Volume 54(1):59-73, 2010
Acta Biologica Szegediensis
http://www.sci.u-szeged.hu/ABS

Involvement of carotenoids in the synthesis and in the assembly of protein subunits of photosynthetic reaction centers of *Synechocystis* sp. PCC 6803

Ozge Sozer

Institute of Plant Biology, Biological Research Center, Hungarian Academy of Sciences, Szeged, Hungary

The *crtB* gene of *Synechocystis* sp. PCC 6803, encoding phytoene synthase, was inactivated in the Δ*crtH* mutant. Thus, a carotenoid-less mutant, Δ*crtH/B*, was produced. Cells of the mutant were light sensitive and could grow only under light-activated heterotrophic growth conditions in the presence of glucose. Carotenoid deficiency did not significantly affect the cellular content of phycobiliproteins while the chlorophyll content of the mutant cells decreased. The mutant cells exhibited no oxygen-evolving activity suggesting the absence of photochemically active PSII complexes. This was confirmed by 2D electrophoresis of photosynthetic membrane complexes. Analyses identified only a small amount of a non-functional PSII core complex lacking CP43, while the monomeric and dimeric PSII core complexes were absent. On the other hand, carotenoid deficiency did not prevent formation of Cyt b_6f complex and PSI, which predominantly accumulated in the monomeric form. Radioactive labeling revealed very limited synthesis of inner PSII antennae, CP47, and especially CP43. Thus, carotenoids are indispensable constituents of the photosynthetic apparatus being essential not only for the anti-oxidative protection, but also for the efficient synthesis and accumulation of photosynthetic proteins and especially that of PSII antenna subunits.

E-mail: ozgebozkurtozge@hotmail.com

The role of bone marrow derived mesenchymal stem cells and their galectin-1 expression in the progression of mouse tumors in models of 4T1 breast carcinoma and B16F10 melanoma

Gábor János Szebeni

Hungarian Academy of Sciences, Biological Research Center, Institute of Genetics, Szeged

Galectin-1 (Gal-1) has a powerful anti-inflammatory effect (Kiss et al. 2007; Veronika et al. 2008) dominantly due to the induction of apoptosis of activated T cells (Ion et al. 2005, 2006). Gal-1 expression or overexpression in a tumor or in the tumor associated stroma must be considered as a sign of a poor prognosis for patients (Camby et al. 2006). Recent literature data report about the role of bone marrow derived mesenchymal stem cells (bmMSCs) in the process of tumorigenesis. It has been shown in these studies that bmMSCs selectively migrate into the tumor sites and are engrafted in the tumor stroma (Berber et al. 2009). Moreover bmMSCs may contribute to the formation of tumor associated stroma supporting the progression of cancerous cells, may regulate the neoangiogenesis and prevent the tumor specific immune response (Lazennec 2008). Several proteomic studies revealed the Gal-1 expression in mesenchymal stem cells (Silva et al. 2003; Panepucci et al. 2004; Kadri 2005; Lepelletier et al. 2009) however its role in MSC has to be elucidated.

Our purpose was to examine the role and influence of bmMSCs and bmMSC derived Gal-1 in the course of primary tumor development and metastasis.

We examined the Gal-1 production in MSCs in Western blot and FACS experiments. Balb/C or C57Bl/6 mice were subcutaneously injected with 4T1 breast carcinoma or B16F10 melanoma cells, respectively with or without bmMSCs. Primary tumor size was regularly measured. After sacrificing the animals, weight of the lung and number of metastatic nodules were analyzed. Histochemical analysis was also carried out on different tissues isolated from treated mice. We established Gal-1 knock-down MSCs in order to investigate their effect in tumor progression, neovascularization and metastasis.

Co-injection of bmMSCs with 4T1 breast carcinoma or B16F10 melanoma tumor cells induced larger primary tumor size and increased necrotic lesions on the 3rd week after treatment compared to these parameters in animals treated with the tumor cells alone. Metastatic phenotype characterized by the lung mass and the number of metastatic nodules is also more pronounced in animals injected with combination of tumor cells and bmMSCs. Histopathology also confirms the participation of bmMSCs in the pathogenesis of cancer, since bmMSCs enhance the number of micrometastasis in lungs and in lymph nodes. Moreover we detected CM-DiI labeled MSCs in the tumor samples on the 3rd week after treatment. Co-transplantation of Gal-1 knock-down MSCs with 4T1 cells slowed down the 4T1 tumor growth and vascularization compared to that of the effect of wild type MSCs.

In this study we show that bmMSCs enhance the growth kinetics of the primary orthotropic 4T1 mouse breast carcinoma and B16F10 melanoma. Also they contribute to progression of metastatic phenotype of the investigated tumor models. Supportive effect of bmMSCs to the tumor progression prevails on the 3rd week of treatment, since co-injection of bmMSCs with tumor cells do not modify the survival period of the animals. MSC derived Gal-1 could play an important role in the tumor promoting effect of MSCs.

Camby I, Le Mercier M, Lefranc F, Kiss R (2006) Galectin-1: a small protein with major functions. Glycobiology 16:137R–157R.

Ion G, Fajka-Boja R, Tóth GK, Caron M, Monostori E (2005) Role of p56lck and ZAP70-mediated tyrosine phosphorylation in galectin-1-induced cell death. Cell Death Differ 12(8):1145-1147.