UNCOVERING CANCER CELL BEHAVIOR USING QUANTITATIVE PHASE MICROSCOPY

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Metastatic cancer have been known to use a large number of cellular mechanisms, which increase their resistance to chemotherapy. Some of them have been very rare (e. g. entosis), and can be easily left undetected by biochemical techniques or flow cytometry, which analyze large populations of cells. Because many of these mechanisms are associated with the changes in cancer cell morphology and relocation of cellular mass, they can be traced by time-lapse microscopy. Phase contrast or DIC microscopy have been commonly used methods for label free imaging of living cells. Although these techniques provide a good visual observation, the segmentation of cellular boundaries, which is a prerequisite for analyzing many parameters of individual cells (e.g. trajectory, mass, circularity), is very difficult.

Quantitative phase microscopy or imaging (QPI) allows detailed assessment of cell attributes due to the extremely high sensitivity in detecting even the smallest changes in mass density. This in turn allows very good segmentation of individual cells and further in depth analysis of many cellular parameters, such as mass changes, confluency, directionality, growth and many more. Based on these parameters, rare cells with unique behavior can be identified in large populations of cancer cells and eventually provide answers to origins of chemotherapy resistance.

Here, we used QPI as a method for a label-free quantification of unique proliferative properties of cancer cells and their changes in respect to various chemotherapeutic treatments. An examples of cell fate monitoring techniques and their use to evaluate rare variations in cancer cells chemotherapy response will be shown.