PERSIMUNE SCIENTIFIC ANNUAL REPORT 2020

Annual highlights:

The PERSIMUNE research agenda in 2020 was challenged greatly by the COVID-19 pandemic. However, PERSIMUNE researchers responded admirably, not only continuing with the established PERSIMUNE research portfolio, but also pivoting to respond to emerging questions related to COVID-19. The response to COVID-19 built upon previous infrastructure and expertise developed as part of PERSIMUNE and the funding provided by DNRF.

The first COVID-19 activity PERSIMUNE was involved in was the development of the Corona Application Tool for Collaborating Hospitals (CATCH). CATCH, a clinical application that utilized IT and clinical expertise developed for a similar program in transplant patients (i.e. MATCH), was designed and implemented in the clinic during the first wave to assist clinicians dealing with an influx of COVID-19 patients, and is still in use today.

The second major COVID-19 activity of PERSIMUNE was to build upon years of experience in data infrastructure and immune phenotyping to establish two national cohorts. The first, COVIMUN, aims to predict clinical outcomes in SARS-COV-2 infected patients using machine learning and immune phenotyping analyses. The second cohort, the National cohort study of effectiveness and safety of SARS-CoV-2 vaccines (ENFORCE), is a national study aimed at assessing efficacy and safety of emerging SARS-CoV-2 vaccines used in Denmark. These activities, along with other COVID-19 research, are described in more detail later in the report.

One highlight from 2020 was the continued development of the microbiome research area. Over the last few years, PERSIMUNE has quietly built one of the largest and best characterised clinical cohorts with matching microbiome data. The collection and analysis of this cohort has been driven by Emma Ilett as part of her PhD project together with guidance from Joanne Reekie, Henrik Sengeløv and Daniel Murray, as well as with bioinformatic support and analysis from the Bioinformatics group led by Mette Jørgensen and Cameron MacPherson. The extent of the work that has been put in by this group can be seen in the recent study by Ilett et al. (*Ilett et al. Blood Adv 2020*). This study utilised biological samples collected from patients and clinical data from the PERSIMUNE data lake to explore the dynamics of the microbiome pre- and post- allogeneic stem cell transplantation and associations with acute Graft versus Host Disease (GVHD). The group used state of the art shotgun metagenomic sequencing to show that microbial diversity in the gut decreases post-transplant and certain aspects of the gut microbiome are associated with increased risk of aGVHD. Crucially, this project utilised both traditional statistical methods as well as bioinformatics methods developed 'in-house', justifying the focus of PERSIMUNE on these two critical data science disciplines.

The final highlight of 2020 is the use of PERSIMUNE data infrastructure and expertise for large national projects seeking to better implement precision medicine strategies. Besides the aforementioned ENFORCE and COVIMUN studies, these projects include the Nationalt Forskningscenter for Børnekraft (CONTROL; led by Kjeld Schmiegelow) and a national Chronic Lymphocytic Leukaemia cohort (led by Carsten Utoft). Although these projects are wide ranging in their design and aims, they are expected to have a global impact in their respective fields and will further promote PERSIMUNE as a crucial player in the endeavour to implement precision medicine on a national scale.

During 2020, 35 articles were published. During the first 6 years of its life cycle, the centre has produced a total of 191 publications, of which 51 are in A (13 in A+) journals (see annex 1).