MICROSCOPIC DETECTION OF DIESEL EXHAUST PARTICLES IN PERFUSED PLACENTA TISSUE

Astrid Tannert[1,2], Diana M. Morales-Prieto[3], Jana Pastuschek[3], Udo R. Markert[3], Ute Neugebauer[1,2,4]

[1] Leibniz-Institute of Photonic Technology, Albert-Einstein-Straße 9, Jena, Germany
[2] Center for Sepsis Control and Care, Jena University Hospital, Am Klinikum 1, Jena, Germany
[3] Placenta Lab, Department of Obstetrics, Jena University Hospital, Am Klinikum 1, Jena, Germany
[4] Institute of Physical Chemistry and Abbe School of Photonics, Friedrich Schiller University Jena, Helmholtzweg 4, Jena, Germany
E-mail: astrid.tannert@leibniz-ipht.de

KEY WORDS: placenta, black carbon, white light generation. femtosecond pulsed excitation

The placenta is a temporal organ that is responsible for the exchange of nutrients and oxygen between the maternal and fetal circulation during pregnancy. Though the blood circulation system of the mother and the fetus are not directly coupled, potentially hazardous substances might cross the blood-placenta barrier and reach the embryo. Maternal exposure to air pollution has been implicated in influencing fetal development. It has been demonstrated that black carbon particles, which are common components of air pollution, can be detected to a higher extent in the placenta of highly exposed women compared to women from areas with less air pollution [1]. Black carbon particles generate a bright white light signal under femotosecond pulsed illumination [1]. We have perfused human placenta with a defined amount of diesel exhaust particulate (DEP) of 40 nm diameter for 3 h. Placental sections were taken before and after perfusion and analysed by two photon excitation at 810 nm and non-descanned detection in 4 different channels. In addition to tissue autofluorescence and signals from collagen second harmonics generation, black carbon particles could be detected by a bright signal in all channels. The scans were compared with images of parallel section stained with hematoxylin and eosin. The number of DEP found before and after perfusion was quantified by scanning the whole placenta sections. A clear increase in the amount of DEP per mm^2 was found after perfusion, indicating that quantification of DEP load in the placenta is possible with this technique. In agreement, DEP detectable at the fetal side of perfused placenta tissue increased over time of perfusion.

References

[1] H. Bove et al, “Ambient black carbon particles reach the fetal side of human placenta,” *Nature communications* **10**, 3866 (2019).

Acknowledgement

Financial support from the BMBF via the CSCC (FKZ01EO1502) and the DFG via SFB 1278 (project Z01, project number 316213987) is highly acknowledged. This work was performed with the help of the Jena Biophotonics and Imaging Laboratory (JBIL) and the Thüringer Innovationszentrum für Medizintechnik-Lösungen (ThIMEDOP) (FKZ IZN 2018 0002).