Non-radioactive molecular imaging of cancer drugs

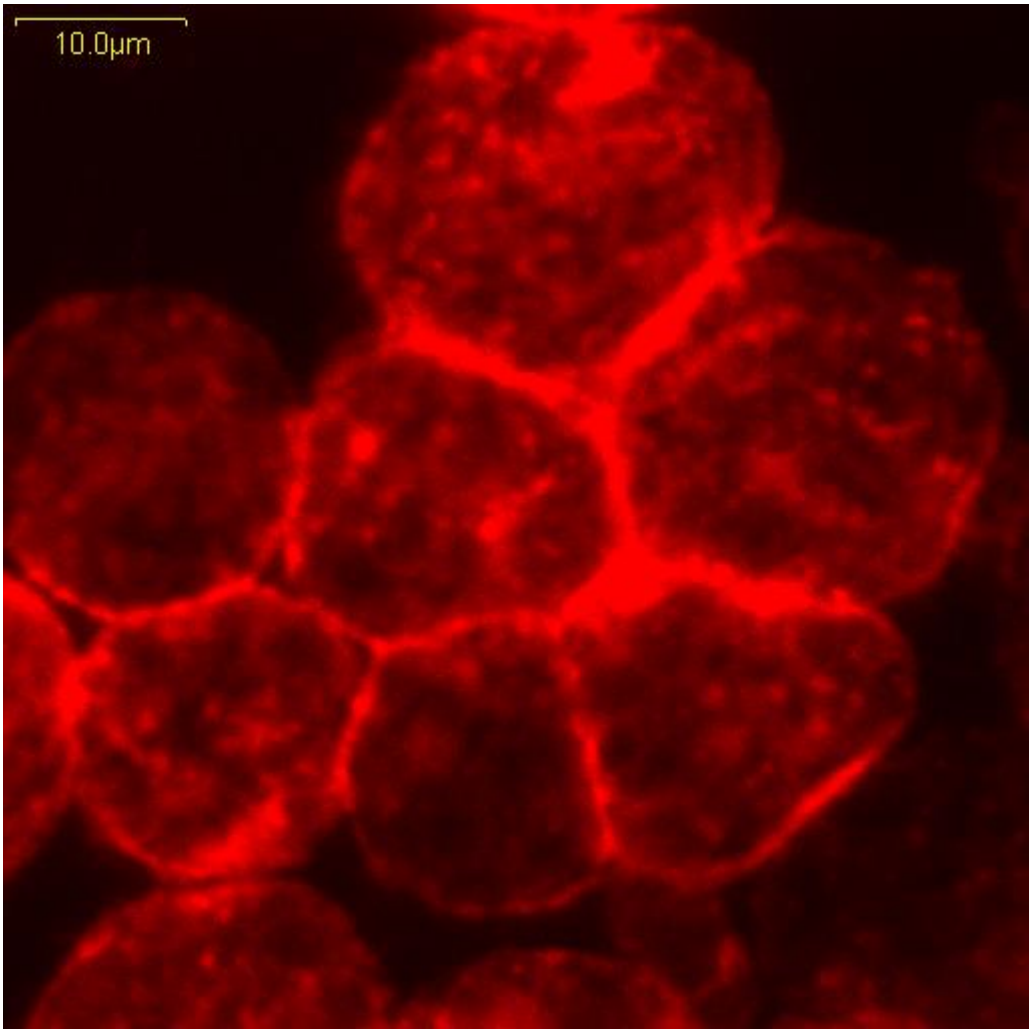
The overall goal of the research project performed in a collaboration between the University medical center Groningen (UMCG) and the University of Twente is to develop anti-cancer drugs primarily based on non-radioactive molecular imaging. This research will guide patient-tailored selection of drugs directed at the HER pathway, measure in vivo drug and tumor behavior, and allows dynamic treatment tuning.

Molecular imaging of anti-cancer drugs is performed by labeling fluorescent molecules to the cancer drugs, allowing them to be visualized under a fluorescence microscope.

The used anti-cancer drugs are mainly antibodies. These antibodies are specifically designed to target a certain molecule known to play a role in cancer development. Target molecules are biomolecules known to be more present in tumors than in healthy tissue. The epidermal growth factor receptor (EGFR) and the vascular endothelial growth factor (VEGF) are examples of biomolecules known to be overexpressed in certain cancer types.

Our contribution to this project is to develop techniques to be able to quantify the cancer drugs in tumors and healthy tissue. We also develop techniques to measure effects of cancer drug treatment on cells and tissue using label-free optical imaging. Label-free optical imaging modalities such as coherent anti-stokes Raman scattering and stimulated Raman scattering are used for this.

Finally, we investigate the label-free detection of the anti-cancer drugs and targets in tumor tissue using techniques based on (coherent) Raman spectroscopy.



This figure shows the fluorescence emission from the fluorophores attached to the anti-cancer drugs

Hyperspectral CARS imaging to detect cancerous tissue

Using nonlinear optics such as CARS and SRS, we try to collect hyperspectral images of molecular vibrations in both healthy and cancerous tissue samples. Due to different concentrations of for example lipids and DNA in those tissues, spectra of both samples will differ. This hopefully enables an fast and relatively easy way to distinguish healthy tissue from cancerous tissue.