

# Noninvasive control of distribution of rhodamine-loaded capsules in vivo



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## INTRODUCTION

Optical methods, in particular, fluorescent spectroscopy, are promising tools for diagnostics in the modern medical practice. In this study, processes occurring in a living organism using optical methods of diagnostics were assessed. Fluorescence spectroscopy has a high potential in the field of drug research (drug discovery and drug delivery), preclinical and clinical trials.

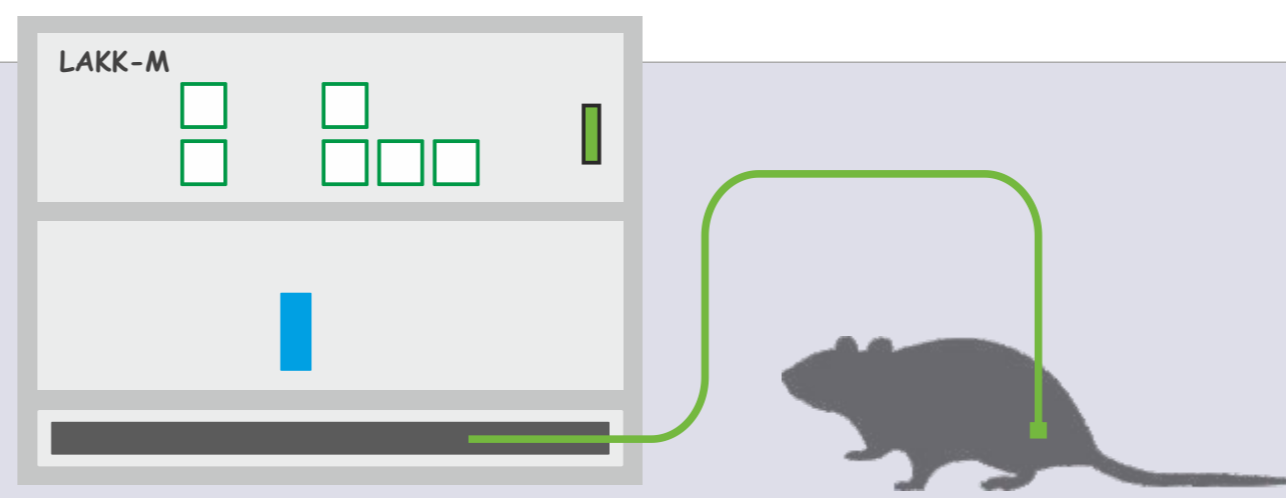
## THE AIM OF RESEARCH

To find informative points (areas) on the rat skin for transcutaneous fluorescence measurements and to investigate the efficiency of propagation of the fluorescent-labelled (Rhodamine TRITC) nanocapsules injected in the circulatory system.

## EXPERIMENTAL STUDY

The research was conducted with the LAKK-M system usage (SPE "LAZMA" Ltd, Russia) with a measuring channel of FS at a wavelength of 532 nm.

Fluorescence spectra were recorded from thighs of anaesthetized rats during 90 min with 10 min intervals.



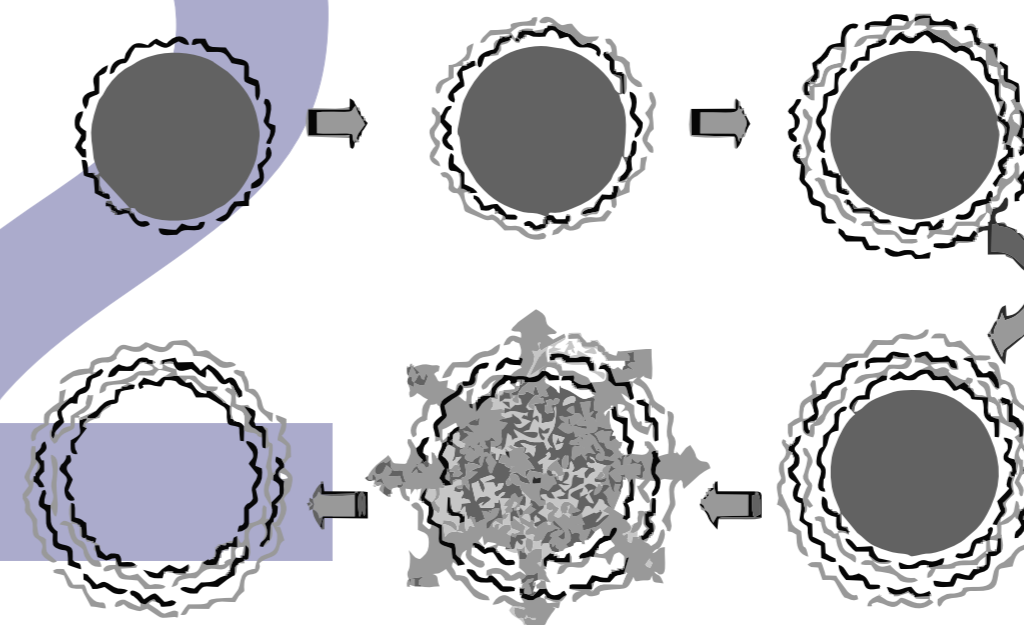
Twelve 100-120 g, Wistar rats were divided into two groups: treated with rhodamine-loaded capsules, injected directly into the bloodstream, (n = 6) and control (n = 6).

## AREAS OF INTEREST

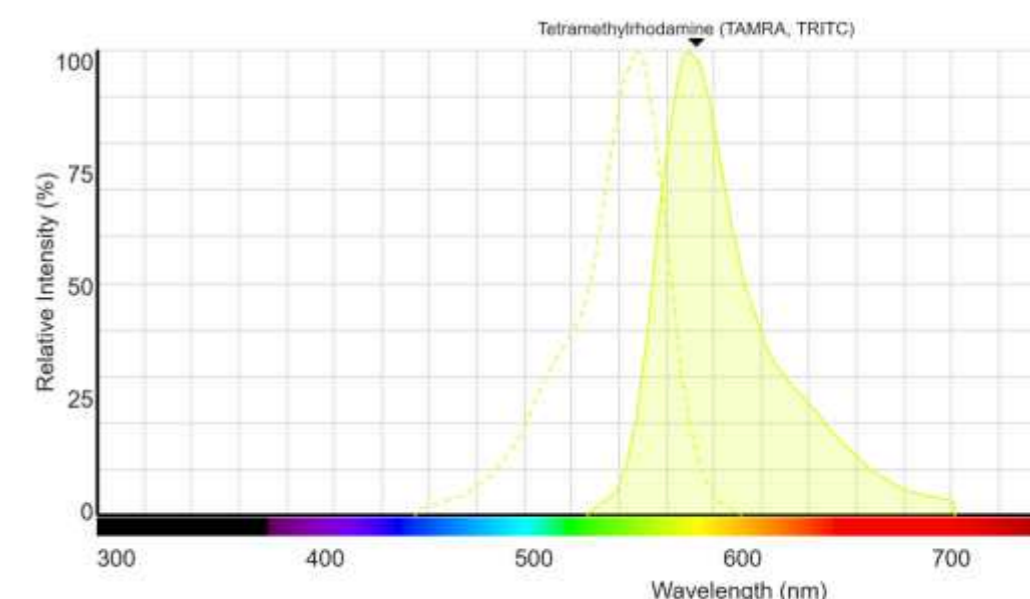


Final points of measurements were selected on the right thigh and at the base of the tail.

## 2 FLUORESCENT-LABELLED NANOCAPSULES



Polymeric capsules



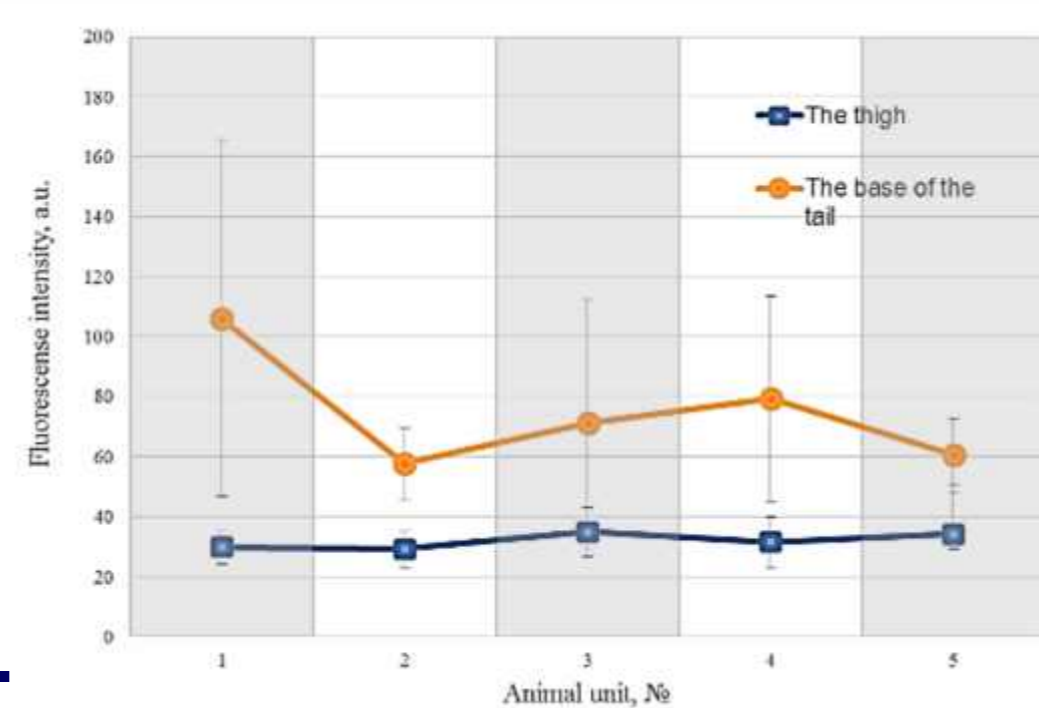
Fluorescence spectra of rhodamine

## RESULTS

The fluorescence intensity at the point on the thigh was  $35.9 \pm 12.6$  a.u., at the base of the tail point –  $74.7 \pm 38.1$  a.u.

The range of parameters in the fluorescence intensity analysis at the point on the thigh was 14-30%, at the point on the base of the tail – 20-58%.

The obtained fluorescence spectra show a statistically significant increase in the fluorescence intensity in a group of rats that received nanocapsules with rhodamine. In this group, a marked increase (210% of the baseline level) in the average peak fluorescence intensity from  $42 \pm 5$  to  $87 \pm 7$  a.u. was registered.



The fluorescence intensity were normalized by the:

$$k_f(\lambda) = \frac{1}{1 + \frac{I_{max\ laser}}{I(\lambda)}}$$

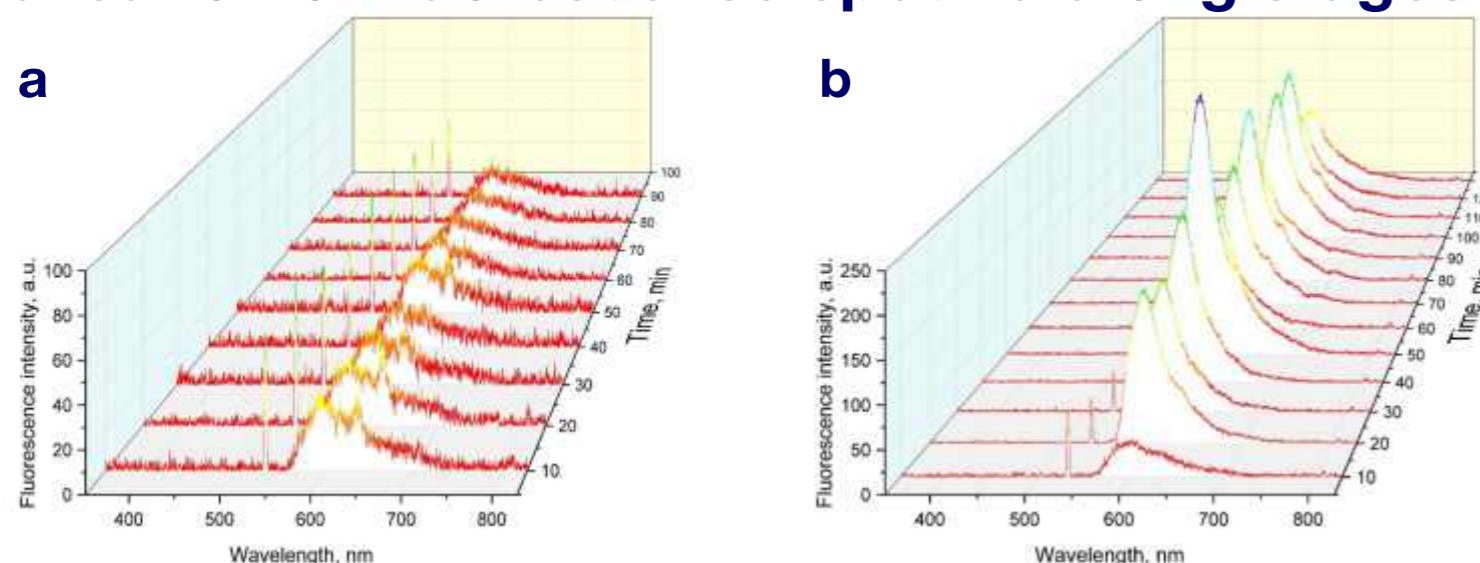
$I(\lambda)$

represents registered fluorescence intensity at wavelength  $\lambda$

$I_{max\ laser}$

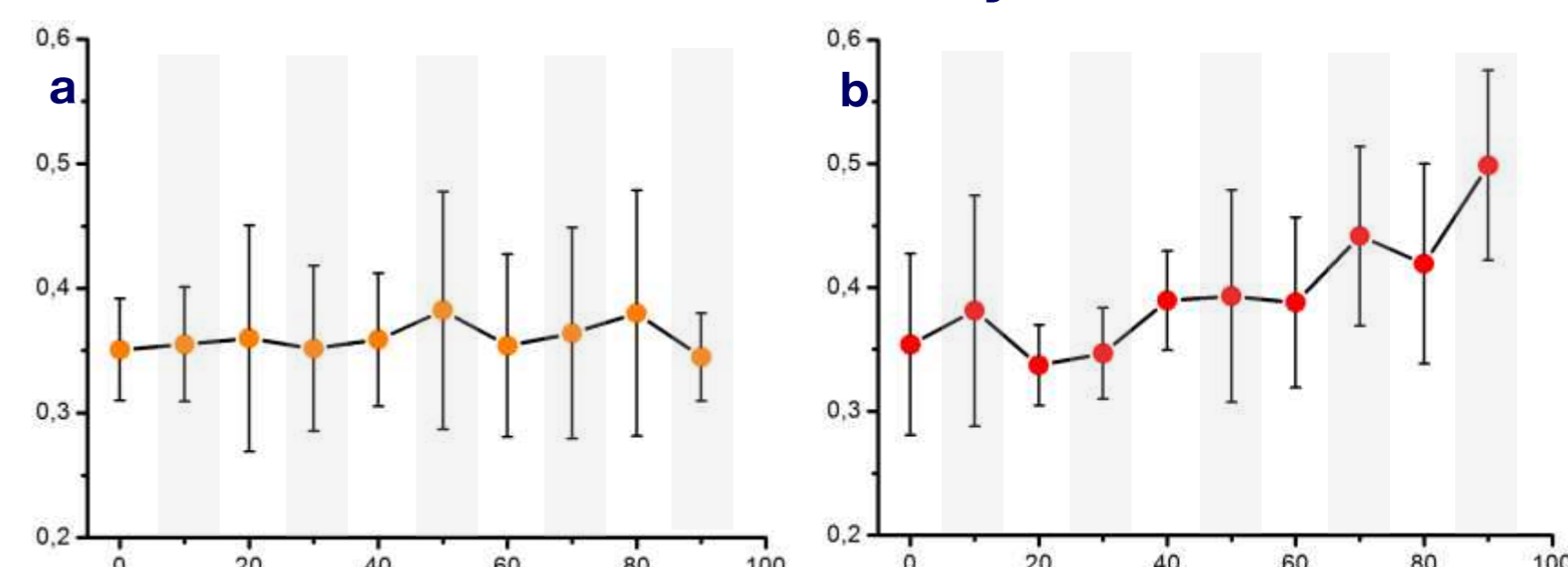
represents the maximum intensity of the backscattered laser radiation (532 nm)

## Visualisation of fluorescence spectra along stages of experiment



a) control group  
b) group received fluorescent-labelled (rhodamine TRITC) nanocapsules

## Normalized fluorescence intensity versus time



## CONCLUSION

Based on the results it was found that the fluorescence of the tissue increases significantly in the group where the rats received the particles. The use of fluorescence spectroscopy can increase the statistical significance and reliability of clinical trials and reduce needed and suffering of laboratory animals. The data obtained by this method can provide information about the pharmacodynamics and the optimal dosage of the drug.