ST. ANNE'S UNIVERSITY HOSPITAL BRNO

INTERNATIONAL CLINICAL RESEARCH CENTER

"CREATING THE FUTURE OF MEDICINE"

Concept of Integrated Research Platforms

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October 21, 2010

MINISTRY OF EDUCATION, YOUTH AND SPORTS

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INTEGRATED RESEARCH PLATFORMS

AC: *Animal Center*

CBCE: Center of Biomolecular and Cellular Engineering

ICCT: Integrated Center of Cellular Therapy and Regenerative Medicine

BME: Center of Biomedical Engineering

CMI: Center of Molecular Imaging

CPU: Clinical Pharmacology Unit

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Clinic of Dog and Cat Diseases, Faculty of Veterinary Medicine

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CARDIOVASCULAR ANIMAL RESEARCH CENTER BRNO

- **MULTIDISCIPLINARY FACITILITY**
- **600 square meters of experimental labs already constructed**
- **Labs in the CARS**
  - **Laboratory for Advanced Cardiovascular and CNS Interventions**
  - **Laboratory for Advanced Experimental Imaging**
  - **Experimental Echo Lab**
  - **2 Experimental Hi-Tech Operating Theatres (Cardio, Neuro)**

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Novel Concept of Animal Research

- One high-tech facility instead of many small ones
- Sharing technology
- Sharing knowledge
- Reducing numbers of experimental animals needed – ethical aspects
- Reducing numbers of useless experiments
- Cost-effective projects

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CARS Specialists Experience

- Animal care
- Animal surgery
- Animal pathology
- Different species
- Behavioral specialists
- Pharmacokinetics, pharmacodynamics
- Animal anesthesiology
- Housing and feeding

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Mission

- Veterinary experts mandatory as a part of research team
- Taking animal physiology in an account!!
- Good planning of animal studies
- Multidisciplinary approach to the animal model

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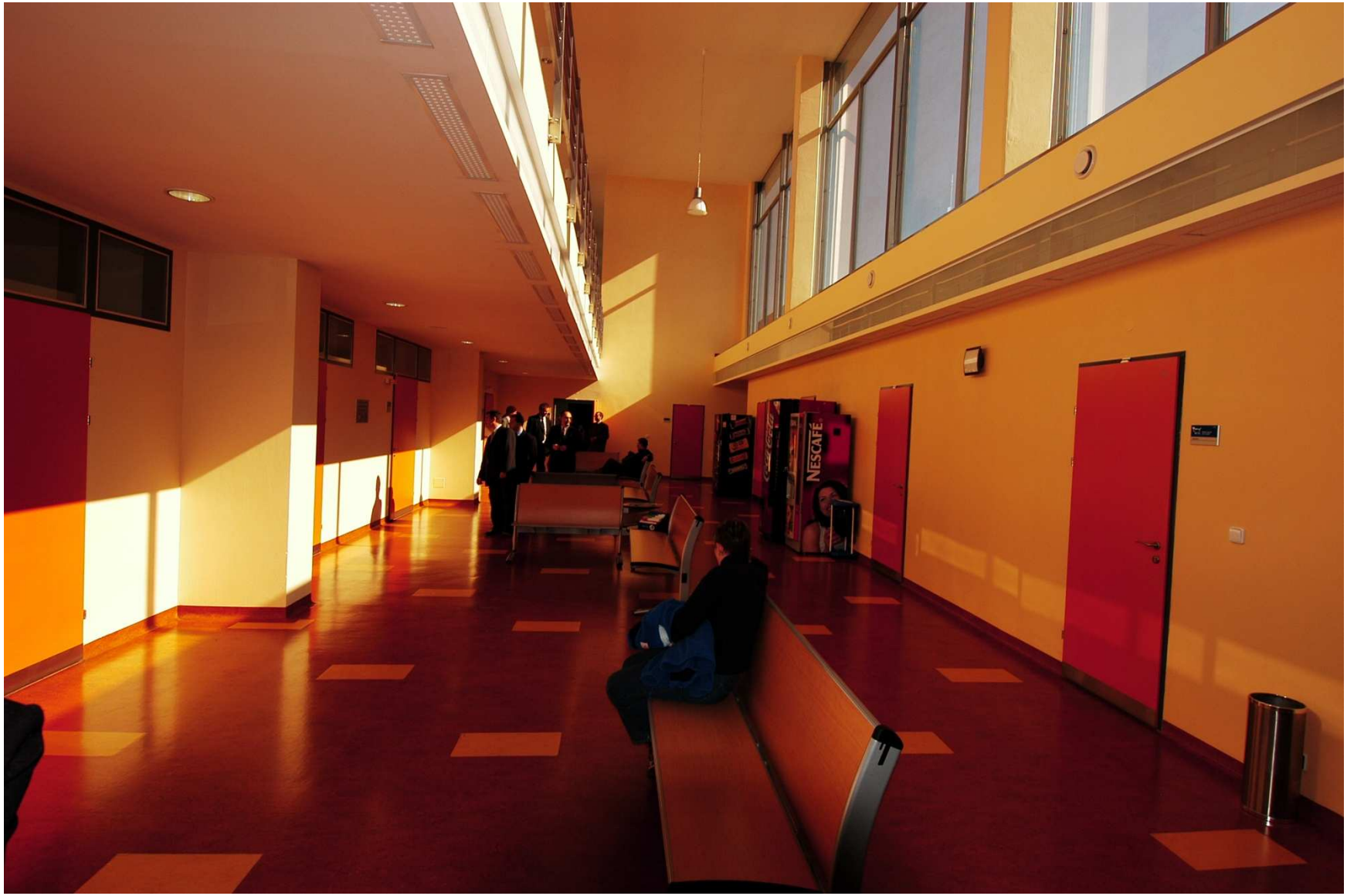
Clinical Background



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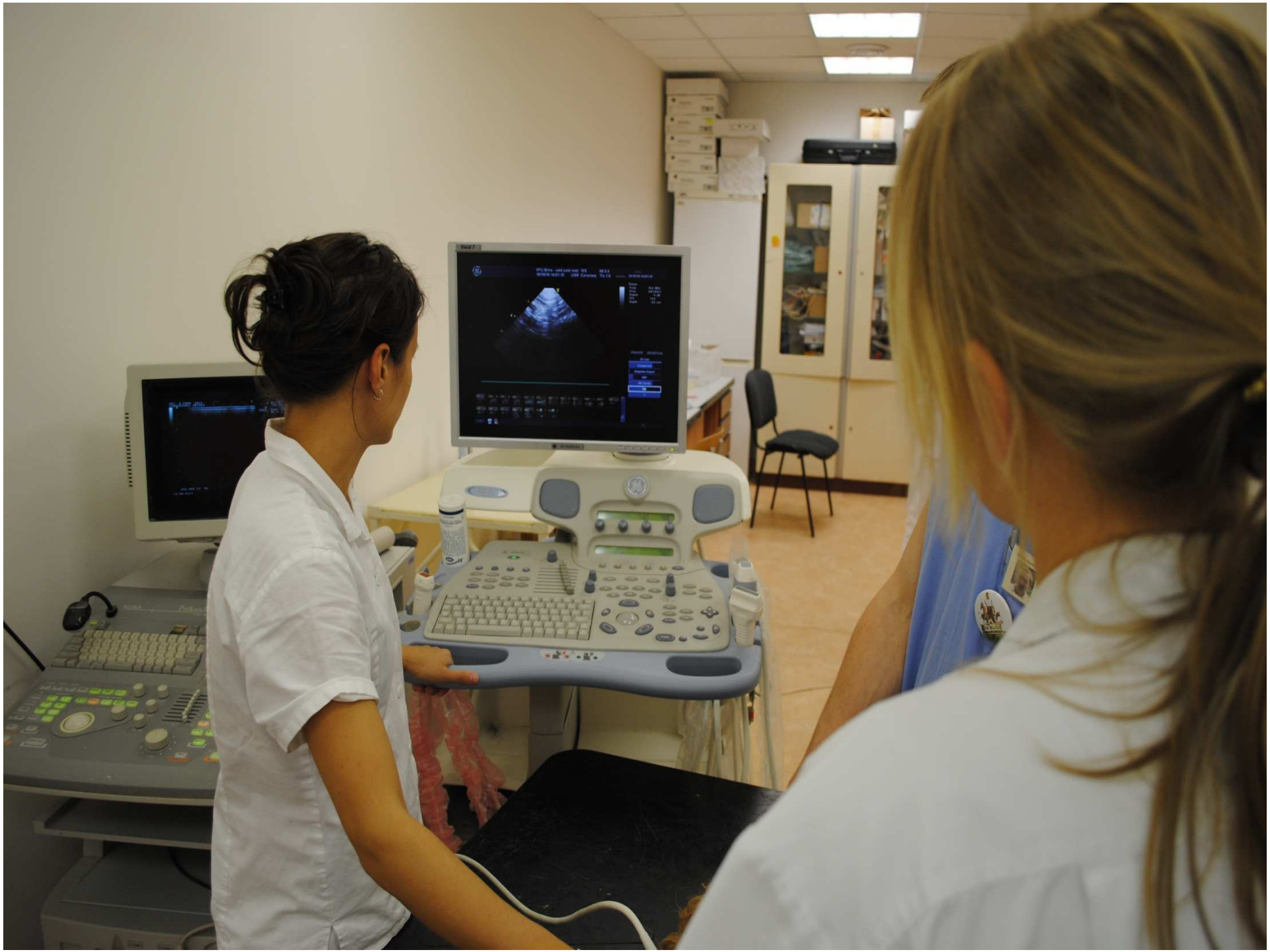
ANIMAL LABORATORY FOR ADVANCED CARDIOVASCULAR AND CNS INTERVENTIONS


STEREOTAXIS
NAVIGANT
niobe


BleaseGenius
SIGNA

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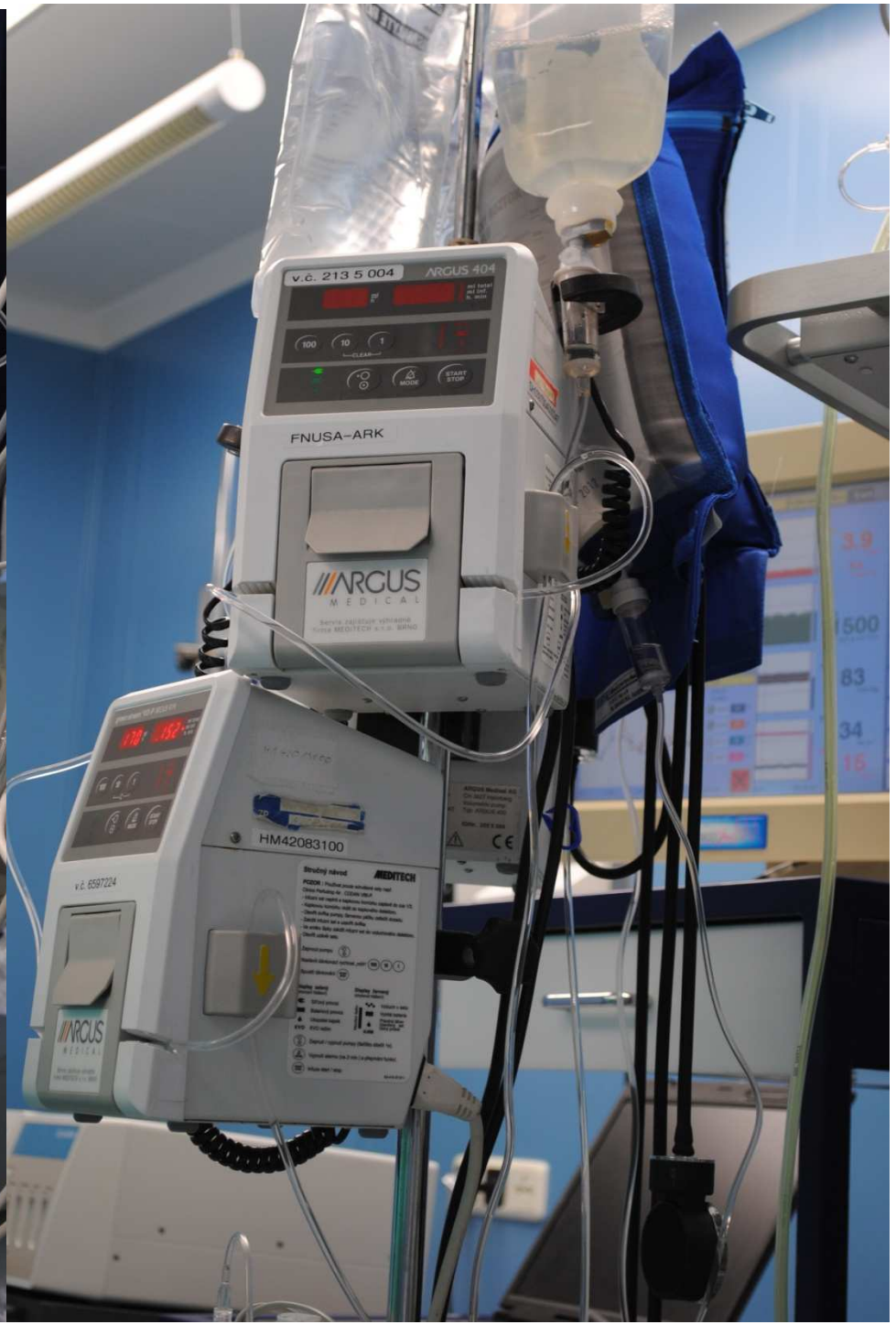
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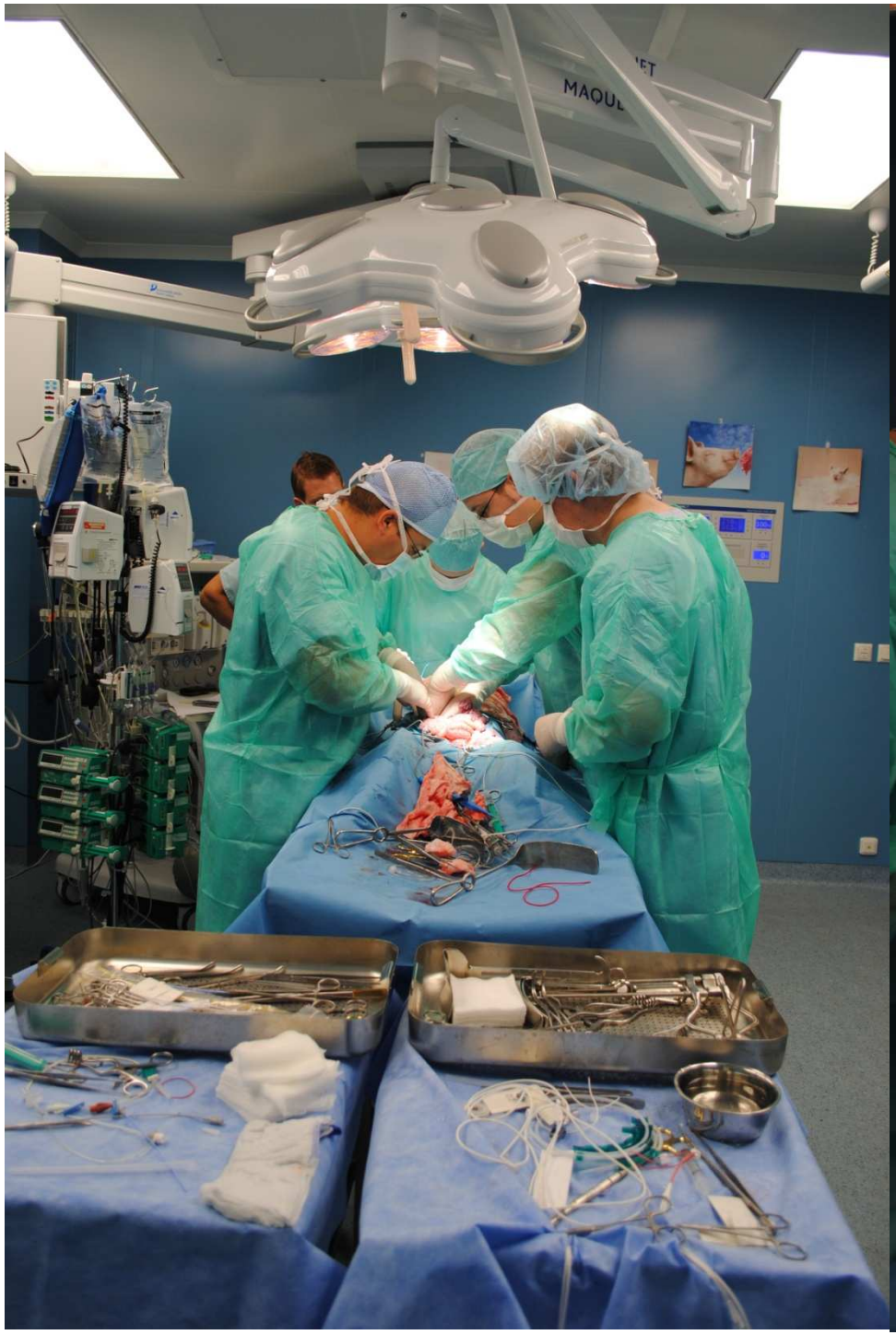


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PERSONNEL ONLY

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Research Support Background

- Separated from clinical settings
- Fully accredited
- Operating suite
- Holding rooms
- Transgenic area
- Non-humane primates

State of the art pre and post procedure animal care

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Current Research Projects

- Neurovascular and cardiac mapping
- Hemorrhagic shock studies
- Nanotechnology
- ARDS pig model
- Arterial thrombosis prevention and treatment models, pitfalls of thrombolysis

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Projects on the Block (VaVPI)

Development of:

- Next Generation Artificial Heart
- Stem cells and proteins for enhanced cardiovascular protection and regeneration
- Biological Coronary Stents
- Technology for Left Atrium Appendage Closure
- Xeno-transplantation and Cardiovascular Tissue Engineering
- Minimally invasive brain surgery


Windows
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STEREOTAXIS
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Acute Myocardial Infarction

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Acute myocardial infarction

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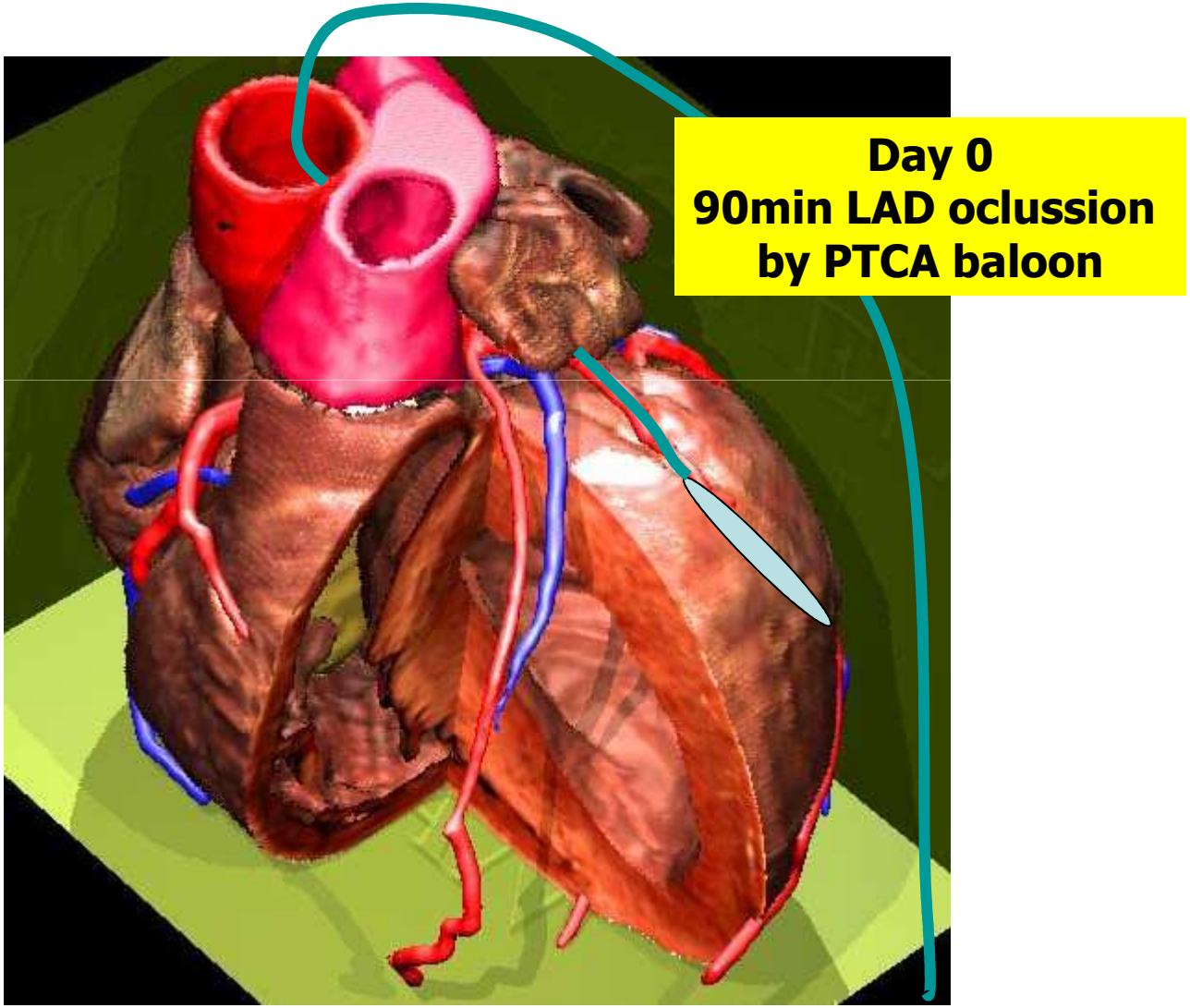
Acute myocardial infarction



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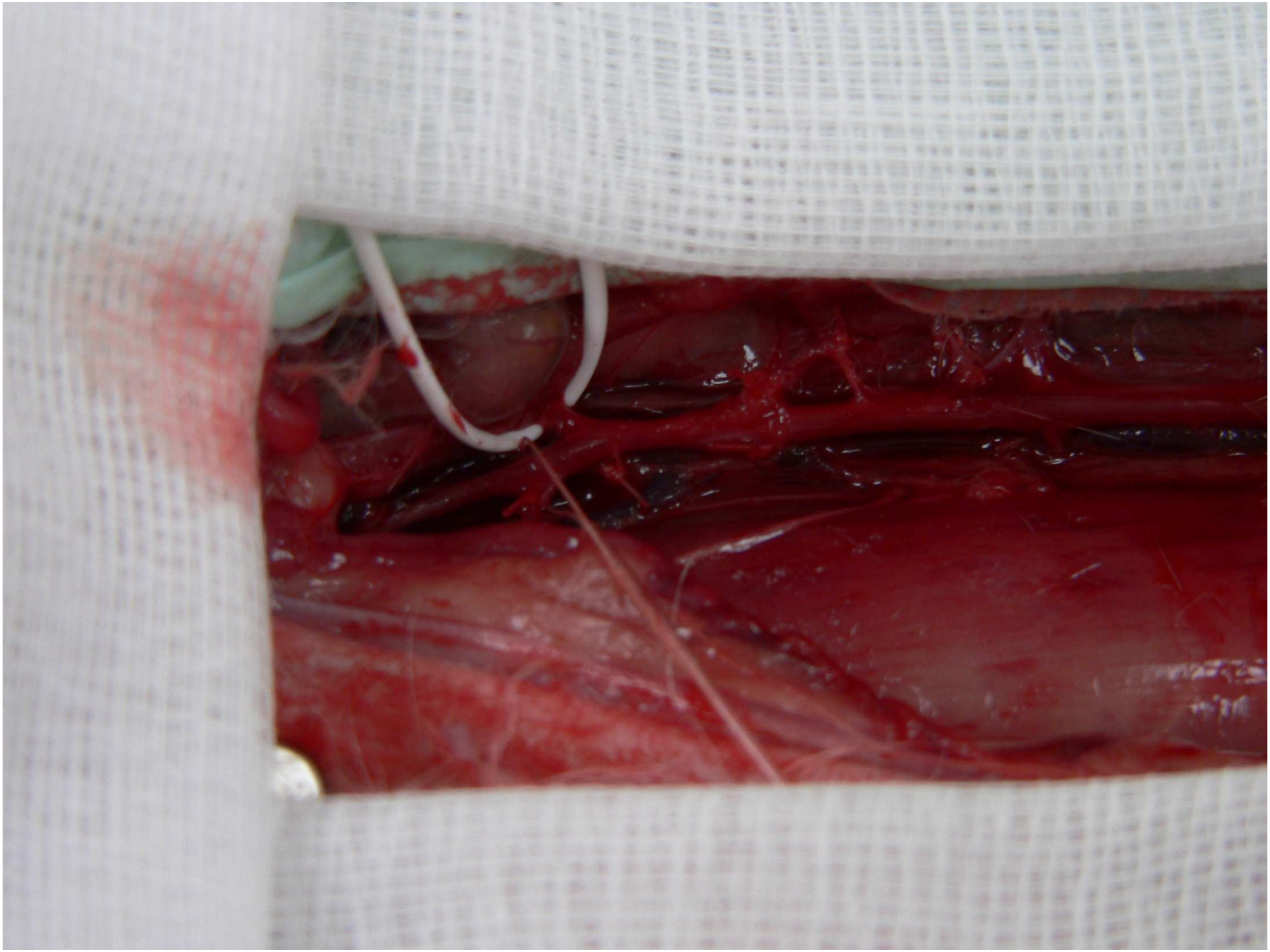
Rabbit model of arterial thrombosis

- Abdominal aorta similar to human coronary artery (about same diameter, high pressure, thick vessel wall)
- Balloon angioplasty (intimal denudation) and cross-clamp (vascular damage)
- Critical stenosis (vascular narrowing)
- Clot accretion and lysis
- Blood flow through the damaged area



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Major Issue of Thrombolysis

- Intracranial bleeding
- Secondary clot resistance
- Efficacy x Safety
- Arterial thrombosis model x bleeding ear model
- Adjunctive treatment
- Supplementation of clotting factors (consumption during thrombosis)

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Experts Involved in Animal Research

- M. Vlasin – surgery, hematology
- M. Svoboda – endocrinology
- P. Rauser – anesthesiology
- P. Kohout – ultrasonography, MRI
- C. Agudelo - cardiology
- J. Doubek – laboratory, hematology
- And many others…

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Maximum Flexibility

- We can offer our basic models
- But, we are opened to invention from outside
- We work to master our models
- Mayo Clinic remains partner No 1.

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Center for Biomolecular and Cellular Engineering

Lumír Krejčí, Ph.D.

Departmenf of Biology & NCBR, MU

ICRC

21. October 2010

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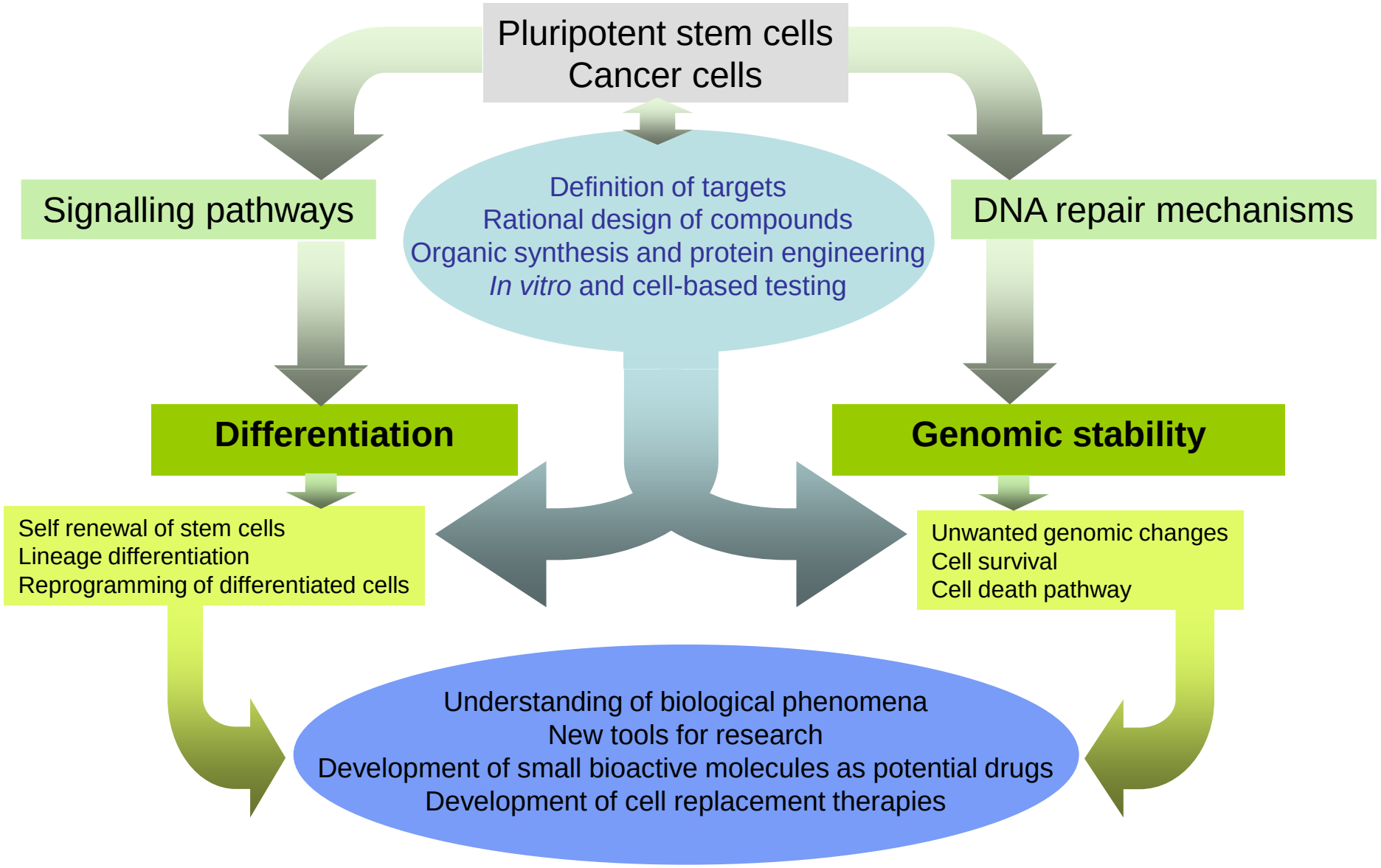
BIOMOLECULAR AND CELLULAR ENGINEERING



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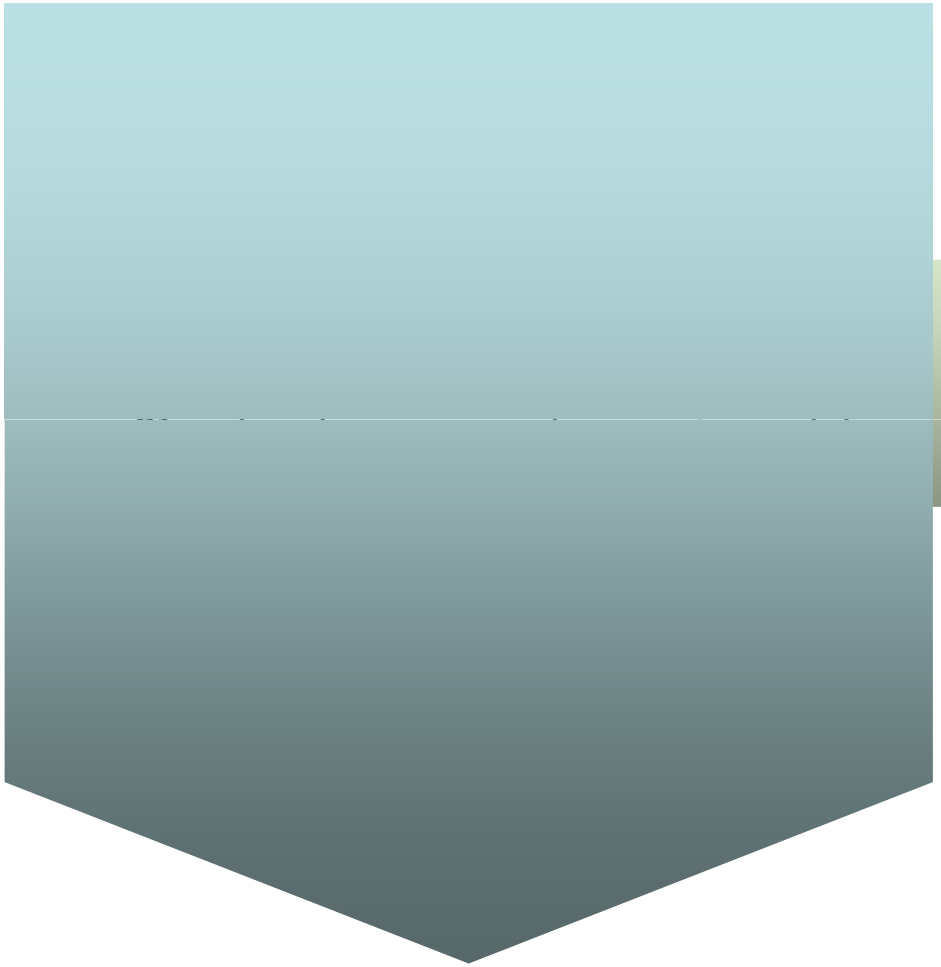
GROUPS AND EXPERTIES



2

- Rational design of biomolecules
- *In silico* screening
- Organic synthesis

3

- Protein engineering
- Inhibition studies
- Enzyme kinetics
- Thermodynamic studies
- Molecular interactions

4

- Human embryonic stem cell technology
- iPS cell technology

1

- **Molecular imaging**
- ***In vitro* cellular imaging**
- **Animal models *& in vivo* imaging**

5

- Analysis of signal transduction
- Gene targeting and reporter assays
- Cell phenotyping
- Functional testing

1 - newly introduced approaches
2-5 - existing expertise

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SHORT-TERM PERSPECTIVES (2011-2015)

- **WP1** Development of a robust, reproducible, and efficient platform for culture and differentiation of pluripotent cells with the use of synthetic compounds
- **WP2** Engineering versatile tagging technology for *in vitro* and *in vivo* experiments with biomolecules and cells
- **WP3** Identification of small molecules affecting genomic stability via newly defined biological targets
- **WP4** Engineering bioactive surfaces – „Molecular lawns“
- **WP5** Design of small molecules affecting intracellular signaling via newly defined targets

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Newly recruited PIs

TEAMS OF THESE GROUP LEADERS PRODUCED ~ **150** PUBLICATIONS

IN PEER-REVIEWED JOURNALS AND **37** PATENTS DURING LAST 5 YEARS

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THANK YOU FOR YOUR ATTENTION!

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