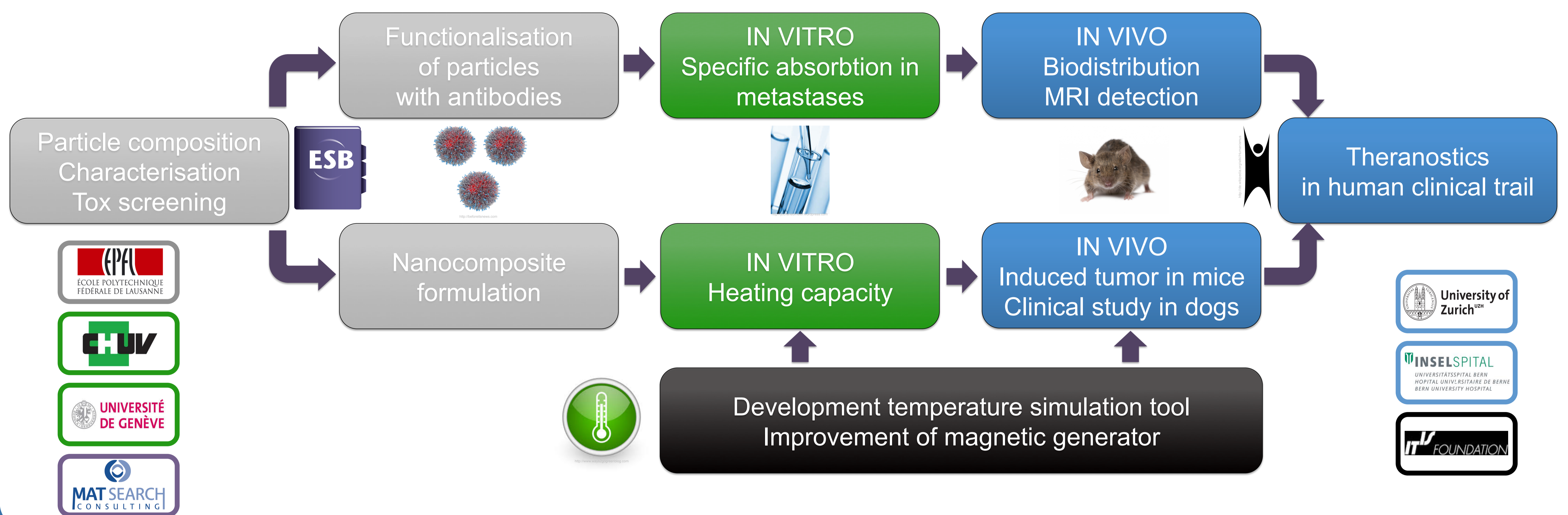


From superparamagnetic nanoparticles to cancer detection and treatment

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Project Layout



AIM: **diagnostic** (MRI) and **treatment** (hyperthermia) of **lymph node metastases** of prostate cancer = **Theranostics**

Experimental Results and Challenges

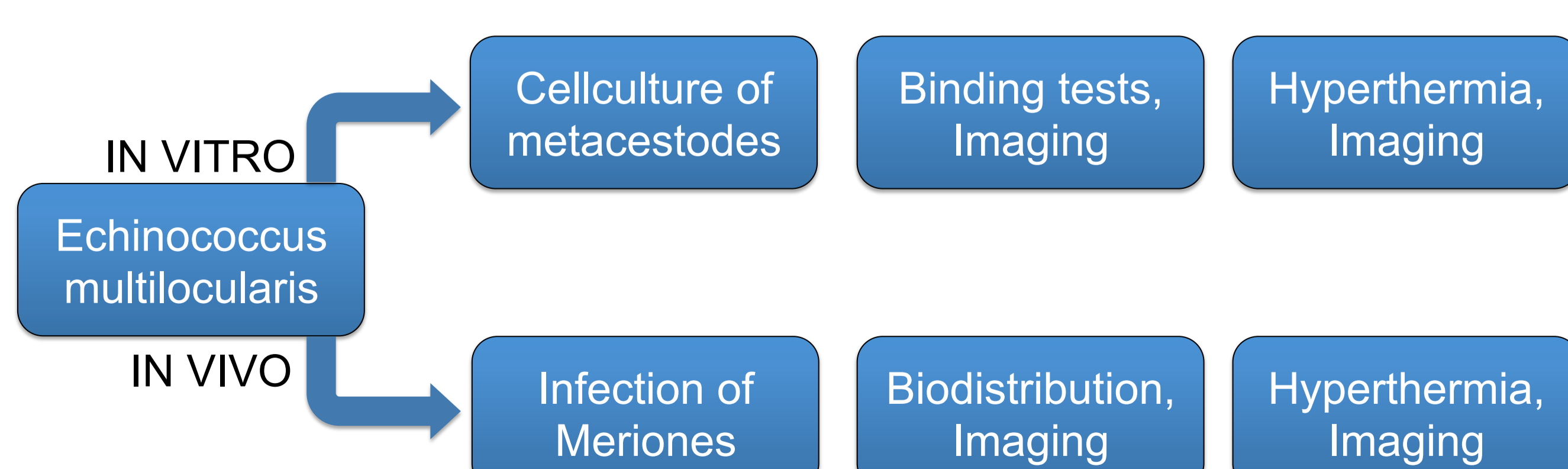
Tumor Marker: PSMA

- PSMA aptamers conjugated onto NP displayed prostate-targeted diagnostic and therapeutic abilities. [Yu Mi Kyung et al., 2012]
- The cloning, expression, biosynthesis, processing and localization of canine PSMA in mammalian cells is described. [Schmidt Sonja et al., 2013]
- Folate linked NP binds to PSMA and is then taken up via an endocytotic mechanism by LNCaP cells. [Hattori Yoshiyuki et al., 2004]

Tumor Model: Prostate Cancer

- induced-tumor-model available for mice = LNCaP orthotopic mouse model
- MRI detection of metastatic Lnn. needs a large-sized animal model – dogs. Clinical cases are rare (3/year)

Tumor Model: Echinococcus multilocularis



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Lymph Node Metastases Detection by MRI

- Prostate cancer is the most frequently diagnosed cancer in men.
- Population ageing leads to more subjects at risk.
- The IRON MR sequence will be adapted and used to generate positive contrast in SPION-labeled lymph node metastases. [Stuber et al., 2007]
- Diffusion-weighted MRI and the IVIM model [Le Bihan, 1988] will be used in combination with IRON imaging to increase the sensitivity and specificity of tumor detection.
- Preliminary work determined that a Bayesian probability approach [Bretthorst et al., 2005] to IVIM parameter estimation leads to a higher precision and accuracy compared to other algorithms.
- Further, we found that the vendor and field strength of the employed MR scanner may have a significant impact on estimated parameter values.
- Challenges to the use of SPION in a theranostic approach include: the required high specific adsorption controlled by antibody-receptor interaction, biocompatibility, and clearing of particles from the body after use.

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