Photoacoustic imaging for characterization of tumors *in vivo*

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Introduction: Photoacoustic imaging (PAI) is an emerging technology that combines the most compelling features of optical imaging and ultrasound, providing both high optical contrast and high ultrasound resolution at depth in living organisms. PAI provides unique opportunities to measure noninvasively, including in deep tissue, endogenous compounds (such as hemoglobin, melanin and fat) to explore physiopathological aspects together with exogenous compounds tracing the expression of specific biomarkers.

Methods: In this study we set up 2 animal models of cancer (glioblastoma and colon cancer liver metastasis) and we monitored the tumor development by combining several preclinical imaging modalities ie bioluminescence, 3D fluorescence, microCT and echography and we evaluated the input of PAI for the biological characterization of the cancer process. Indocyanine green (ICG) and Angiostamp®800 were used as contrast agents for both fluorescence and PA. Nano6000 was used as an X-rays liver contrast agent.

Results: *In vivo* bioluminescence provided a longitudinal follow up of tumor development and metastasis progression in the glioblastoma and colon cancer liver metastasis models. MicroCT is not appropriate to visualize brain structure but it offered a good anatomical visualization of liver metastasis with the use of the X-rays contrast agent.
ICG was shown to accumulate in the liver but there was no specific contrast in the tumor nodules regardless the imaging technique employed. Contrariwise, both glioblastoma and liver metastasis were efficiently labeled by Angiostamp®800 and were well detected by 3D fluorescence and PA. Moreover images quantification allowed to distinguish between 2 cancer progression stages.

Conclusion: PAI offers a new approach for imaging molecular cancer process at the microscopic scale in deep tissues in living organisms that advantageously completes the other anatomical or functional imaging modalities.