IDUN Annual Highlights

The research activities at IDUN in 2017 have resulted in 28 peer reviewed journal articles, 56 conference contributions, including 22 invited talks. 60 people were in 2017 working in relation to the IDUN center (see personnel lists). In terms of teaching we have in 2017 for the second year in a row successfully run our PhD summer school program with a track on drug delivery and one on micro and nano sensors. The two summer schools run in parallel with several joined lectures and social program to facilitate interdisciplinary collaboration. We have also in 2017 had 16 students doing their Master's project with an IDUN supervisor and we are continuing this influx of students, supervising master's and bachelor projects as well as shorter projects. We have also been active in outreach activities such as inspirational talks for students, public talks and interviews in different media (see appendix F).

Figure 1: In 2017 IDUN postcards where made using some of the beautiful pictures taken of microcontainers and spinning discs.

In 2017 IDUN associate Professor Stephan Keller was awarded an ERC Consolidator Grant and IDUN Center Leader Anja Boisen was awarded a Synergy Grant from the Novo Nordisk Foundation. Furthermore Professor Jukka Rantanen received a Nordic University Hub grant from 'NordForsk'.

The continuous discussion of the IDUN values and how we do things in IDUN have given rise to a set of IDUN Guidelines where procedures for deciding authorship, collaborations and supervision are outlined. These guidelines were initiated at a workshop in the fall 2017 and will be finished in the spring 2018.

IDUN Sensor

In IDUN Sensor we explore nanomechanical sensors and combine these into strong and generic research tools and systems, for example for fundamental studies of molecular actions, cell behavior and structural properties. New sensors and sensor systems have been realized and tested in 2017. This includes; Raman based crystallography, combined electrochemical and Surface Enhanced Raman Scattering (SERS) sensing and resonating drug crystals. Much effort has been put into integrating sample pretreatment into sensor systems to facilitate detection of small analytes in complex media – such as cell supernatant and urine. Using centrifugal microfluidics and SERS, bacteria production of chemical compounds as well as drug concentration in urine have been studied in a compact, fast and sensitive manner. By nanomechanics and Raman spectroscopy it has been possible to map e.g. hydration behavior of drug crystals that has never previously been seen.

IDUN Drug

In IDUN Drug we design, realize and characterize micrometer sized containers for oral administration of drug. We have in the past year developed new methods for realizing containers in biodegradable and FDA approved polymers. The fabrication process allows for fast manufacturing and easy loading of drugs. Work on oral delivery of insulin has been initiated, which includes the development of a new intestinal perfusion model, co-loading of insulin and permeation enhancers and development of new protective lids. A second round of *in vivo* vaccine delivery studies are currently being performed and initial results look promising. A generic method for achieving released 3D printed containers has been developed and will form the basis for several studies related to the influence of container design and shape on flow behavior and mucus adhesion. Nanotexturing of the containers is seen to drastically improve the mucus adhesion. For these studies, reliable methods for measuring the adhesion between containers and tissue, such as pig intestine, had to be developed.