / suppressive effect.