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- ▶ **ERASMUS+ PROGRAMME**
 - ▶ Erasmus+ - Key Action 2
 - ▶ Capacity Building in the Field of Higher Education
- ▶ **Project No: 585980-EPP-1-2017-1-DE-CBHE-JP**
- ▶ **Training for Medical education via innovative eTechnology /MediTec**
 - ▶ **January 14-18, 2019**
 - ▶ **Programme for Training in Brno**
- ▶ **Masaryk University, Faculty of Medicine, Center for Healthcare Quality, Brno, Czech Republic**



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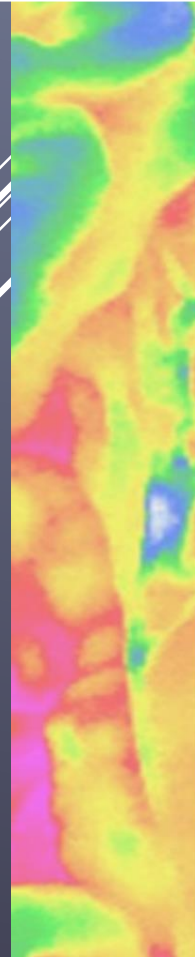


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INFRARED THERMOGRAPHY

CLINICAL USE AND RESEARCH

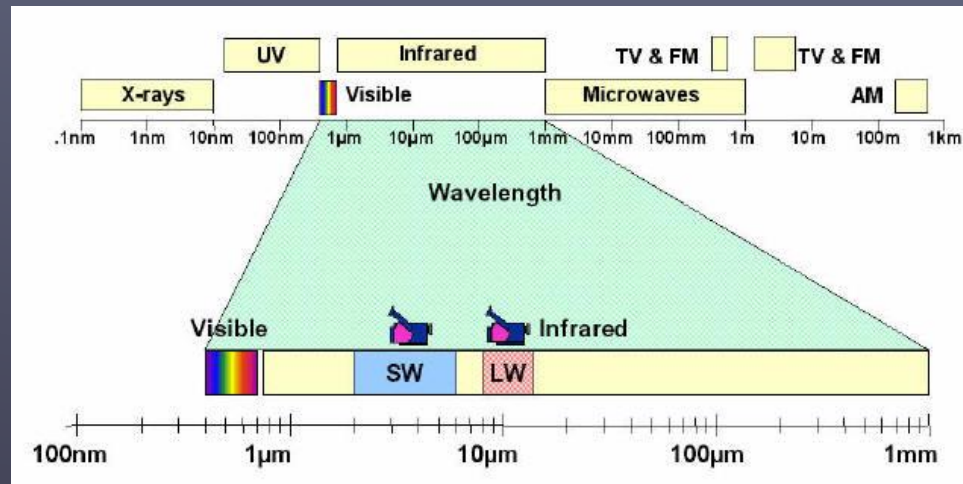
BIOPHYSICS DEPARTMENT
MEDICAL FACULTY
MASARYK UNIVERSITY
BRNO, CZECH REPUBLIC



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MED

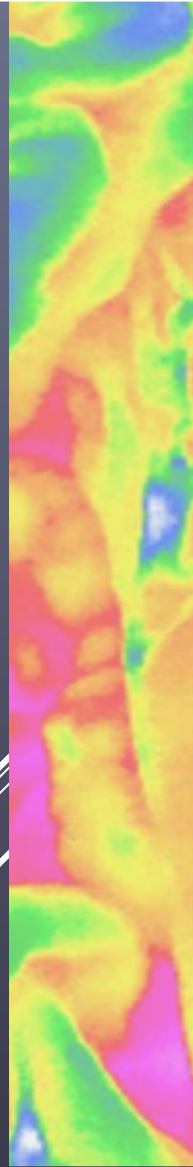


WHAT IS INFRARED IMAGING AND INFRARED RADIATION?



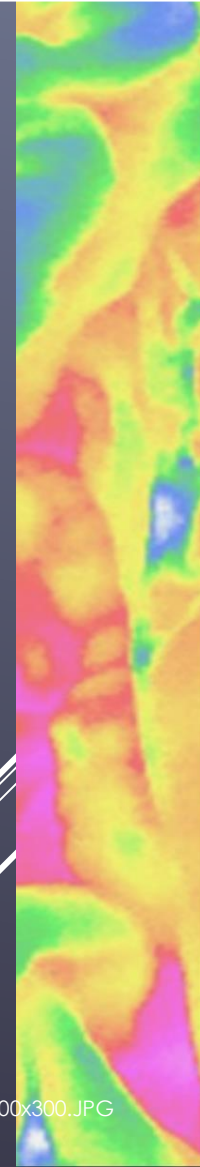
https://sherlockhomes-web.com/wp-content/uploads/2016/02/EM_spectrum.jpg

- ▶ The contact-less thermographic method is based on the measurement of infrared radiation (IR) emitted by the surface of the body.
- ▶ Wavelength 780 nm - 1 mm



IRT equipment

- ▶ AGA (previous)
- ▶ Fluke Ti30 (previous)
- ▶ Flir i7
- ▶ Flir ONE Pro, SEEK Thermal CompactPRO (smartphone)
- ▶ Flir b200
- ▶ Workswell WIC 640



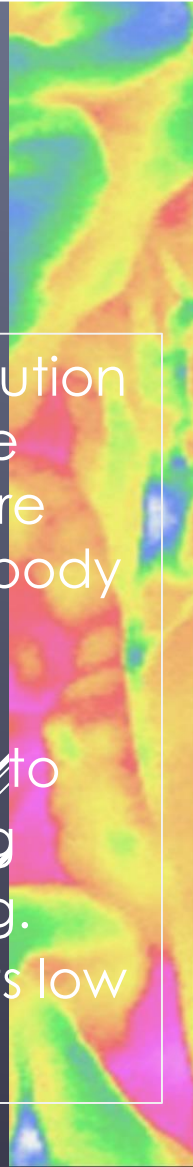
IR IMAGING IN MEDICINE

ADVANTAGES

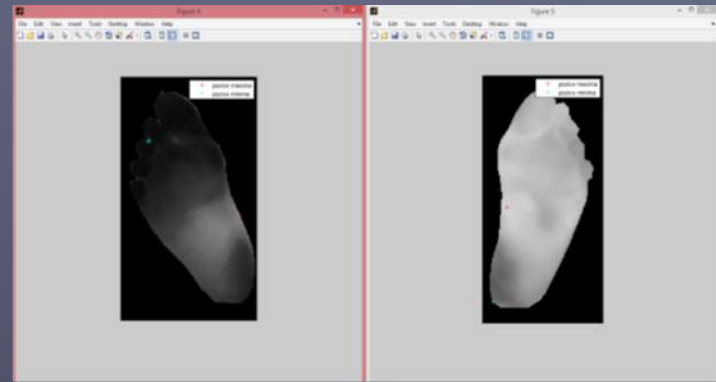
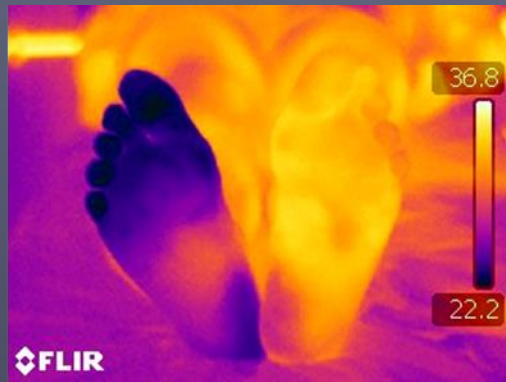
- High temperature and spatial resolution
- Temperature distribution is displayed in the form of isothermal lines – isotherms
- Possibility to display temperature profiles
- Fast measurement

DISADVANTAGES

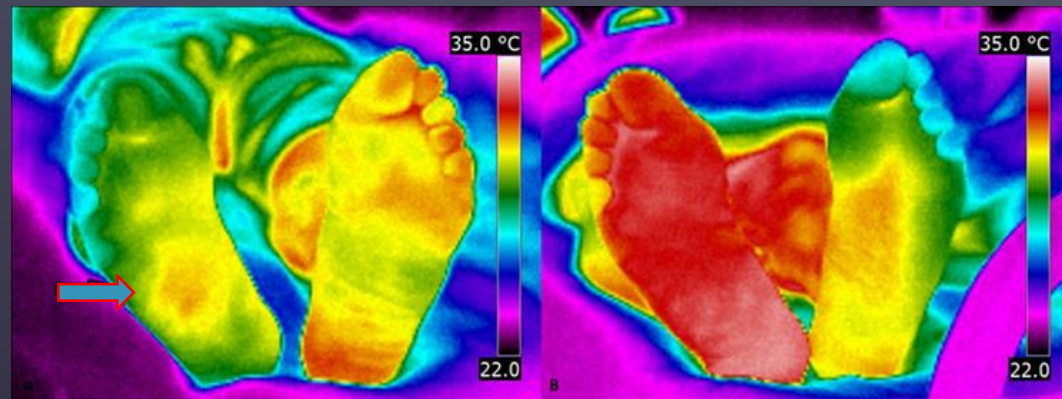
- Surface temperature distribution differs even in healthy people
- We have always to compare temperature of symmetrical body parts
- In contrast to original expectation, it is not possible to use IR imaging as a screening method for malignancies, e.g. breast tumours, because of its low specificity.



LOWER LIMB ISCHEMIA - PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY

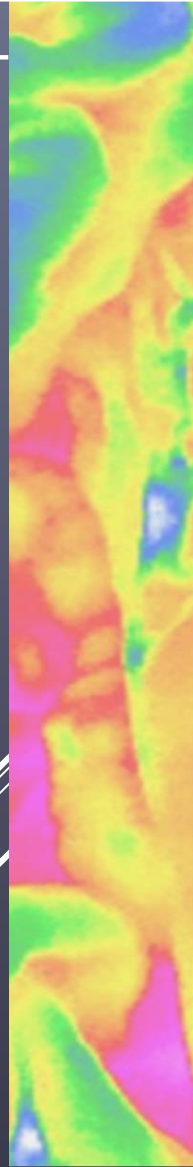


2013, Flir b200, ischemic patient, own analysis software



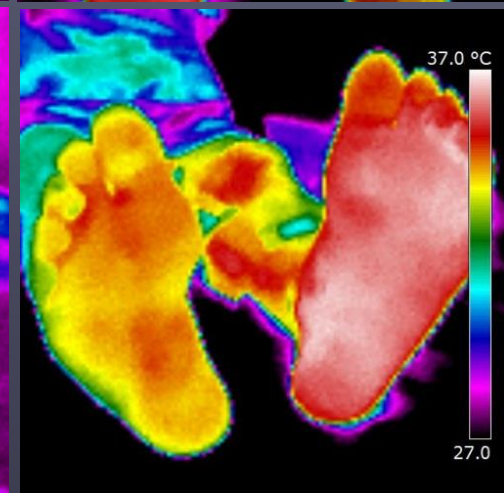
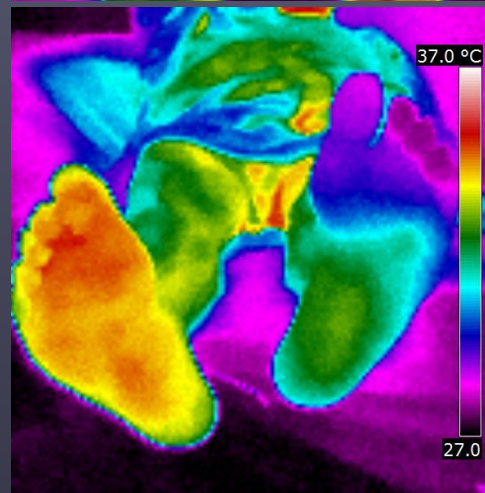
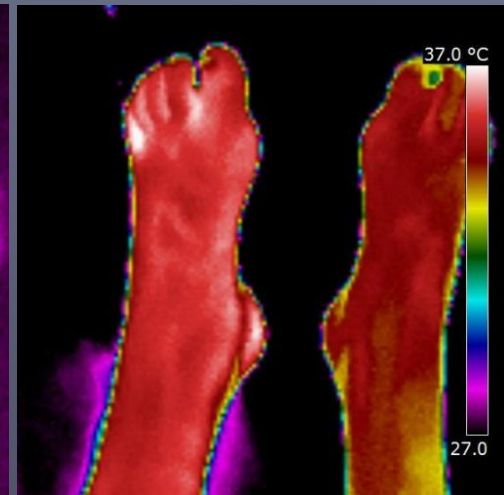
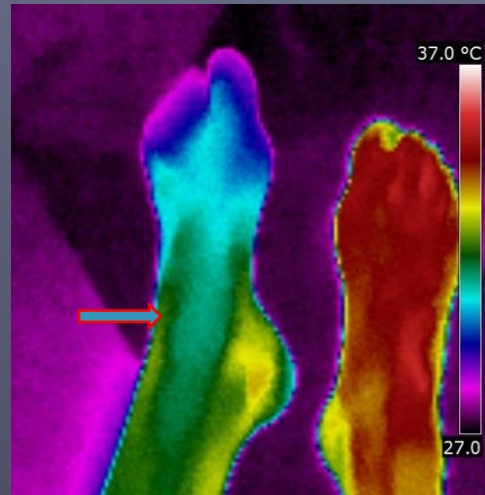
2013, Flir b200,
percutaneous transluminal
angioplasty, before/after

Comparison of the condition before and after surgery; comparison with ABI index or transcutaneous oxygen measurement (quantification)



LOWER LIMB ISCHEMIA – FEMORAL POPLITEAL BYPASS

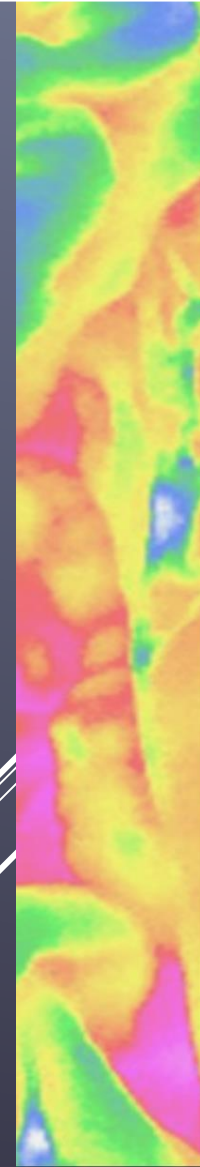
Flir i7, 2015, f-p bypass
before / after



Comparison of the ischemia condition before and after surgery; comparison with ABindex or transcutaneous oxygen measurement, quantification

Diabetic foot ulcer

Flir b200, 2015,
diabetic ulcer

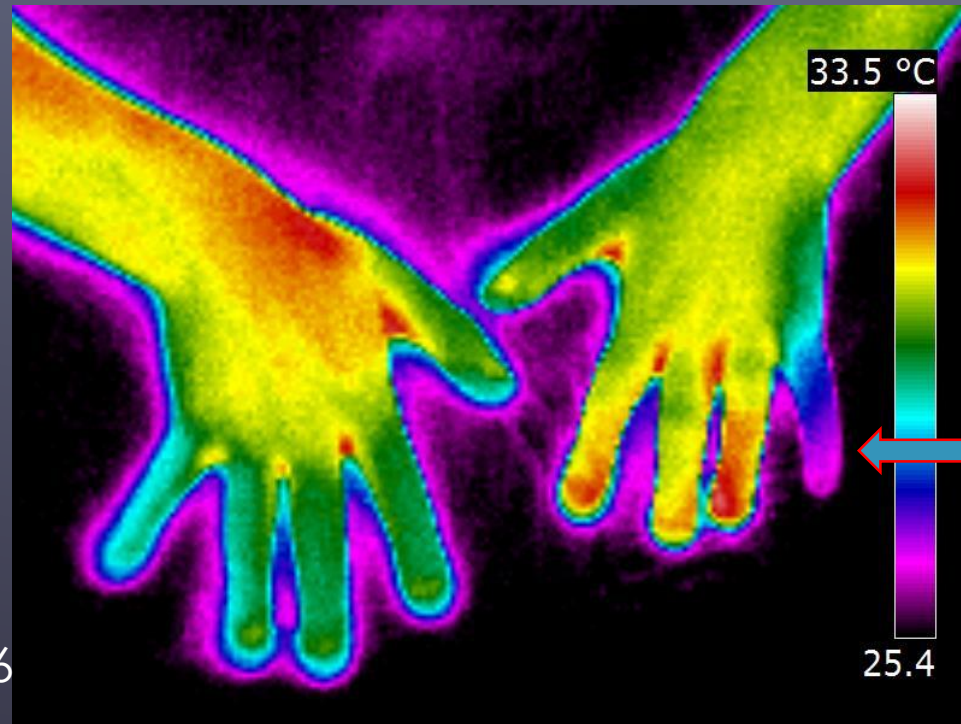


Early prediction, temporal evolution of treatment

THE PARESIS OF NERVES

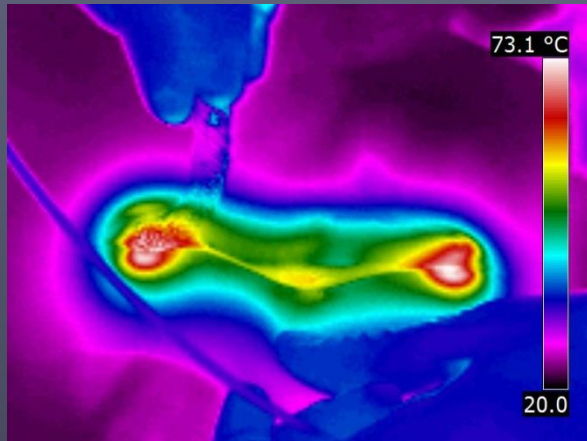


n. facialis, Flir b200, 2016, inconclusive

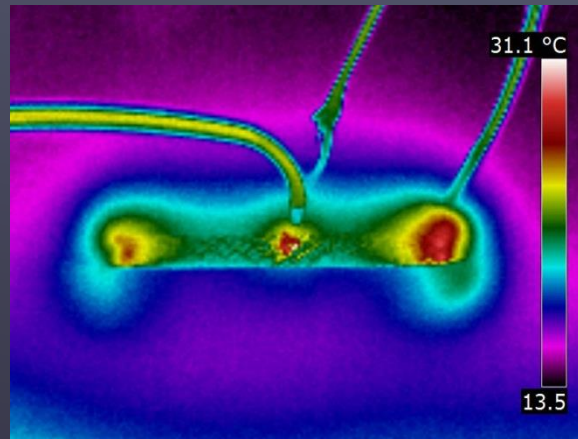
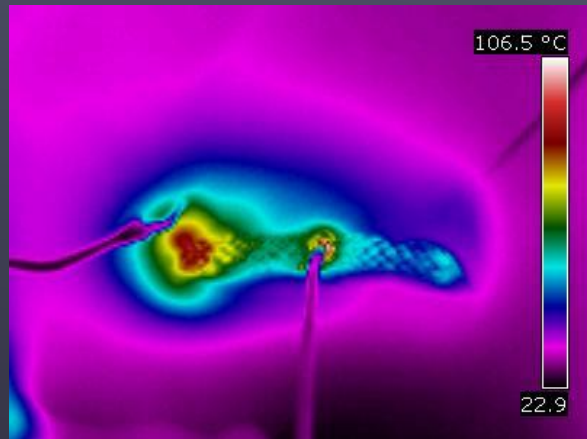


n. ulnaris, Flir b200, 2016

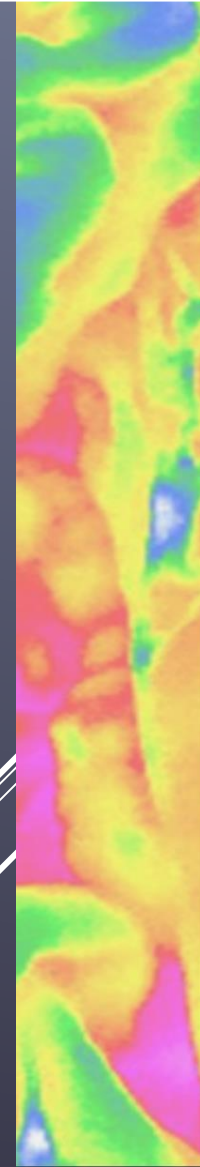
RADIOFREQUENCY ABLATION – METAL STENTS



Flir b200, 2013,
temperature
footprint,
monopolar/bipolar

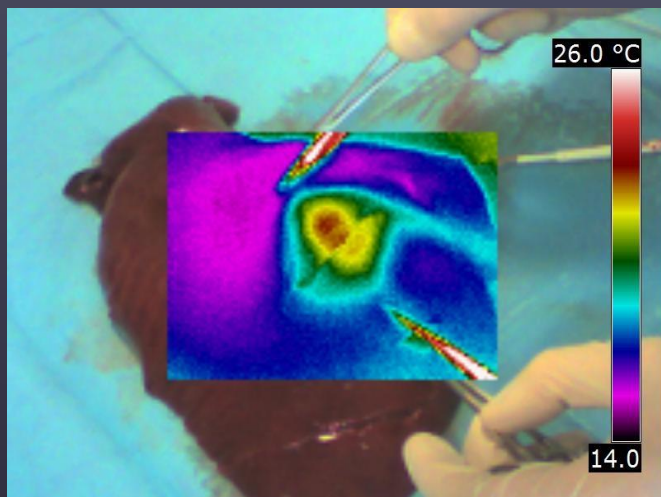
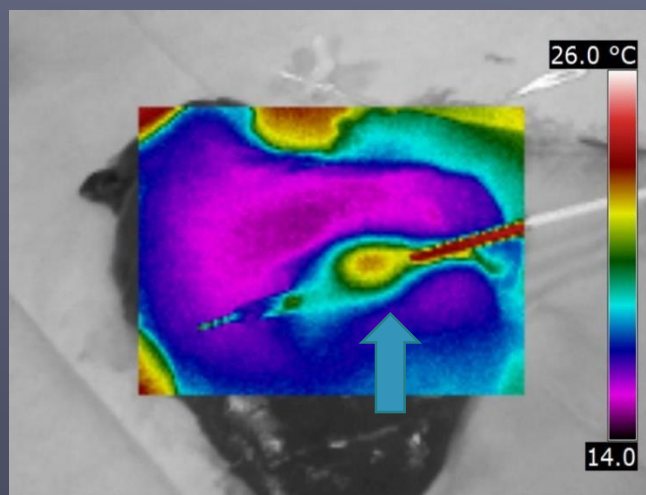
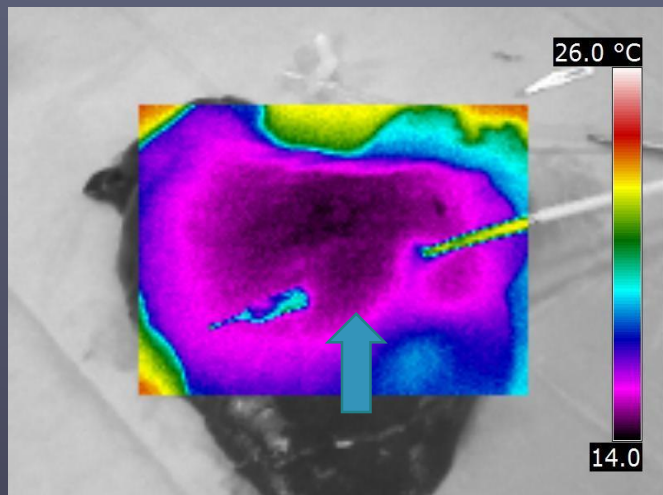


Flir b200, 2013,
asymetry/symetry
stent position vs.
indifferent plate
electrode



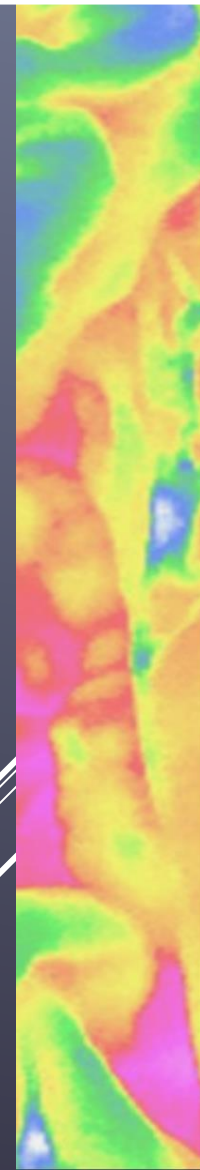
Temperature action in case conductive contact of biliary stent-active electrode, power vs. temperature, monopolar vs. bipolar mode, symetry vs. asymetry position of stent

IRREVERSIBLE ELECTROPORATION

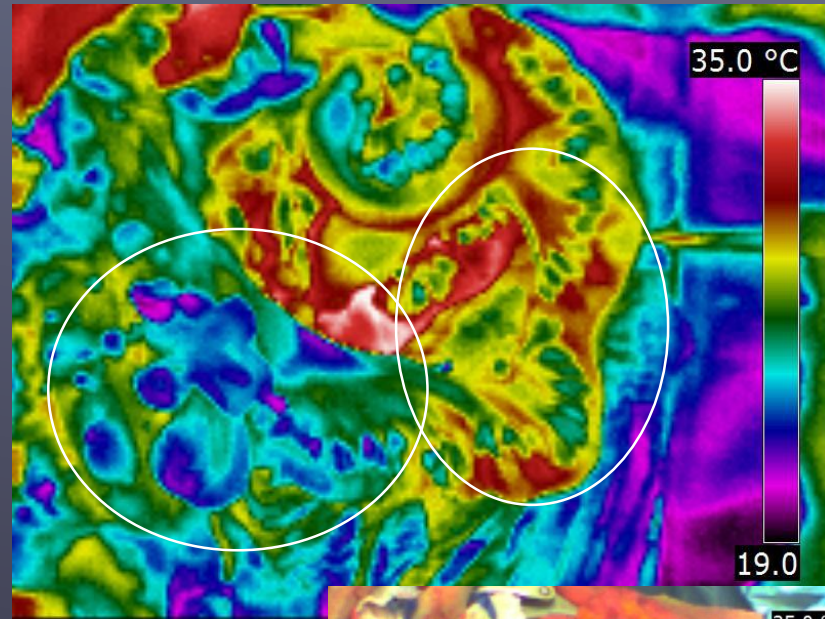
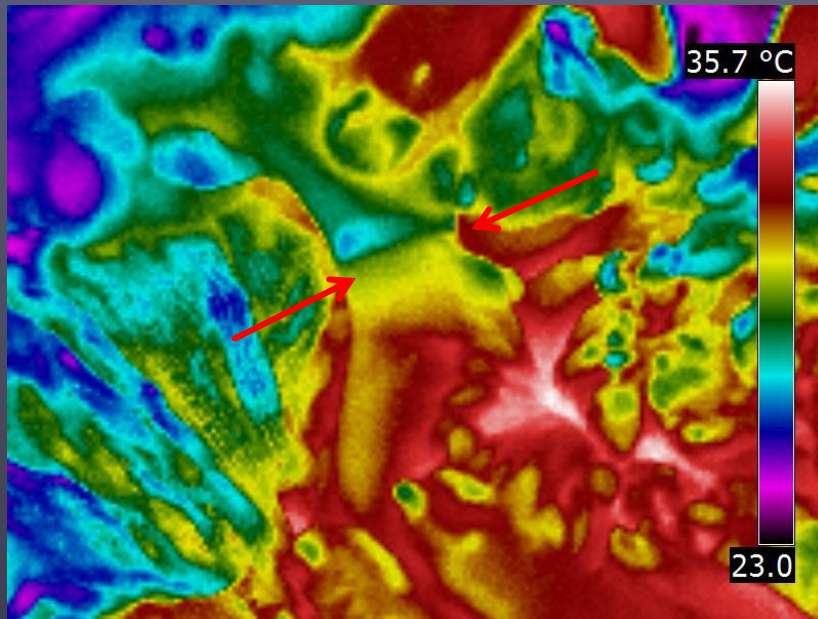


Flir b200, 2017, experimental balloon catheter for irreversible electroporation

Testing new IRE device and new balloon catheter, thermal effect

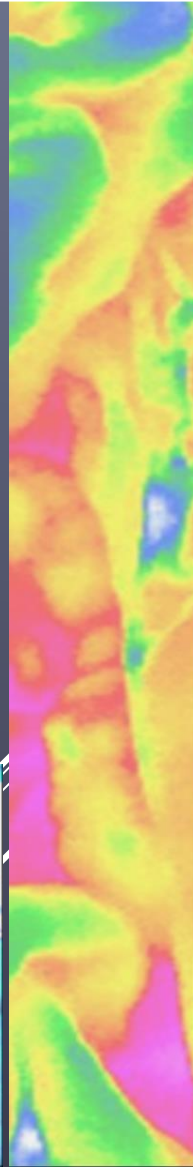


SURGERY – INTESTINE RESECTION

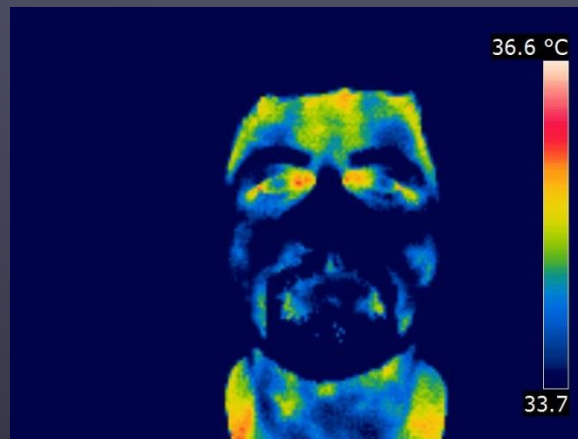
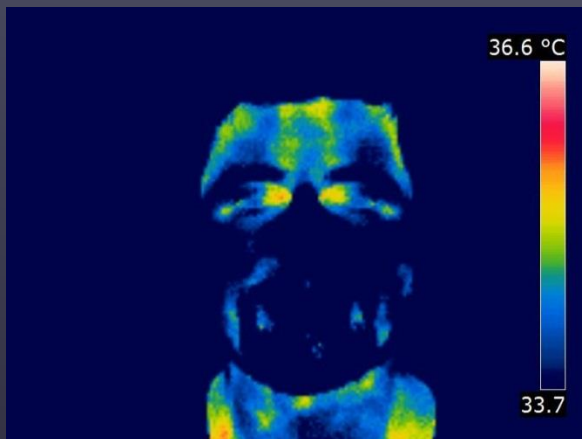
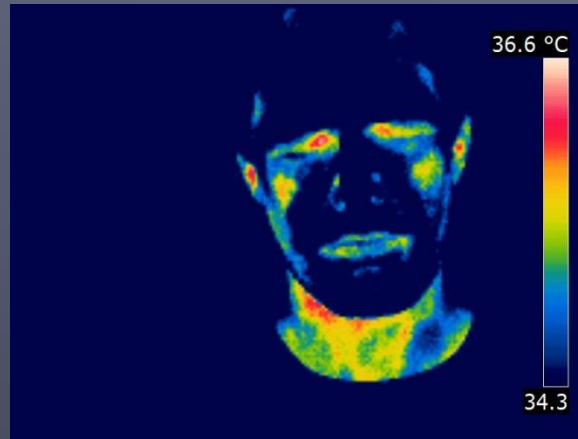
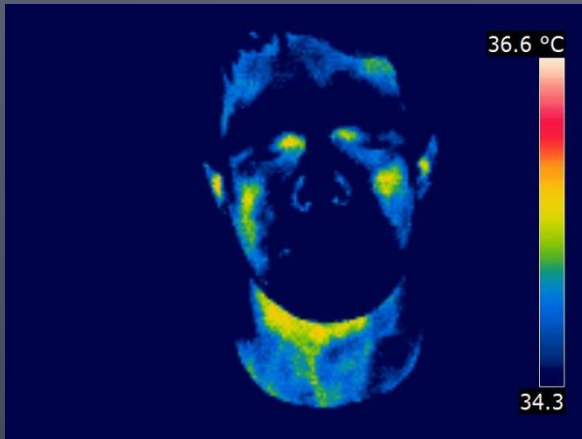


Flir b200, 2017, vascularized/devascularized intestine

Determination of rection line, comparison with ICG method



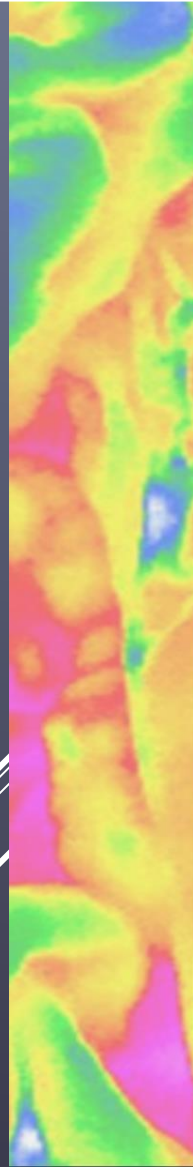
THERMOREGULATION – CAPSAICIN



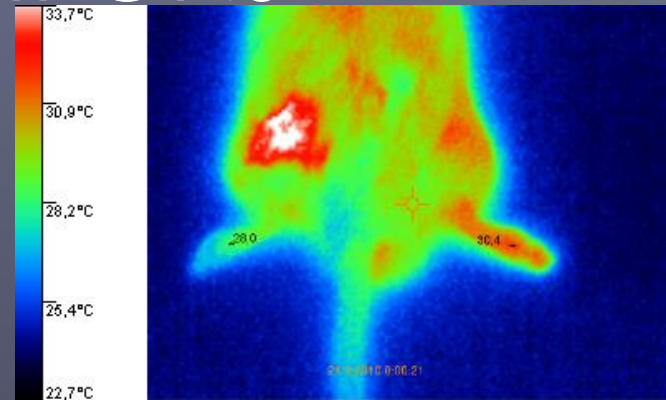
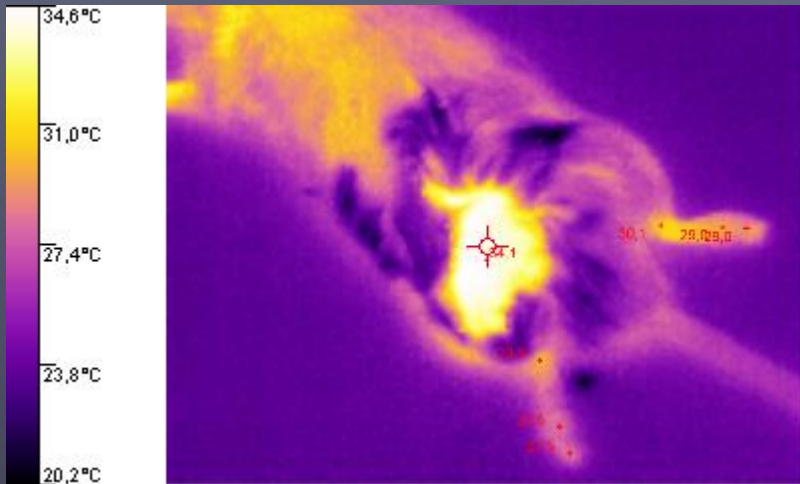
Flir b200, 2017,
capsaicin

before / after
application

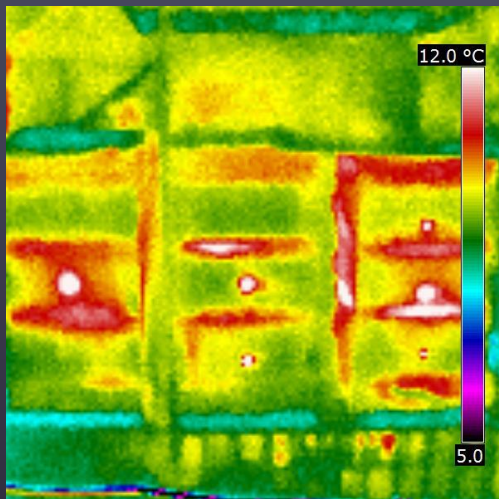
The effect of capsaicin, thermoregulation



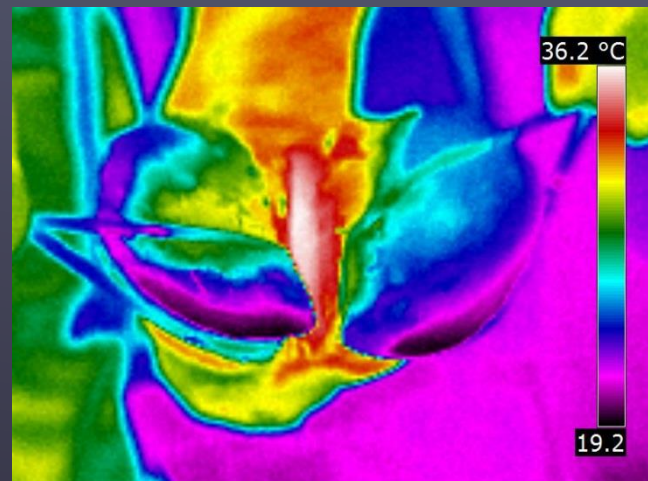
VETERINARY APPLICATIONS



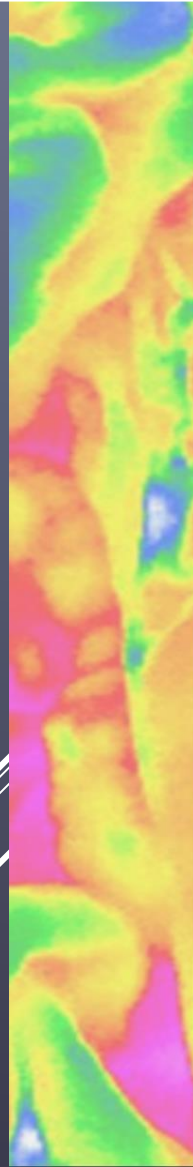
2009, Fluke Ti30, rat, nerve ligature



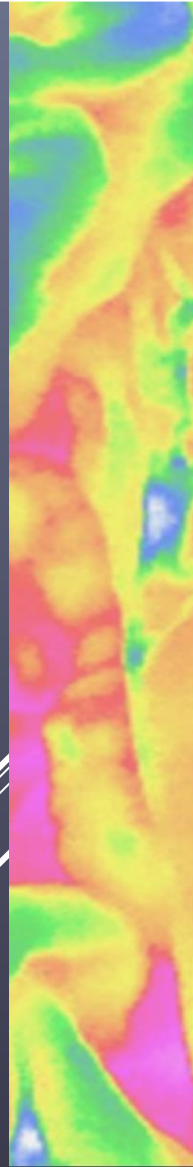
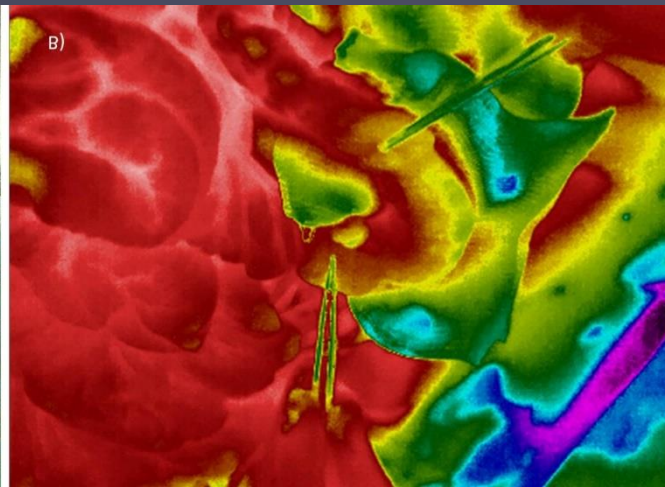
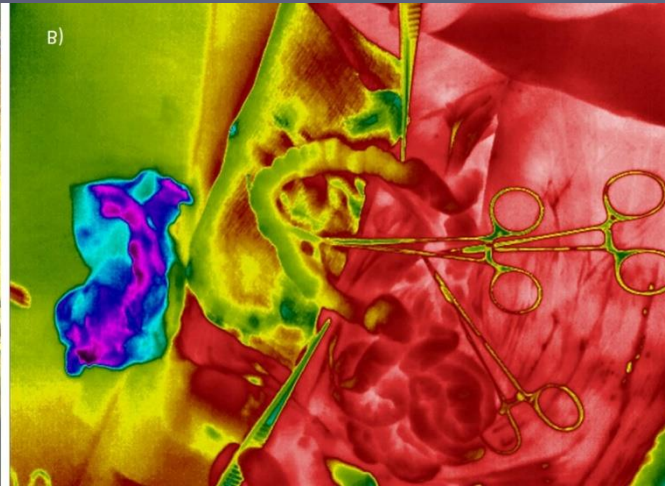
Flir i7, 2016, bee,
thermoregulation
of bee hive



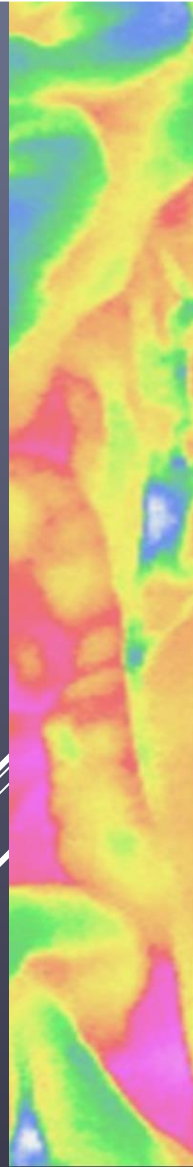
Flir b200, 2017, cattle, inflammation of the hoof

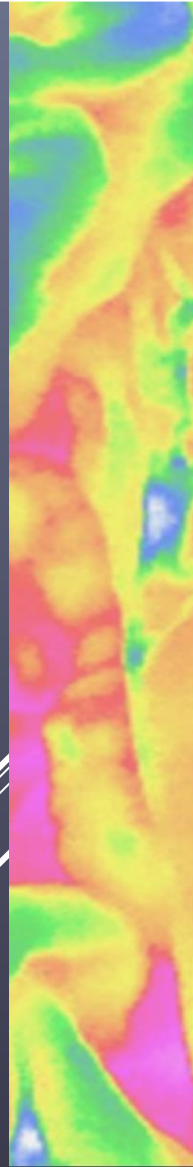


INFRARED THERMOGRAPHY AND INDOCYANINE GREEN ANGIOGRAPHY

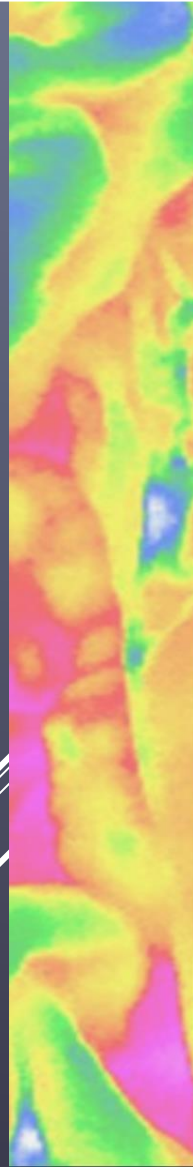


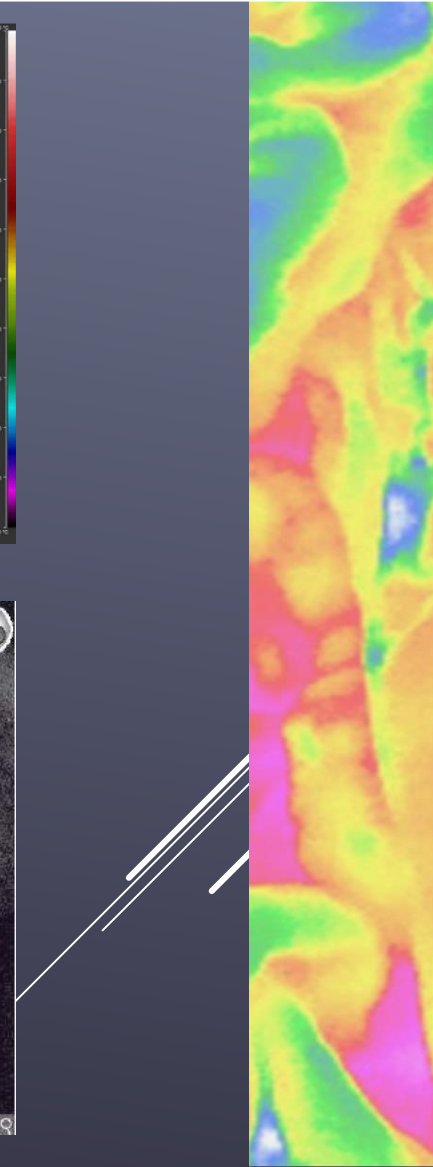
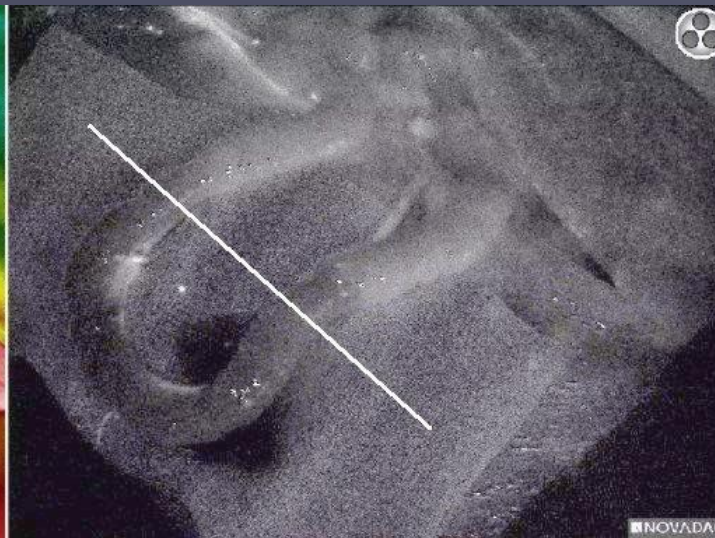
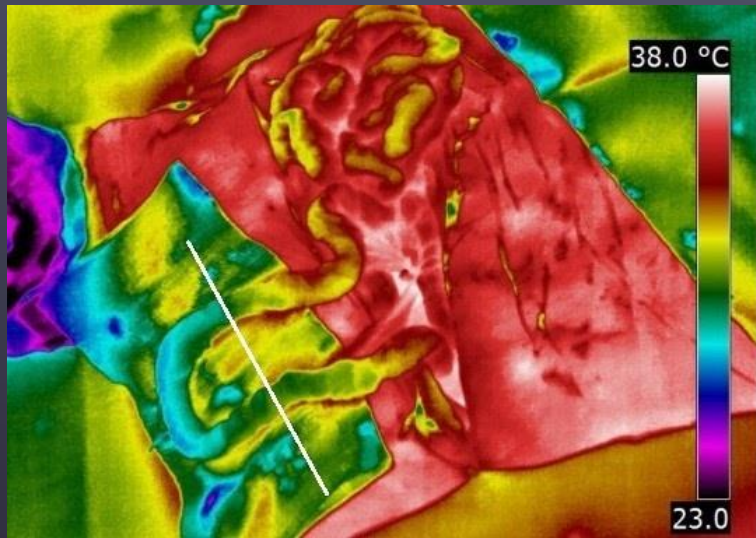
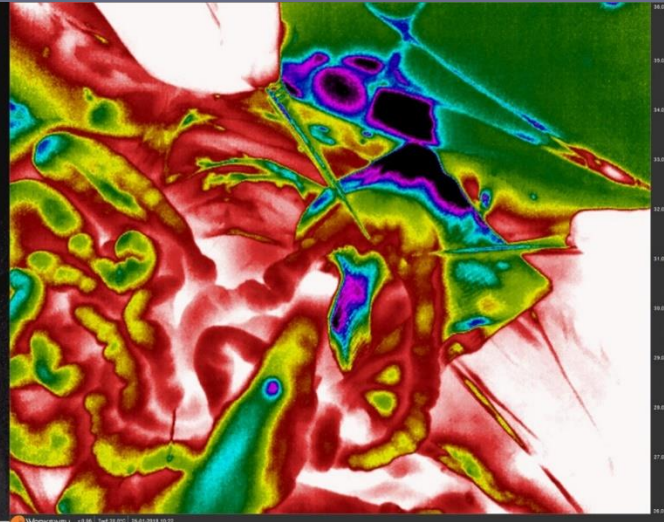
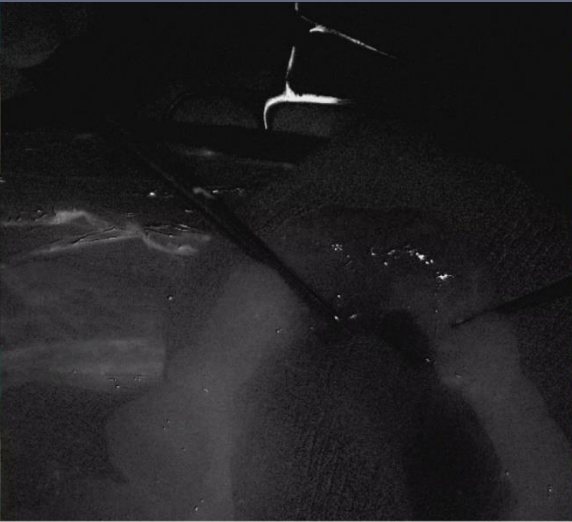
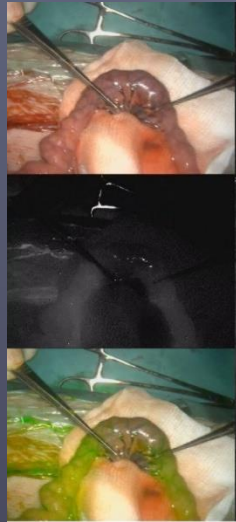
- ▶ **Indocyanine green angiography (ICG)** – the contrast agent (VERDYE – diagnostic green) is fluorescent with wavelength 830 nm and could be visualized with special probe
- ▶ The application of ICG should be performed intravenously **immediately after the devascularization** of the intestine subsection



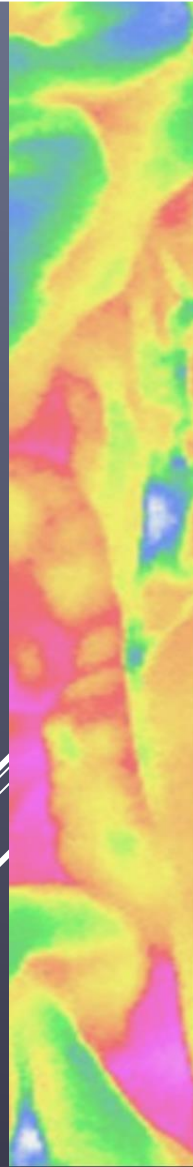
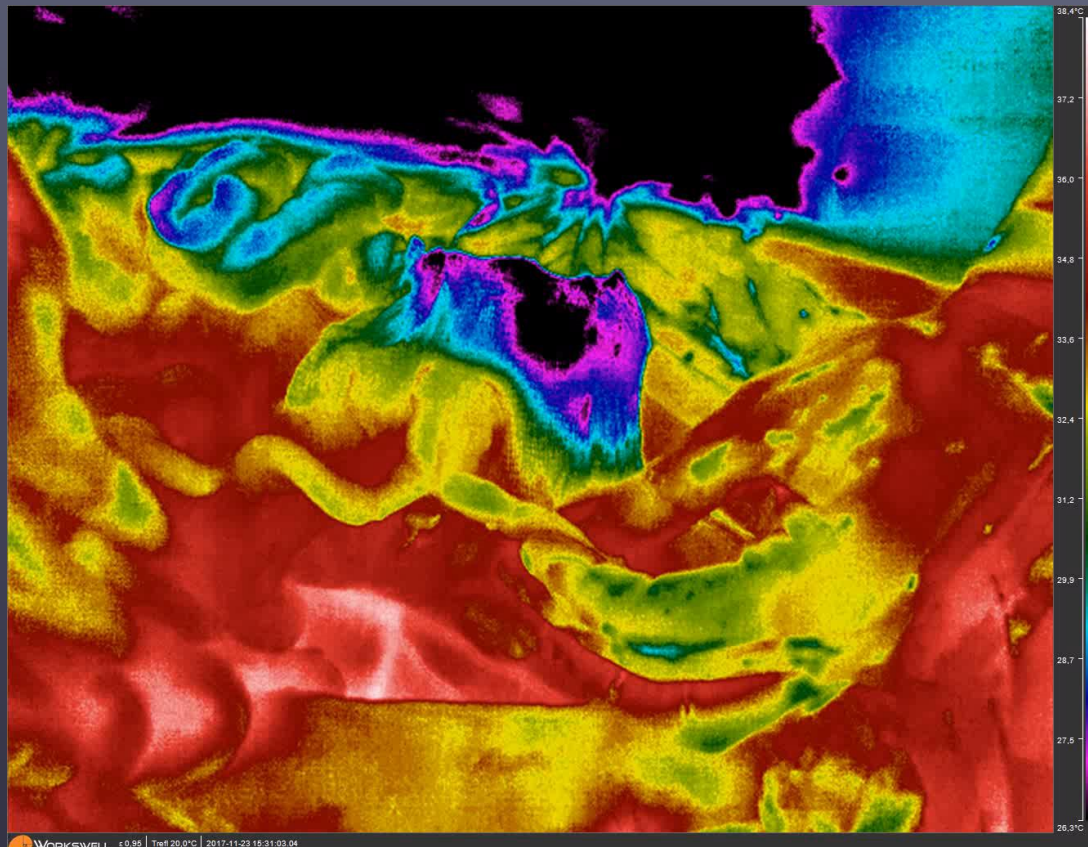


▶ Comparison ICG angiography and IRT in a porcine models



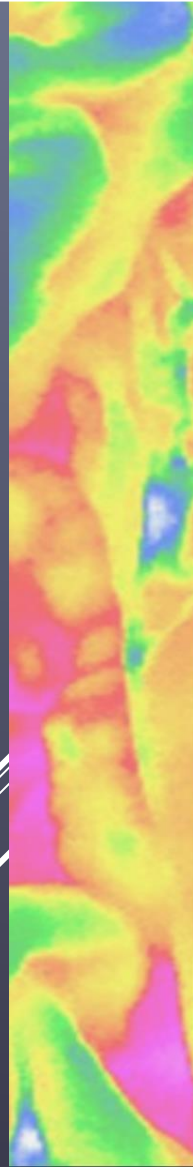
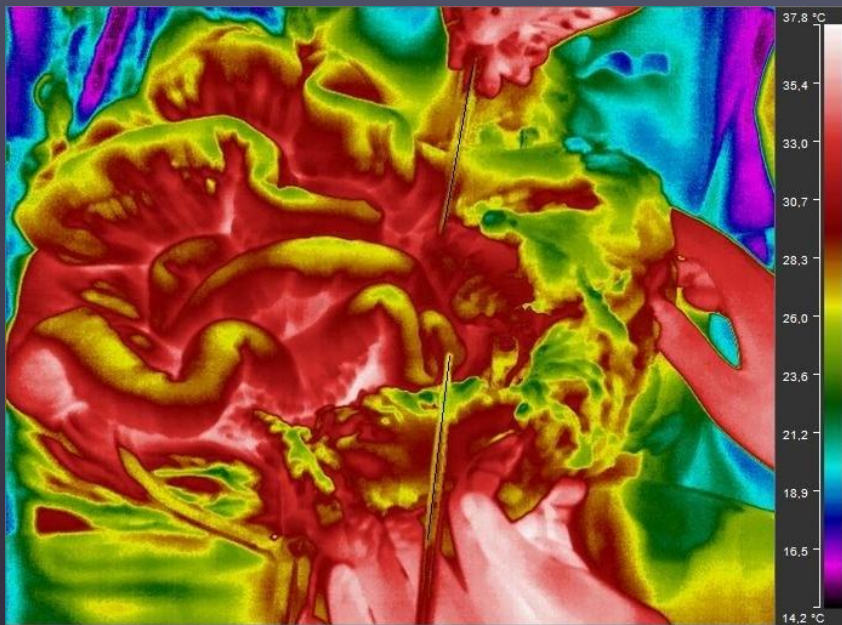


TESTING OF CREATED ANASTOMOSIS





- ▶ Tweezers show the place of resection based on macroscopical evaluation by surgeon
- ▶ There was a clear visible line of ischemic part used by ICG
- ▶ However post-operative course of the patient was complicated on the 7th day by sepsis from anastomotic leakage which was confirmed by a CT scan and later by surgery.





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THANK YOU FOR YOUR ATTENTION!

... and enjoy the visit of Brno...

