**Single-molecule immunoassays based on upconversion nanoparticles (UCNP)**

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Single-molecule assays require the highest detection efficiency because each label must be detected and counted individually. We have used luminescent nanomaterials, so-called upconversion nanoparticles (UCNPs), for the design of conventional (analog) and single-molecule (digital) immunoassays because the anti-Stokes emission of UCNPs can be effectively detected without any optical background interference. The upconversion-linked immunoassay (ULISA) was used for the detection of SARS-CoV-2 and other diagnostically relevant biomarkers. UCNP labels typically improve the sensitivity of immunoassays more than 100-fold as compared to conventional microtiter immunoassays or lateral flow assays. The digital readout has the potential to further improve the sensitivity depending on the antibody affinities. The ULISA enables a wide range of applications in biomedicine, environmental sciences as well as food control.

**Short Bio:**

**Hans H. Gorris** received his PhD degree from the University of Lübeck, Germany, and was a postdoctoral fellow at Tufts University, USA. He was an independent research group leader and Heisenberg Fellow at the University of Regensburg, Germany. Since 2021, he has been an Associate Professor at the Department of Biochemistry at Masaryk University in Brno, Czech Republic. His main research interests are digital immunoassays based on photon-upconversion nanoparticles (UCNPs) and other single-molecule detection techniques.