

Analysis of experimental surgical lighting parameters in organs *in vivo*



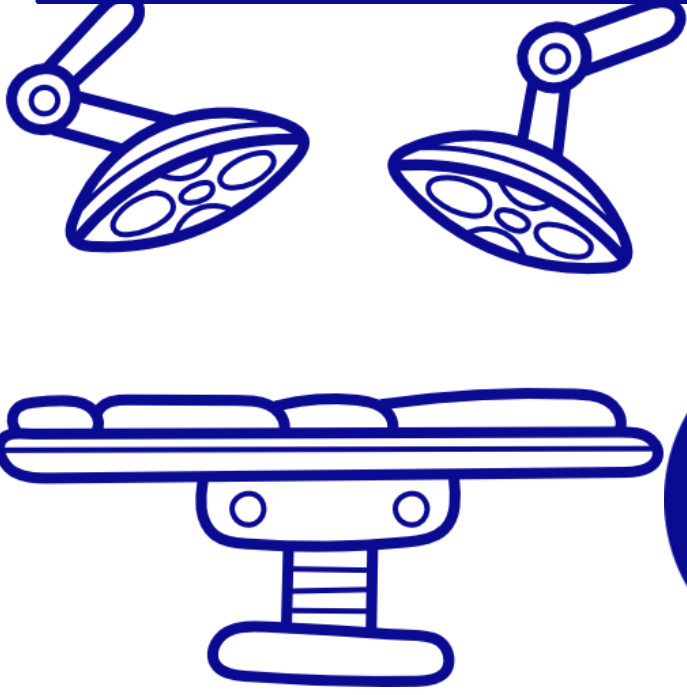
Andrian Mamoshin* 1,2
Evgeniya Seryogina** 1
Anastasiia Krasova 1
Elena Potapova 1
Valery Shupletsov 1
Andrey Dunaev 1
Anton Chernyakov 3
Andrey Aladov 3
Yuri Ivanov 4,5
Dmitry Panchenkov 6



ЦНИИ Туберкулеза
ФГБНУ "ЦНИИИТ"

1 Research and Development Center of Biomedical Photonics, Orel State University, Orel, Russia
2 Orel Regional Clinical Hospital, Orel, Russia
3 Submicron Heterostructures for Microelectronics, Research & Engineering Center, RAS, Saint-Petersburg, Russia
4 Federal Scientific and Clinical Center for Specialized Medical Service and Medical Technologies, Moscow, Russia
5 Central Research Institute of Tuberculosis, Moscow, Russia
6 A.I. Yevdokimov Moscow State University of Medicine and Dentistry, Russia

Introduction



Operational lighting is an irreplaceable part of any surgical intervention.

Modern surgical light has:

- Uniform light over the entire area of illumination,
- brightness adjustment,
- uniform light,
- central illumination



However, it has some drawbacks that prevent an accurate assessment of tissue parameters:

- low tissue contrast,
- insufficient color reproduction,
- lack of volumetric vision,
- insufficient depth of illumination,
- the merger of neighboring structures,
- psycho-emotional stress and rapid fatigue of the operating team.

The Aim of the Research

is to identify patterns based on spectral analysis of data and their organoleptic correction to create a library of color lighting combinations..

Materials and Methods

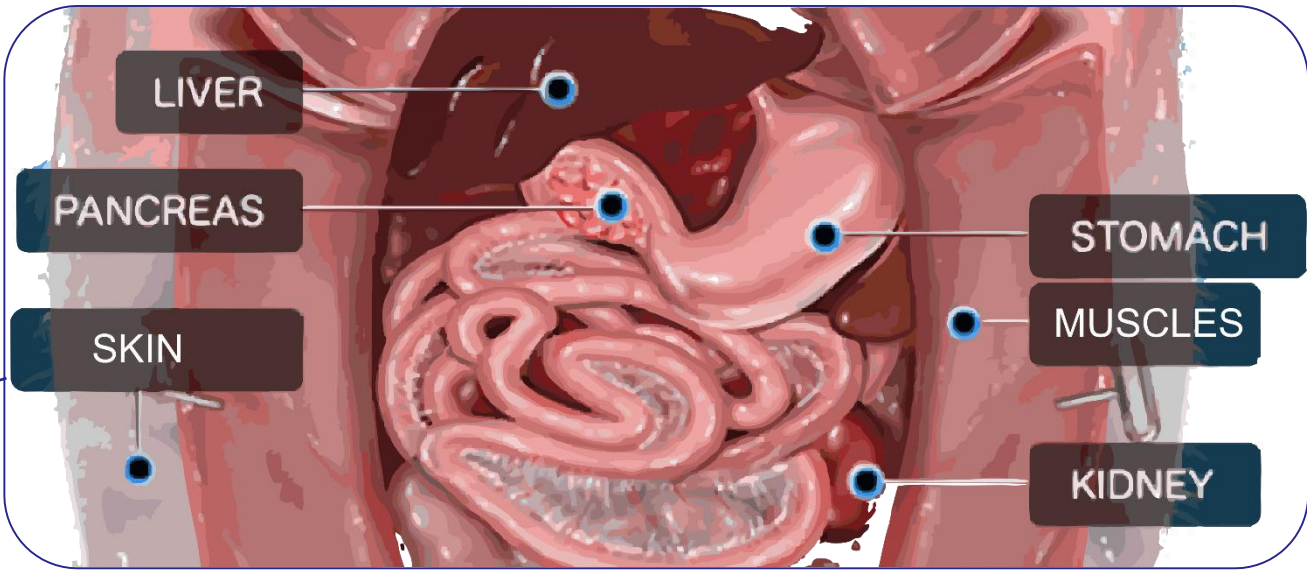
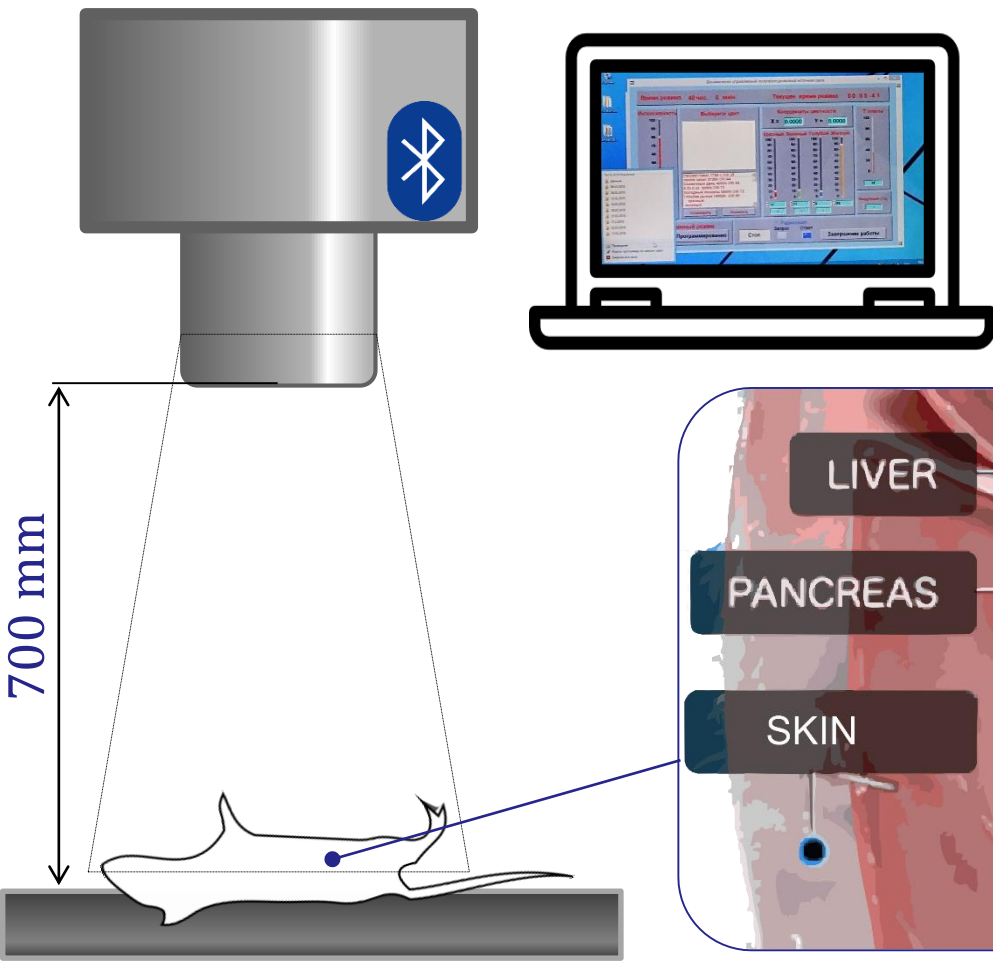
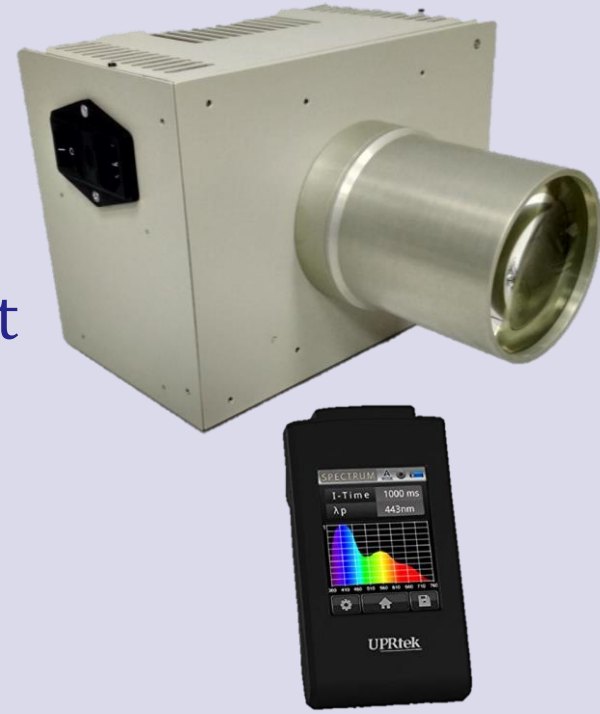
1 The measure optical parameters of tissues.

- OL 770-LED High-speed LED Test and Measurement system (Optronic Laboratories, Inc., USA) includes supplementary device OL 700-71.



2 The correction during experimental *in vivo* study.

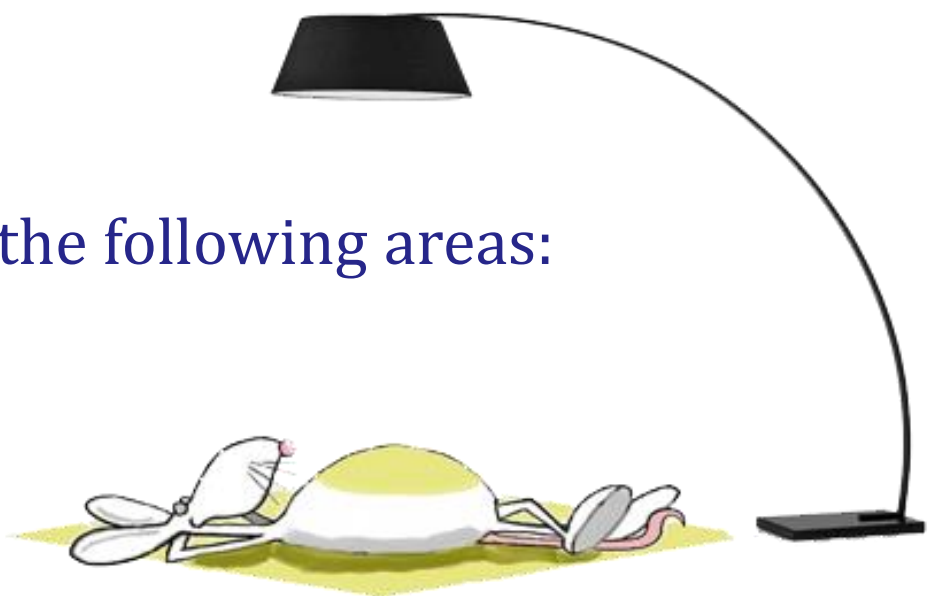
- RGBW LED Phlatlight CBM-360 Luminus Inc.
- Spectrometer MK350



Male Wistar rats (n = 3)

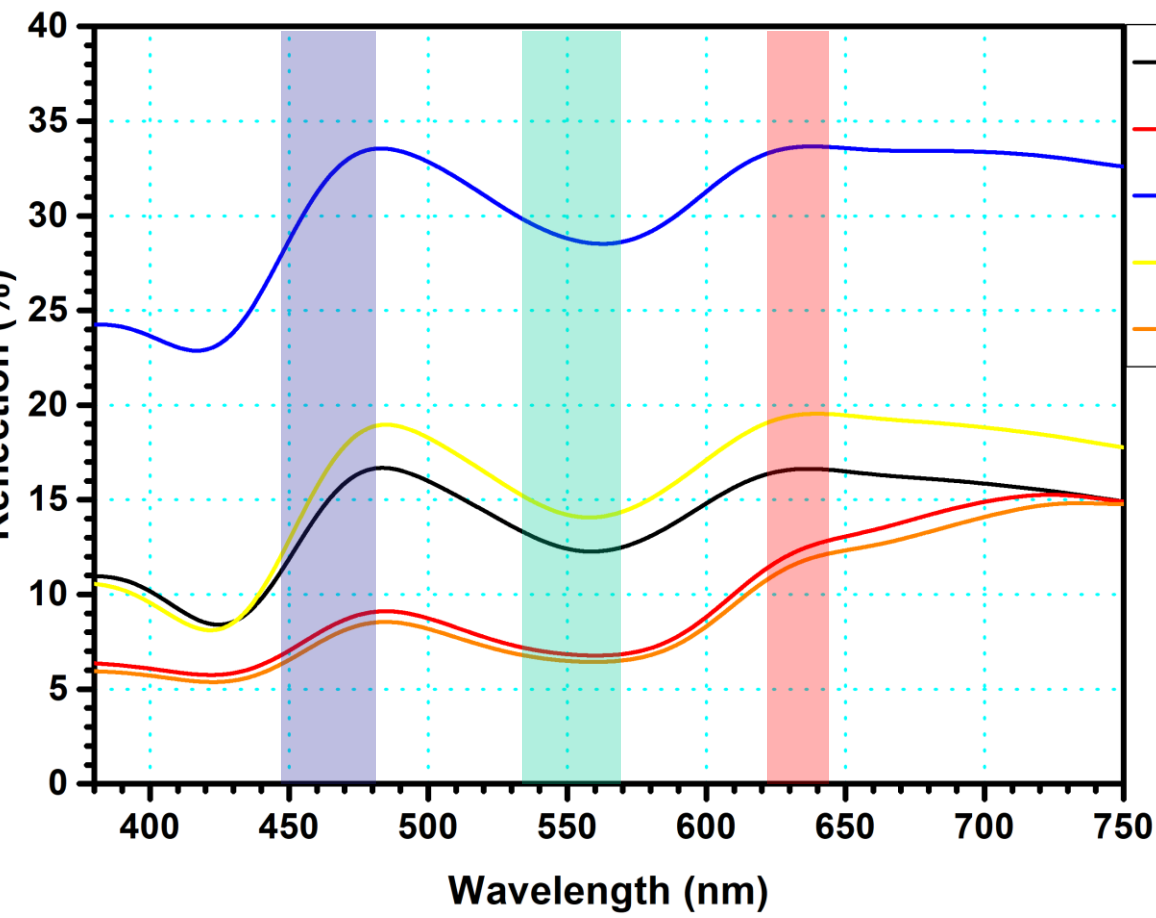
The study was carried out in strict sequence in the following areas:

- Skin,
- Muscle layer and myxofibrosarcoma,
- Kidneys,
- Liver,
- Pancreas and pancreatic tissue when modeling of acute destructive pancreatitis.



Results

Based on the data of spectrophotometric studies, the optimal color mixing parameters for each organ and tissue were selected.



The correction was performed during experimental *in vivo* study depending on the recommendations of the operating team.

According to the analysis results, it was noticed that the optimal surgical field illumination parameters changed depending on the external illumination, the subjective characteristics of the surgeon's eyes, as well as the individual characteristics of each biological object.

Place of study	Skin	Muscle layer	Myxo-fibrosarcoma	Kidney	Liver	Pancreas	Ischemic pancreas
Red (630 nm)	26,0	18,5	14,0	46,0	37,3	24,5	19,0
Green (525 nm)	55,0	32,0	4,0	61,0	44,8	36,5	24,0
Blue (460 nm)	5,0	10,5	8,0	12,0	19,8	7,5	10,0
White (6500 K)	80,0	92,5	99,0	80,0	92,3	88,0	96,0
T _e , K	4873,0	5304,0	5126,0	4686,0	5393,0	5798,0	5078,0
E _v , lux	5901,0	8213,8	177,0	4760,0	5582,0	763,0	500,0
λ _p , nm	635,0	530,0	451,0	634,0	634,0	451,0	632,0
CRI	81,0	81,5	88,0	78,0	78,0	78,0	86,0

Summary table of source parameters and measured data by spectrometer

Conclusion

- The use of dynamic control of light and colour parameters of the illumination of the operating field has the potential for contrasting visualization and a differential approach to the illumination of specific anatomical structures.
- At present, data are being collected on an extended range of biological objects, including *in vivo*, in order to develop optimal operating illumination algorithms for surgical interventions on various organ systems.

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*Email: dr.mamoshin@mail.ru
**Email: e.s.seryogina@gmail.com
<http://www.bmecenter.ru/en>

