

## Annual Highlights

The research activities at IDUN in 2018 have resulted in 35 peer reviewed journal articles, 63 conference contributions and 27 invited talks. 63 people were in 2018 working in relation to the IDUN center and together they supervised 26 Master students and taught several courses. We successfully ran our PhD summer school program, with a track on drug delivery and one on micro- and nano-sensors, and hosted our annual "IDUN Industry Day" where IDUN researchers were given a platform to share their research while learning more about the industry.

In 2018 IDUN Senior Scientist En Te Hwu was awarded the Villum Experiment grant for his project "3D micro/Nano printing". Professor Jukka Rantanen, Associate Professor Martin Dufva and Associate Professor Stephan Keller were independently awarded grants from the Independent Research Fund, receiving more than 8 MDKK. In addition, Associate Professor Stephan Keller secured funding for his project "Microneedles for allergy testing in the skin" from the Leo foundation and the Copenhagen Center for Health Technology, while Associate Professor Martin Dufva was awarded a Marie Curie grant as a co-applicant. IDUN PhDs and postdocs took home 68.000 kr. in travel grants.

In 2018 IDUN hosted Micro and Nano Engineering (MNE), a large international conference with 600 participants, attracting many of the top researchers within the field of micro- and nanotechnology. IDUN researchers gave 7 talks and presented 9 posters at the conference, generating significant interest in the research conducted at IDUN. The feedback has been overwhelmingly positive and has provided IDUN researchers with an array of collaborative ideas and future research partners.



## IDUN Drug

IDUN drug has made a breakthrough in the realization of released 3D printed microcontainers. These allow for fundamental studies on how size and shape of the containers affect flow and attachment to intestinal surfaces. New tissue-based models have been developed for the characterization of mucus adhesion and these have been applied to study e.g. influence of lid material, container surface texture and geometry. First in-vivo vaccine studies have been concluded, showing the potential of container-based oral vaccination. Using cell-models, container-based delivery of insulin and permeation enhancers have been studied, clearly illustrating the benefit of confining delivery to small regions and at a close distance to the cell layer. New studies on delivery of antibiotics and probiotics are ongoing.

## IDUN Sensor

Nanoresonators, which are very sensitive to temperature changes, have been used for thermal analysis of a variety of materials, e.g. polymers and proteins. Our nano-pillar Surface Enhanced Raman Scattering (SERS) substrate has been developed into a chromatography-like platform, showing e.g. direct separation and detection of analytes in urine samples. Complex sample pretreatment and up-concentration of analytes have been integrated on a centrifugal microfluidics platform, and demonstrated on cell supernatants. SERS substrates have been combined with electrochemical sensing and potential control of the SERS substrate facilitates reliable and quantitative SERS measurements. New SERS substrates in polymers and using recyclable nano-hoods have been pioneered.