EMBL Australia
Single Molecule Science

SMS External Seminar Series 2022
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UNSW AUSTRALIA

Single-molecule visualisation of DNA replication

Lecture by

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Abstract

The replisome, the multi-protein system responsible for genome duplication, is a large and highly dynamic complex, displaying a large number of different enzyme activities. The roles of the individual proteins involved in DNA replication are fairly well understood. The study of the dynamic behaviour of these proteins and their interactions in the context of the replisome, however, require the use of single-molecule visualisation techniques.

We have developed fluorescence visualisation techniques coupled to microfluidics systems that allow us to study DNA replication at the single-molecule level. We reconstitute replisomes from purified proteins and can monitor the behaviour of fluorescently labelled proteins during active DNA synthesis.

In contrast to the widely accepted view that the replisome acts as a stable machine, we were able to show that proteins in the replisome can exchange rapidly with proteins from solution. Recently, we have shown that DNA replication does not require ATP, challenging the textbook view of DNA replication as an ATP dependent process.

We hypothesise that the dynamic behaviour of the replisome provides the adaptability to respond to cellular stresses and ensure continued replication.

Biography

Lisanne obtained her BSc and MSc in physics in the Netherlands. For her PhD, she joined the lab of Antoine van Oijen at the University of Groningen to study bacterial DNA replication at the single-molecule level. She moved with the van Oijen lab to the University of Wollongong and obtained a joint PhD degree from the Universities of Groningen and Wollongong in 2018. Lisanne worked as an Associate Research Fellow at the University of Wollongong on developing new single-molecule techniques to study the more complex eukaryotic DNA replication system. In 2022, she was awarded an NHMRC Investigator grant. She aims to use her expertise in the development of single-molecule visualisation methods to design a novel single-molecule directed-evolution approach.

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