The evolution of cancer cell population is a very dynamic process, involving numerous cell-cell and cell-matrix interactions constantly shaping the cancer cell population. Time-lapse videomicroscopy of living cell cultures can be very instrumental in following and dissecting these interactions and the resulting evolution within the cancer cell population.

We demonstrate this approach by two examples. First, we have followed the fate of putative cancer stem cells over prolonged time scale. A derivative daughter of the bladder cancer cell line BFTC-905 has been transfected with an expression vector coding for the GFP reporter under the control of a doxorubicin-responsive promoter and cultured in doxorubicin containing medium; cancer stem cells, by virtue of their constitutive expression of multidrug resistance efflux pumps, constantly eliminate doxorubicin out of the cell and therefore cannot switch on the doxorubicin-regulated GFP, in progenitor cells is this capacity limited, leading marginal GFP expression level, whereas in differentiated cancer cells strong GFP expression could be recorded. The time lapse videomicroscopy is thus able to unravel the intrinsic hierarchy of carcinoma cell lines. In the second experiment, we cocultured subperitoneal fibroblasts with the A2780 ovarian carcinoma cells. Peritoneal spreading is the preferred way of ovarian cancer metastasis and the chemotaxis of ovarian cancer towards subperitoneal fibroblasts is supposed to represent one of the underlying mechanisms. By long-term coculture recording, we could really observe a strong chemotaxis of ovarian carcinoma cells towards sparsely grown subperitoneal fibroblasts. These examples illustrate the power of time-lapsed videomicroscopy in analysing complex dynamic processes in cancer biology.

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Fig. 1: Cocultivation of subperitoneal fibroblasts with the A2780 ovarian carcinoma cells, magnification 100x