Summary

The submitted dissertation addresses the issue of autofluorescence diagnostics of colorectal carcinoma. The following objectives were set: to verify the possibilities of exploiting the autofluorescence properties of normal colon tissue and tissue changed by tumour to differentiate them and to verify the possibility of using an experimentally created portable measuring set to carry out an "optical biopsy" during the colorectal carcinoma operation.

The project solution was divided into three phases:

Phase I focused on experimental verification of the fluorescence characteristics of normal colorectal tissue and tissue changed by tumour with the use of argon and a helium-neon laser. The obtained values confirmed the possibility to differentiate not only in terms of quality (change in the spectral curve) but quantity as well (change in intensity of the autofluorescence emission at selected wavelengths). When excited by the **He-Ne** laser, an approx. 30 a.u. contribution was observed practically throughout the measured interval, the maximum being between 670 – 700 nm, which corresponds to the fluorescence spectre of porphyrins. Normal tissue did not show hardly any activity. When the **Ar laser** was used, intensity discriminant values ranged only in individual units.

Phase II was devoted to verification of the function and ability of clinical use of the experimentally created portable measuring set, consisting of a light source based on an incoherent LED, two-fibre light emitting transmission system and an Avantes spectrum portable analyser. In measuring, we obtained values allowing discrimination between the tumour and normal tissues based on the intensity difference; these values reached up to hundreds in the wavelengths about 690 nm.

Phase III was intended for clinical testing and subdivided into 2 sub-phases.

In the first phase, the discriminatory possibilities of autofluorescence characteristics obtained in measuring in a real environment were verified and statistically evaluated. For statistical evaluation, a logistic regression analysis and the principal components method were used. The evaluation was carried out for a model with 30 and 40 analysed

components. Our measurements showed that the classification ability of the model is 79.7% and 82.5%. The resolution of the models under Tapea was 0.88 and 0.91.

In the second phase, actual use was simulated. 100 measurements were made, 17 localities were assessed as uncertain and 3 as malignant. Histological examination did not confirm tumour involvement in any of these localities. Thus, we obtained a false positive result in 3% and an uncertain result in 17%.

The work demonstrated, consistently with the literature, with high reliability that the autofluorescence properties of tissue can be used to distinguish normal and tumorous tissues of the colon – rectosigma.

The optical biopsy methodology designed and tested by the authors provides very good results that could serve well as an orientation aid for targeted histological examination. Its practical use, however, is still limited by 2 problematic areas: the great variability of the measured values in the tested individuals and the methodology for setting the reference areas.