

Evaluation of a PhD candidate: Mgr. Tereza Tučková

In vivo application of holographic endoscopy

The goal of Tereza's Ph.D. studies was development of holographic endoscopy for *in-vivo* applications in brain research. This technique explores ultra-thin multi-mode fibres as endoscopic probes in conjunction with wavefront shaping to achieve diffraction-limited resolution imaging at the tip of the fibre. This technique has high potential in deep tissue imaging providing the best ratio between resolution and the probe footprint. This is especially important in brain research where disruption of functional connection of neuronal networks corrupts physiology.

In the first part of the work, Tereza built an endoscopic setup and tested the quality of imaging. The main problem was a longer-term stability which was resolved mainly by temperature stabilization of the light modulator – the digital micro-mirror device. This way a long-term imaging capacity was achieved in the range of hours.

Then she collected experimental data for development of post-processing algorithms to enhance image contrast and resolution. This part of work was published in Optics Express in 2021, Tereza being the first author.

In the last part of her work, she implemented a new principle of confocal imaging through the multi-mode fibre. She upgraded the experimental setup with a confocal module for calibration and elimination of the out-of-focus signal. She demonstrated the confocal principle experimentally on phantom samples as well as on mouse brain slices. The confocal principle is going to be patented and published soon.

Overall, Tereza has made a significant contribution in advancing the holographic endoscopy towards its applications in *in-vivo* brain research. Specifically, the confocal modality seems to be very important for good-quality routine imaging of brain tissue. She has worked with great enthusiasm, drive and smile on her face. She was communicating and collaborating well with other members of the team. Over the course of her Ph.D. studies, she has improved her weakness which is presentation and scientific writing. Yet there is still room for further work, especially in clear and concise writing. In the future I would encourage Tereza not to be afraid to take time and think deeply about challenges, building the knowledge and solutions from basic fundamentals.

From my perspective as a supervisor, I recommend Tereza for a Ph.D. and wish her best luck in her future career and life.

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