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## **HUMBOLDT-KOLLEG**

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## **BOOK OF ABSTRACTS**

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## PHOTOSYNTHETIC PERFORMANCE OF SHOOT *IN VITRO* CULTURES OF MEDICINAL PLANTS WITH MODIFIED SECONDARY METABOLISM

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The organization and functionality of photosynthetic apparatus of higher plants bear essential information on the overall physiological state of the plant. Studying the crosslink between the photosynthetic performance and secondary metabolites production is important for establishing optimal growth conditions for *in vitro* tissue cultures of medicinal plants. Therefore in this work we characterized *Artemisia alba* Turra shoot *in vitro* cultures treated with two plant growth regulators (benzyl adenine and indole-3-butyric acid) by exploring the structural organization and functionality of the photosynthetic apparatus, as well as the productivity of antioxidant polyphenolic compounds. A complex non-linear relationship between plant growth regulators supplementation, the polyphenolic levels and the architecture and functionality of the photosynthetic thylakoid membranes was found. The structural features of thylakoid membranes were found to correlate with the PGRs type and concentration and the polyphenolics and flavonoids level. Also a strong correspondence was established between the quantum yield of photochemical reactions of photosystem II in dark adapted state and its ability for photoprotection, and polyphenols and flavonoids accumulation.

The applied approach helped to determine the optimal plant growth regulators concentration and combination that rendered both high photosynthetic efficiency and high accumulation of polyphenols and flavonoids.

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## IN VITRO THREE-DIMENSIONAL HUMAN CELL CULTURE MODEL OF BONE LESIONS IN MULTIPLE MYELOMA

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Bone marrow metastasis remains one of the main causes of death associated with solid tumors as well as multiple myeloma (MM). MM is a disseminated malignancy of plasma B-cells in the bone marrow. In myeloma, the understanding of the tissue, cellular and bone microenvironment alterations have progressed from *in vitro* and *in vivo* studies. However, none of the established models reproduce exactly the human form of the bone lesions. Known animal models include: (1) injection of pristane oil leading to intraperitoneal plasmacytomas without bone marrow colonization and osteolysis; (2) injection of human MM cells in immunodeficient mice with or without bone lesions if additionally transplanted human embryo bone; and (3) injection of murine allogenic MM cells in C57BL/KalwRij mice with proliferation in bone marrow. We developed one 3D cell culture model based on human osteoblastic spheroids formed under microgravity conditions in a similar to the developed by NASA rotating vessel bioreactor system. The system has a modified computer controlled electric motor control and rotation velocity increase algorithm was established by mathematical modelling of the spheroid movement with mass increase. The osteoblastic SAOS-2 cells lack the expression of the Bcl-2 protein and allowed the discrimination between MM and osteoblastic cells. The immunohistochemical findings confirmed the invasion of the spheroids by the human MM cells.

Taken together our experimental findings indicate that the established *in vitro* model of bone lesions, which are typical for human MM, is based on human cells and may represent an attractive and perspective alternative to animal experiments thus replacing, reducing and refining (RRR) the use of experimental animals. Moreover, it can be beneficial in obtaining new data about the pathogenesis and identification of targets for innovative treatments of bone invasion in MM, which is potentially fatal hematological malignant disease despite of the newly approved targeted drugs and cytoreductive treatment regimens.