

Název: **TECHNIQUES AND METHODS FOR VISUALIZATION OF  
DOXORUBICIN**

Školitel: Iva Blažková, Markéta Vaculovičová

Datum: 7.3.2014

Reg.č.projektu: CZ.1.07/2.3.00/20.0148

Název projektu: Mezinárodní spolupráce v oblasti "in vivo" zobrazovacích technik



# IMAGING METHODS

## Invasive methods

- Histopatologic analysis
- Drug extraction and quantification (microdialysis)

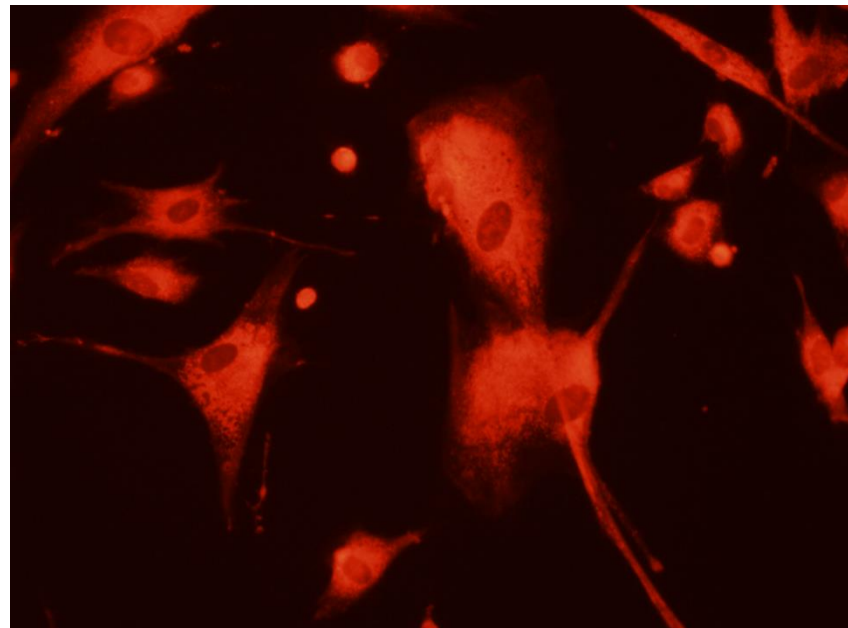
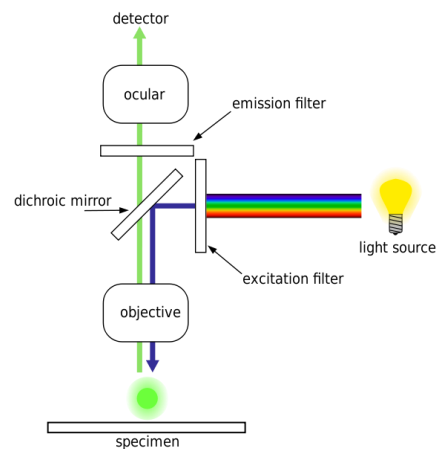
## Non invasive methods

- Magnetic resonance (MR) imaging
  - magnetic targeted carrier bound to doxorubicin (MTC-DOX)
- ultrasound (US)
- positron emission tomography (PET)
- computed tomography (CT)
- single-photon emission computed tomography (SPECT)
- Optical imaging
  - Fluorescence properties of doxorubicin



Doxorubicin

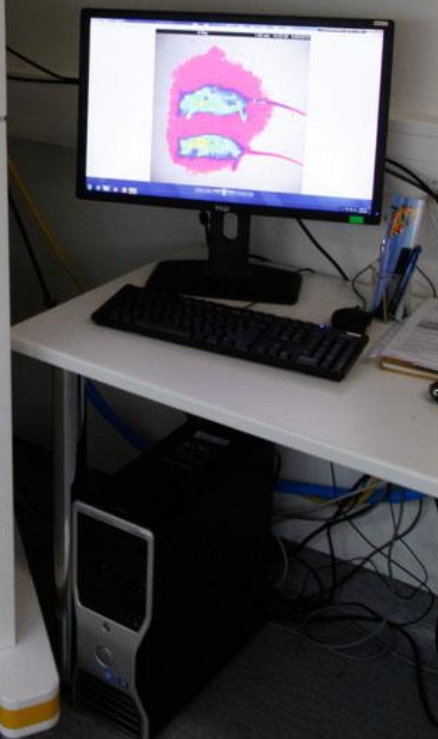
Cells



**In-vivo Xtreme  
(Carestream  
Health Inc.)**



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



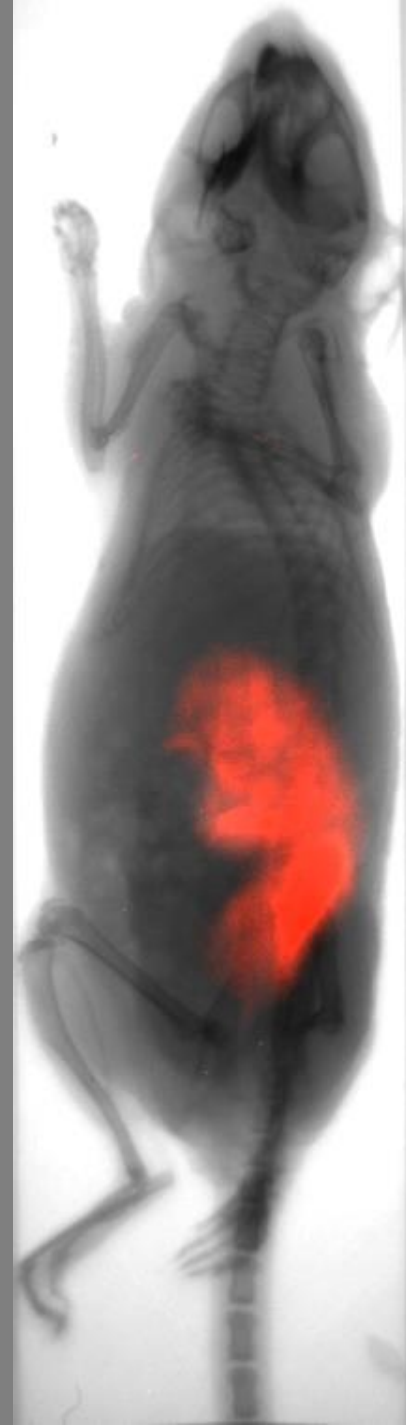
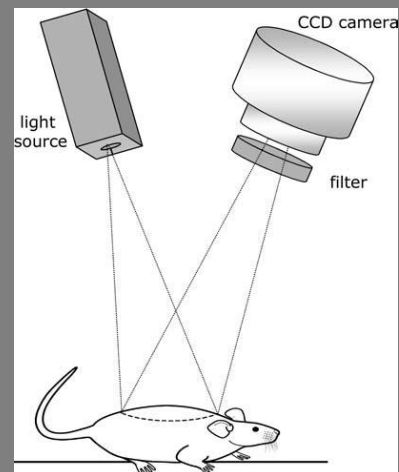
28 excitation filters (410-760 nm)  
6 emission filters (535 – 830 nm)

Limits

- tissue autofluorescence
- fluorescence properties (UV, VIS, IF)
- fluorescence intensity of drug
- concentration of drug
- volume of the drug
- accumulation

Doxorubicin

- strong tissue autofluorescence from the animal skin
- the excitation/emission of Dox lies in the visible spectrum window



## ***RGD-Modified Apoferritin Nanoparticles for Efficient Drug Delivery to Tumors***

### **Efficient delivery**

- doxorubicin loaded onto RGD modified apoferritin nanocages (D-RFRTs)

### **Apoferritin**

- longer circulation half-life
- better tumor accumulation rate

### **RGD**

- RGD is a three-amino-acid sequence with high affinity toward integrin  $\alpha_v\beta_3$ , a tumor angiogenesis biomarker that is up-regulated on tumor endothelial cells and many types of tumor cells
- Enhanced permeability and retention effect (RFRT)
- Labeled: ZW800 a near-infrared dye molecule (ex/em: 780/800 nm).

### **Distribution of Dox**

- the accumulation in the tumor was two times higher than in the liver, and the accumulation in other organs was low
- using RFRTs as a drug carrier mitigated toxicity

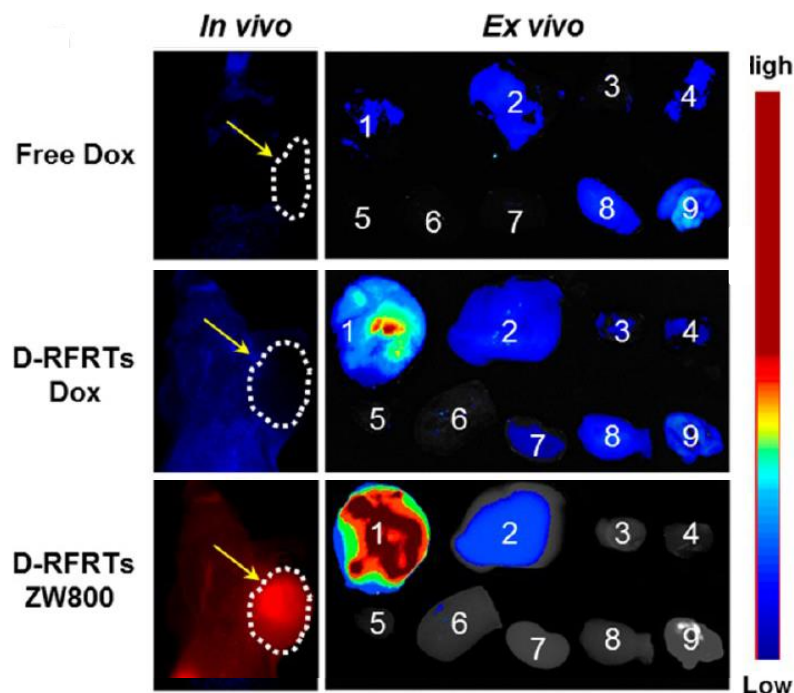


Figure 3. (a) *In vivo* and *ex vivo* imaging results of U87MG tumor-bearing mice injected with ZW800-labeled D-RFRTs and free Dox. For *ex vivo* studies, the organs were arranged in the following order: 1, tumor; 2, liver; 3, lung; 4, muscle; 5, heart; 6, spleen; 7, kidneys; 8, brain; 9, intestine.



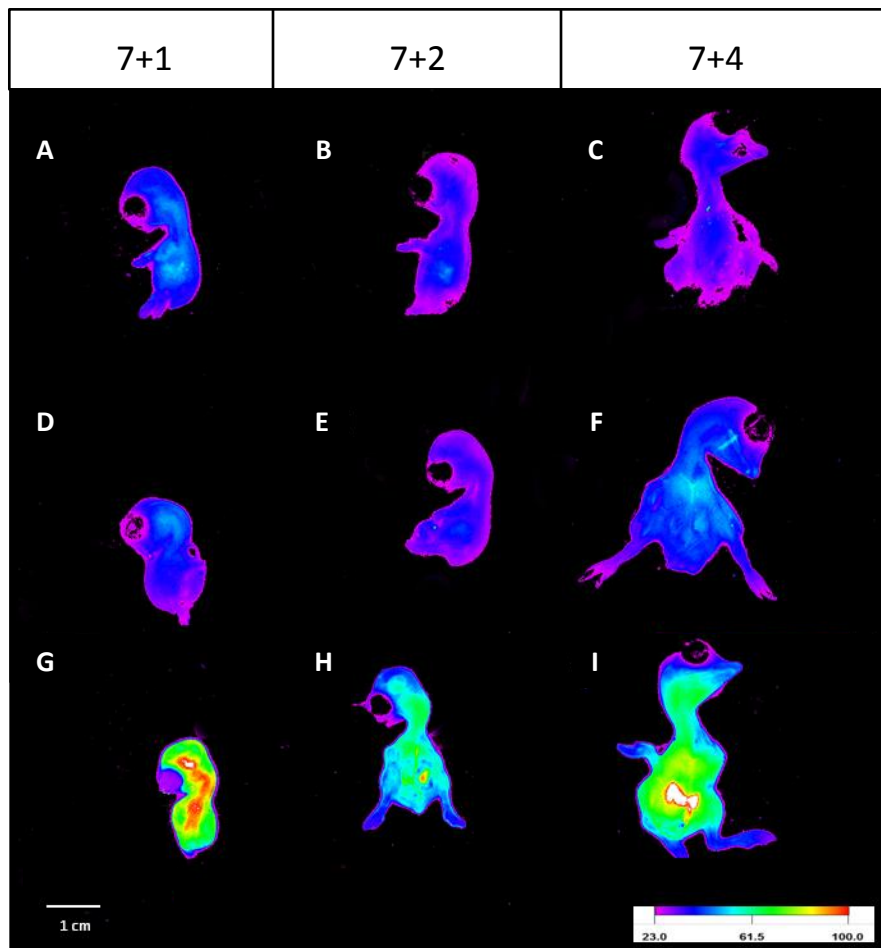


Fig. 2 Fluorescence intensity of chicken embryo with doxorubicin (A, B, C) and control without doxorubicin (D, E, F) or with physiological solution (G, H, I). Embryos of developmental day 7 incubated for 1 day (7+1), 2 days (7+2) or 4 days (7+4).

### Application of doxorubicin - developmental day: 7

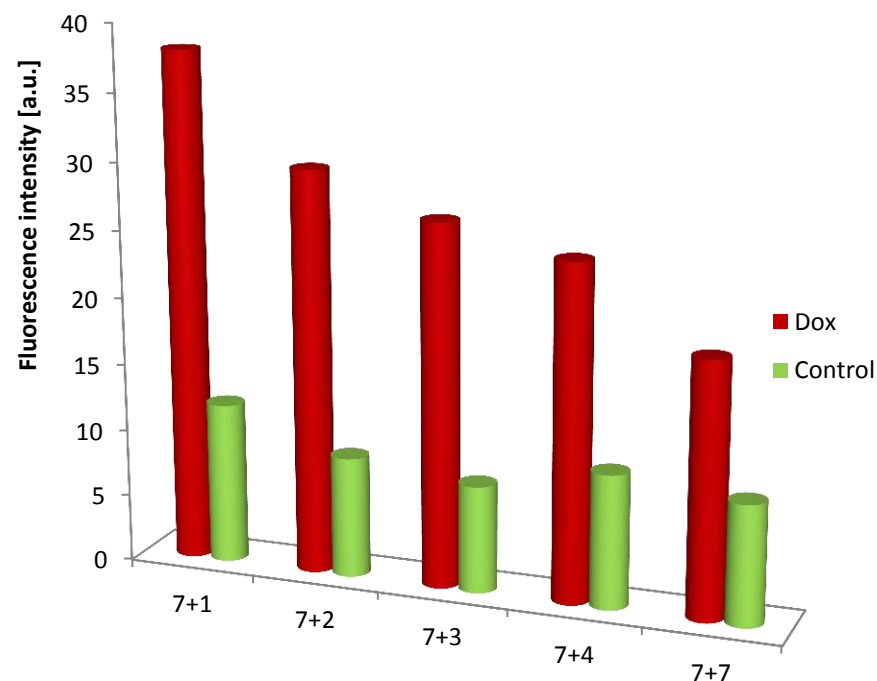


Fig. Fluorescence intensity of chicken embryo with doxorubicin (Dox) and without doxorubicin (Control). Fluorescence analyzed after 1, 2, 3, 4, and 7 days of the incubation.

## Developmental day: 14

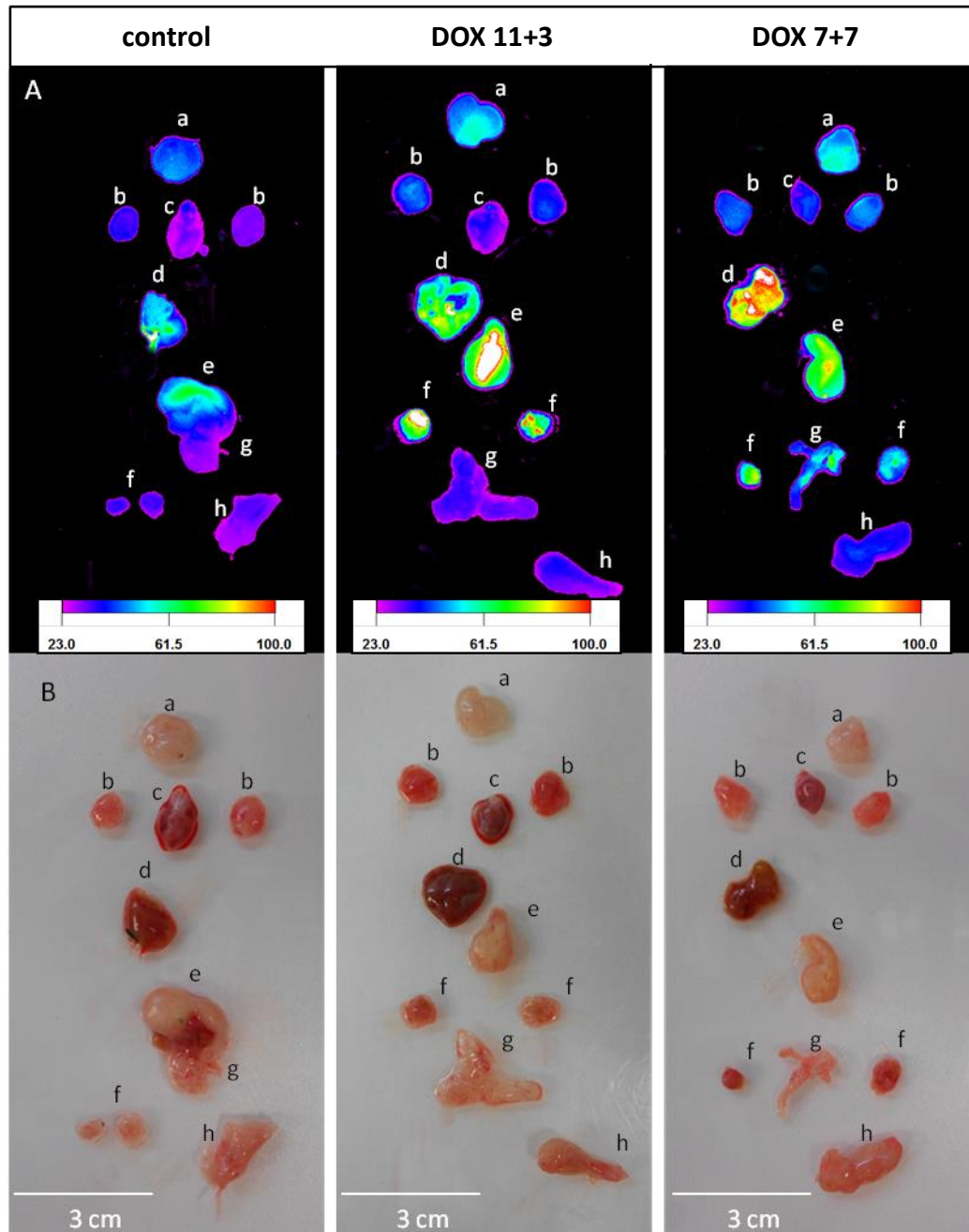
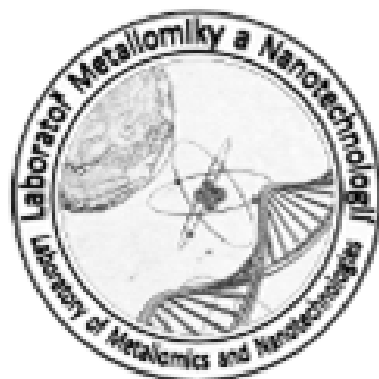


Fig. 3 Fluorescence images of doxorubicin in different organs of the chicken embryos (developmental day: 14). Embryos incubated for 3 (11+3) or 7 (7+7) days with doxorubicin: A) fluorescence images of organs; B) organs in ambient light; C) intensity of the fluorescence in organs;

# Acknowledgement

- Mgr. Markéta Vaculovičová, Ph.D.
- Doc. RNDr Vojtěch Adam, Ph.D.
- Prof. Ing. René Kizek, Ph.D.



evropský  
sociální  
fond v ČR



EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY

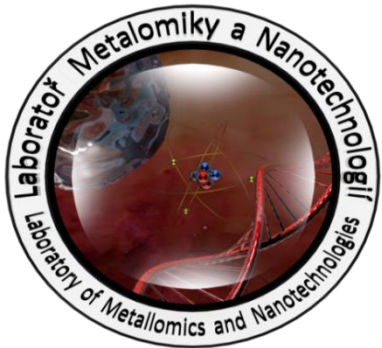


OP Vzdělávání  
pro konkurenceschopnost

Mendel  
University  
in Brno

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

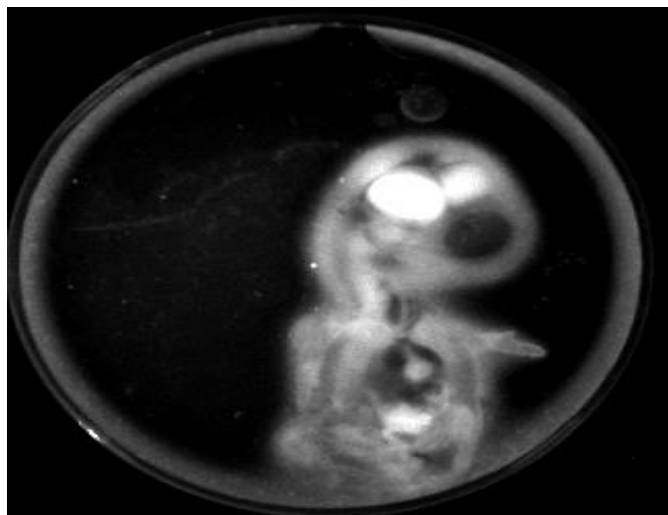




Mendel  
University  
in Brno



# Thank you for your attention!



evropský  
sociální  
fond v ČR



EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání  
pro konkurenceschopnost

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ