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Invitation

Guest Lecture – Microbiology Seminar Series, Institute of Microbiology

A yeast-based synthetic genomics platform to reconstruct and edit mycoplasmal and viral genomes

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Lecture Hall M, Building HA at University of Veterinary Medicine Vienna

Synthetic genomics engages in the design and assembly of genes and chromosomes to create cells with properties unobtainable by conventional molecular biology methods. The field was fueled by the efforts to create a cell, controlled by a synthetic genome and subsequently minimal cell, both mycoplasmas. The techniques established include genome transplantation and the cloning and editing of entire mycoplasma genomes in baker's yeast. Reverse genetics has been an indispensable tool revolutionising our insights into the basis of pathogenesis of microbes and vaccine development. We used synthetic genomes techniques to reveal virulence factors in mycoplasmas belonging to the '*M. mycoides* cluster', to develop a vaccine chassis and to expand the technique to porcine mycoplasmas. Additionally, we adopted the techniques for RNA and DNA viruses, which are often cumbersome to clone and to manipulate in *E. coli* hosts due to size and occasional toxicity. We developed a functional yeast-based synthetic genomics platform for the genetic manipulation of diverse RNA viruses. Therefore, viral genomes were fragmented and reassembled in one step in *Saccharomyces cerevisiae* using transformation associated recombination (TAR) cloning to maintain the viral genome as a yeast artificial chromosome (YAC). T7-RNA polymerase has been used to generate infectious RNA *in vitro*, which was then used to rescue viable virus from cell culture. Based on this platform we engineered SARS-CoV2 based on a synthetic genome within less than a week after receipt of the synthetic DNA fragments. Recently, we extended this platform to large DNA viruses such as African Swine Fever Virus (ASFV) and we are adjusting our pipeline to develop designer bacteriophages to be used for treatment of infections with multidrug resistant bacteria.