

Determination of Dose and Time Dependent Effects of Doxorubicin on MCF-7, a Human Breast Cancer Cell Line, and Its Drug Resistant Variants *via* Impedimetric Measurements

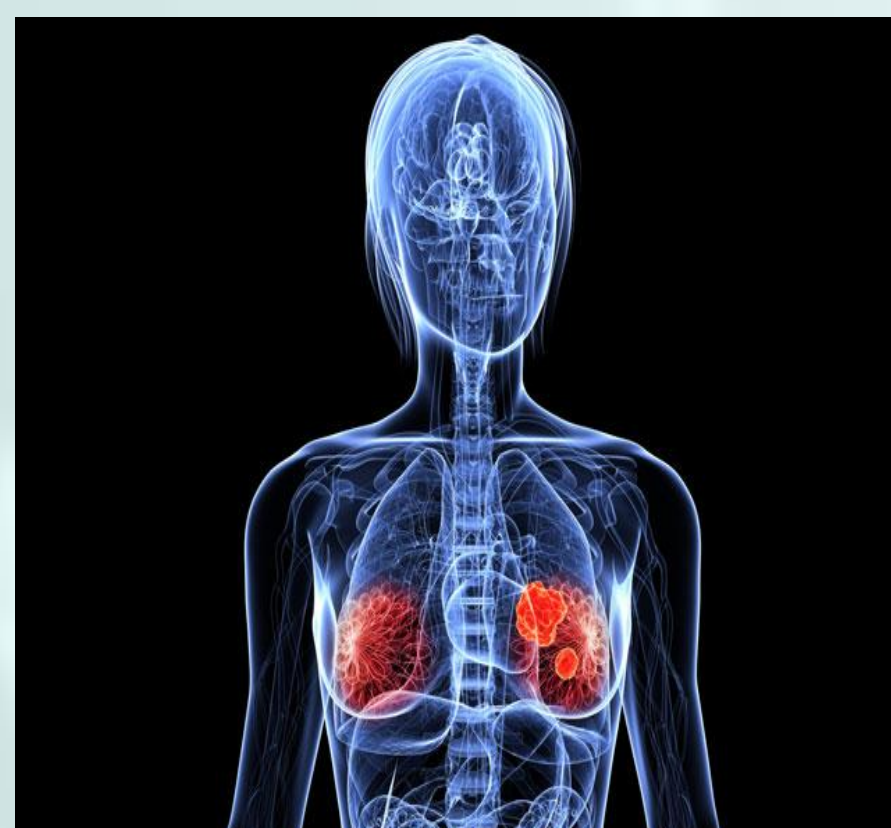
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Motivation

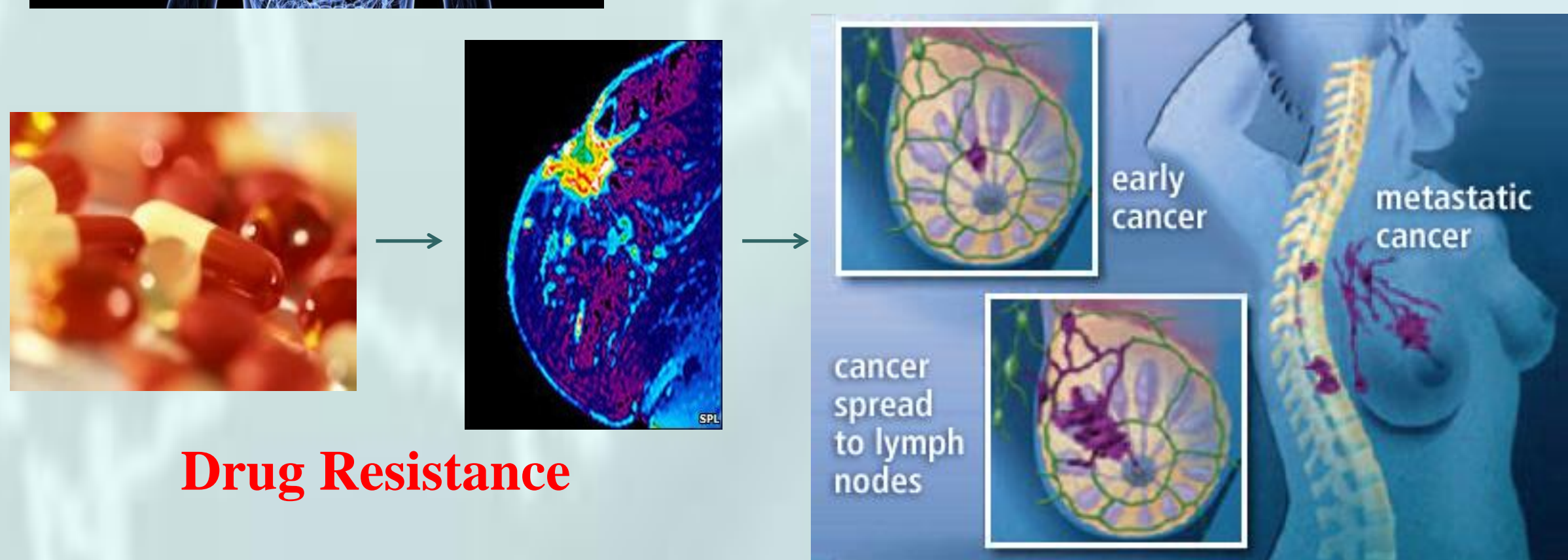
This study highlights the possibility to assess drug efficacy and drug response of MCF-7 cells and its drug resistant variants, offering direct, real-time and label-free measurements of cell dependent parameters under drug exposure, and providing continuous information regarding cell-drug interaction. Herein, a microelectronics-based platform was developed for MCF-7 breast cancer cell culture and real-time monitoring of drug induced cellular changes was performed *via* impedimetric measurements.

Breast Cancer and Drug Resistance



- Breast cancer is one of the most common cancer type (compromises almost 23% of all cancer types)
- Some cancer cells adopt to survive during chemotherapy

Metastasis

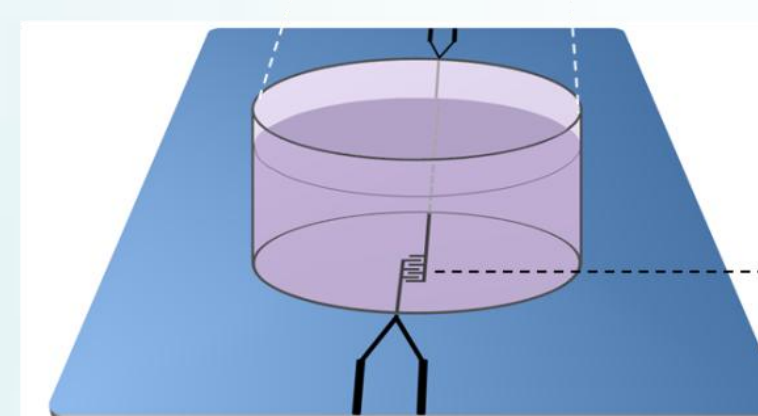
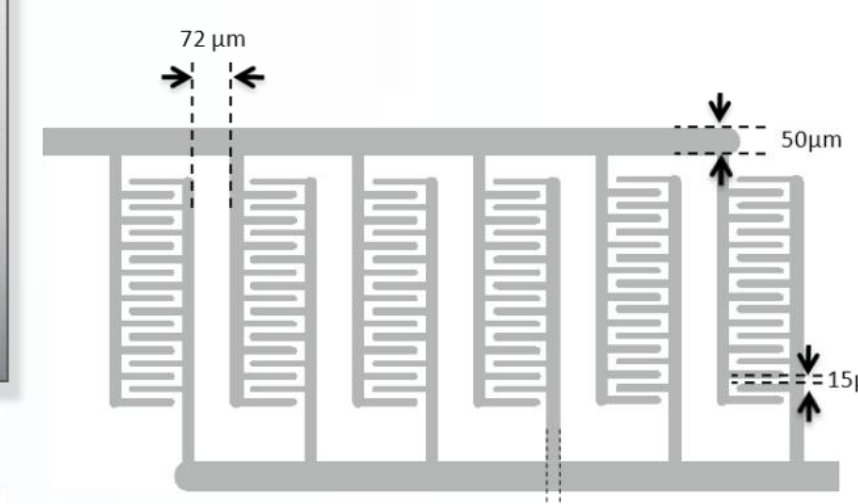
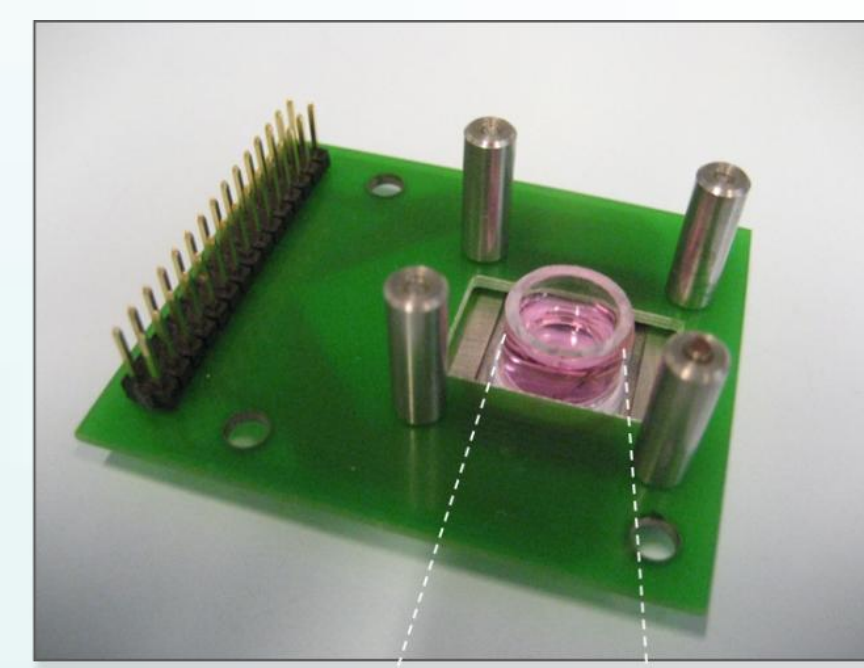


Drug Resistance

- Drug resistance leads to progression of the disease such as metastatic stages with lethal consequences

Great demand to develop rapid and simple techniques to investigate the interaction of breast cancer cells at different stages with drugs and toxins

Cell-based sensing of drug induced changes

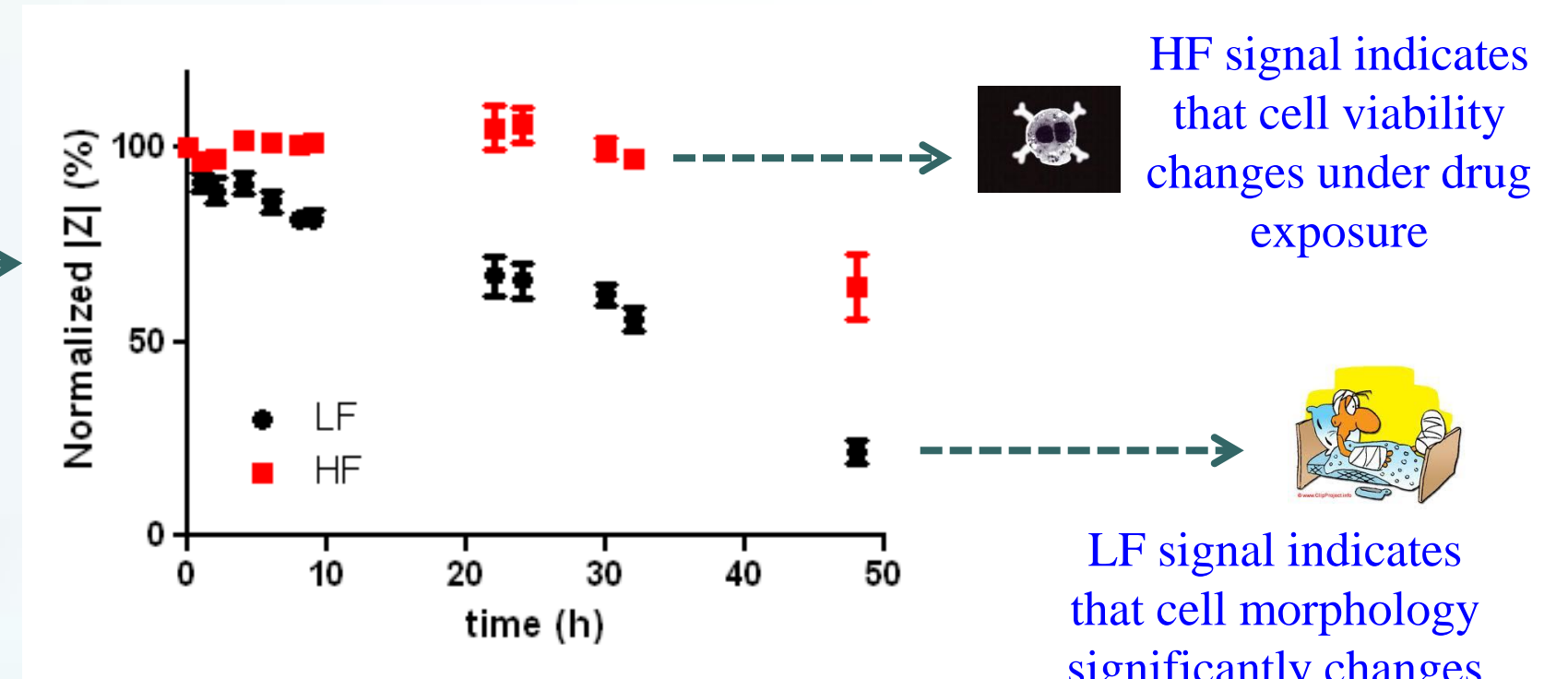


Microelectronics-based cell culture device for drug response studies

Cell culture well and electrical interface (top). Schematic of cell culture on microelectrodes (bottom). Electrode design (right)



Treatment of MCF-7 WT cells with doxorubicin

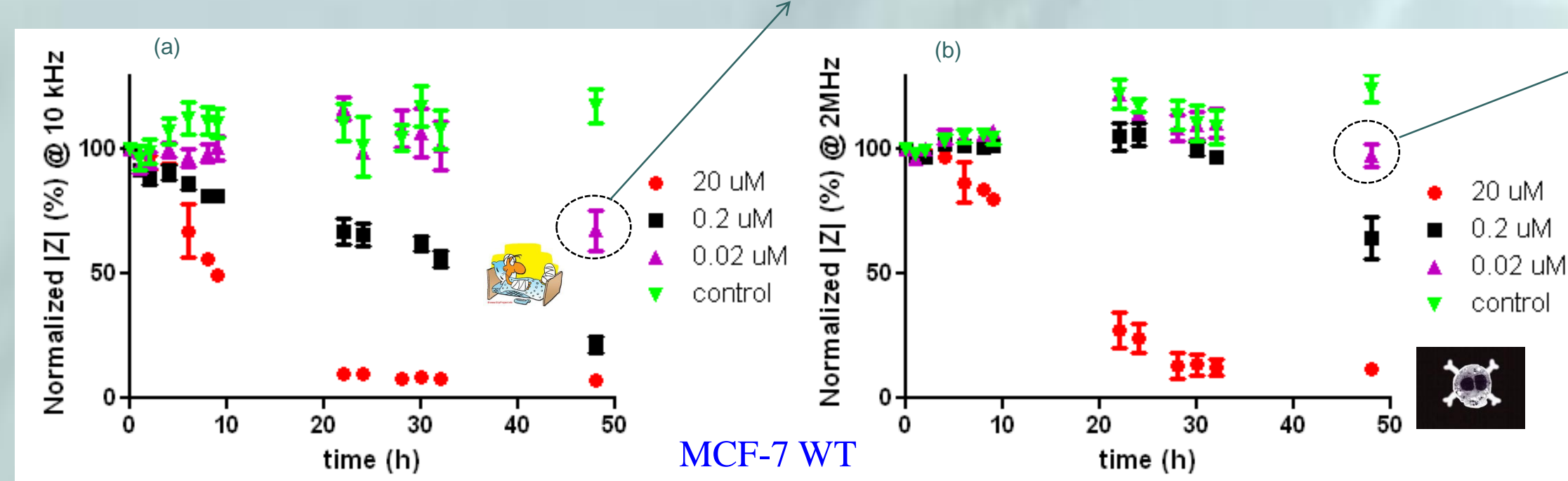


Impedance Measurements

Temporal evolution of $|Z|$ at HF (10 MHz) and LF (2 kHz) during 0.2 μM doxorubicin exposure

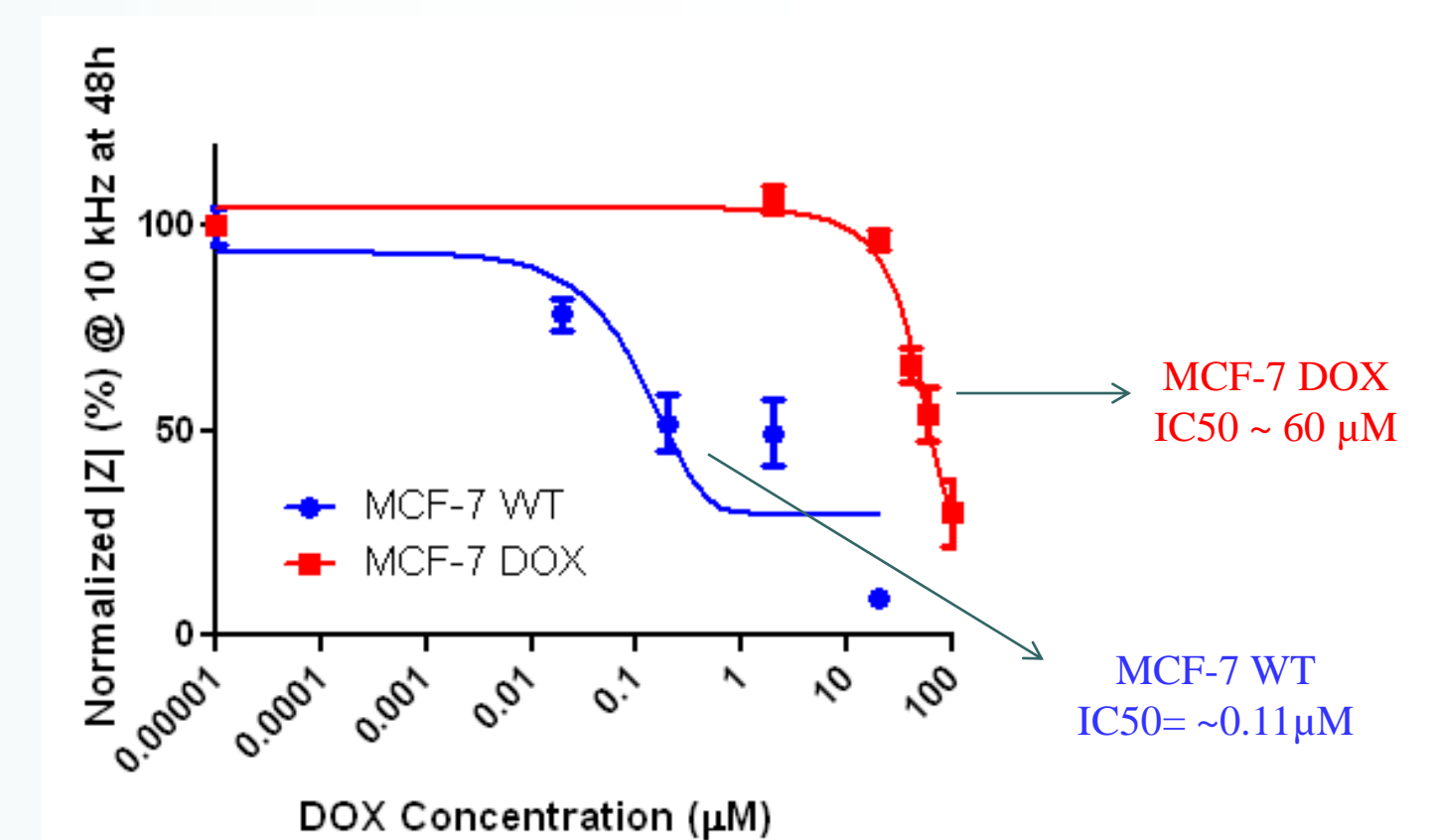
Time and Dose Dependent Drug Effects on MCF-7 and Its Drug Resistant Variant

Drug Induced Morphology Changes



Temporal evolution of $|Z|$ for MCF-7 WT under different doses of doxorubicin at (a) LF (2 kHz) (b) HF (2 MHz)

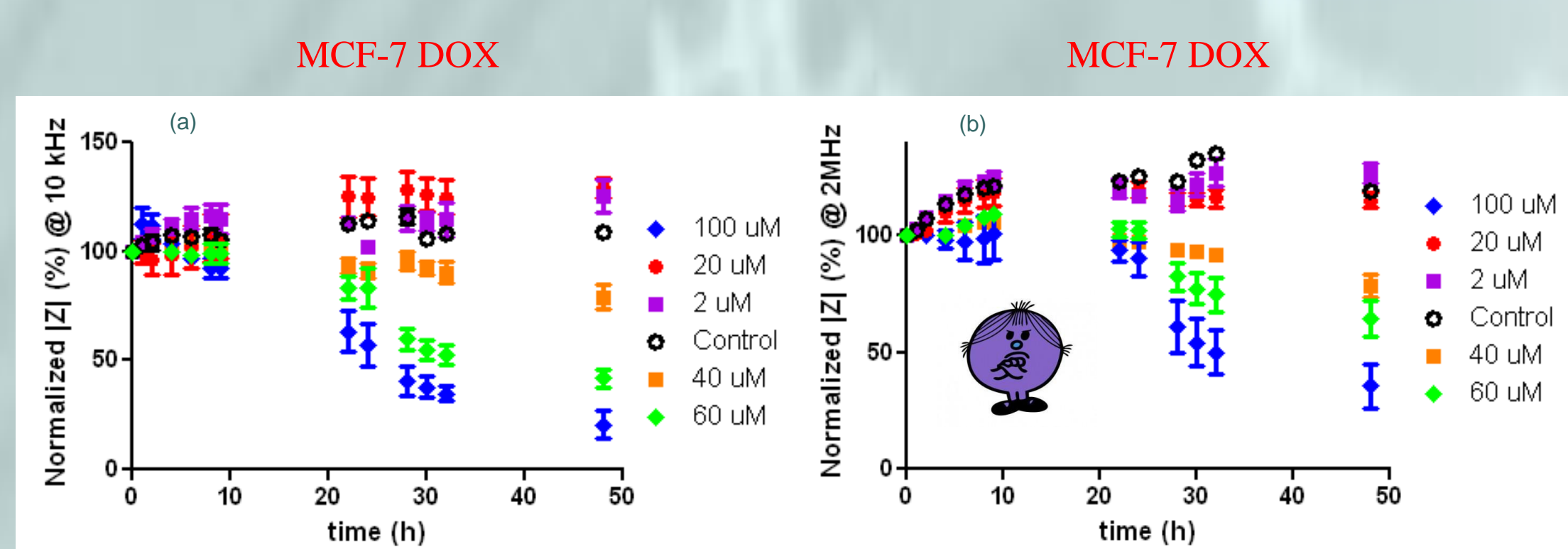
Dose Response Curves



IC_{50} (MCF-7 DOX) is ~ 500 times higher than IC_{50} (MCF-7 WT)

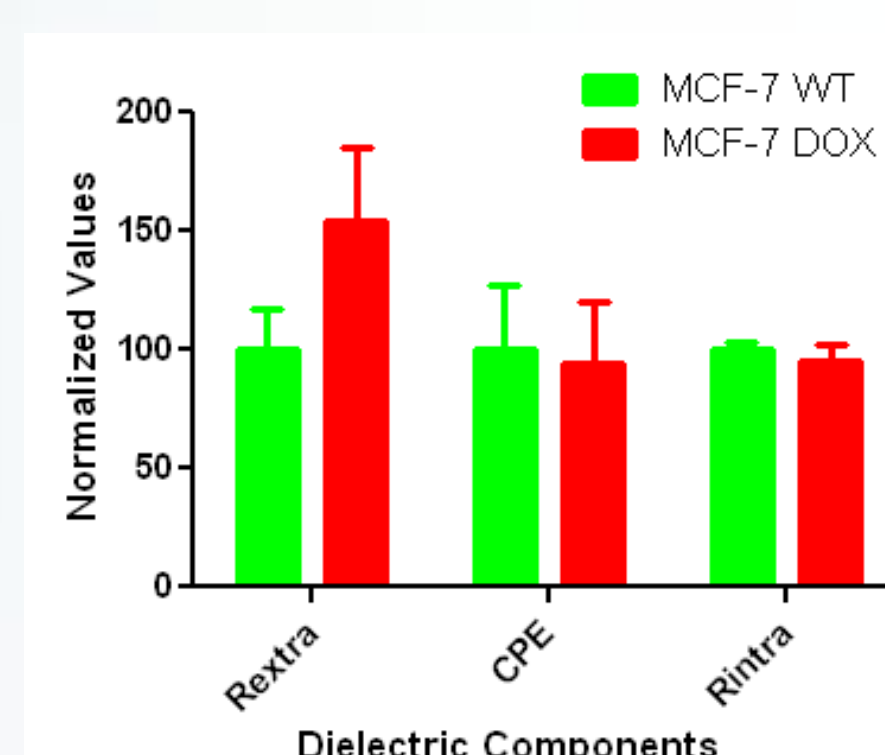
Wild type MCF-7 cells

Drug Resistant MCF-7 cells



Temporal evolution of $|Z|$ for MCF-7 DOX under different doses of doxorubicin at (a) LF (2 kHz) (b) HF (2 MHz)

Dielectric Properties



The extracellular resistance (R_{extra}) increases by 50% when cells get drug resistant!