The Ampere Prize 2021 for Young Investigators

Dr. Antoine Loquet has received the AMPERE prize for Young Investigator during the 17th EUROMAR. The prize was given in recognition of his achievements in solid-state nuclear magnetic resonance study of protein assemblies.

The French chemist is working at the European Institute of Chemistry and Biology (IECB), his group focuses on the development and application of solid-state NMR to study molecular assemblies. PhD in 2009 at the CNRS / University of Lyon, France, under the guidance of Dr. Anja Böckmann, he worked on protein structure determination by solid-state NMR techniques. He moved in 2009 to Germany as an EMBO long-term postdoctoral follow to work in the group of Prof. Adam Lange on structural studies of protein assemblies by solid-state NMR. He obtained a CNRS researcher position in 2014 to move to the IECB. He is a CNRS Research Director and the IECB Deputy Director since 2020.

Dr. Loquet established his research group with a focus on the development and application of new solid-state NMR approaches in the field of structural biology. In 2015, he obtained an ERC Starting Grant to study weak interactions in complex assemblies by solid-state NMR, with an emphasis on amyloid fibrils. His group worked on the structural basis of amyloid signaling in the context of programmed cell death (PCD) (1-4). He explored the molecular basis of amyloid cross-seeding at an atomic resolution. Solid-state NMR approaches combining strategic labeling schemes to detect intermolecular distances and fast magic-angle spinning instrumentation were used to derive an atomic resolution structure of a functional amyloid assembly based on 1H-1H distances (3). Functional amyloids involved in biofilms (5) as well as pathological amyloids (6-7) were also investigated using solid-state NMR methods, to deliver crucial details about their architecture.

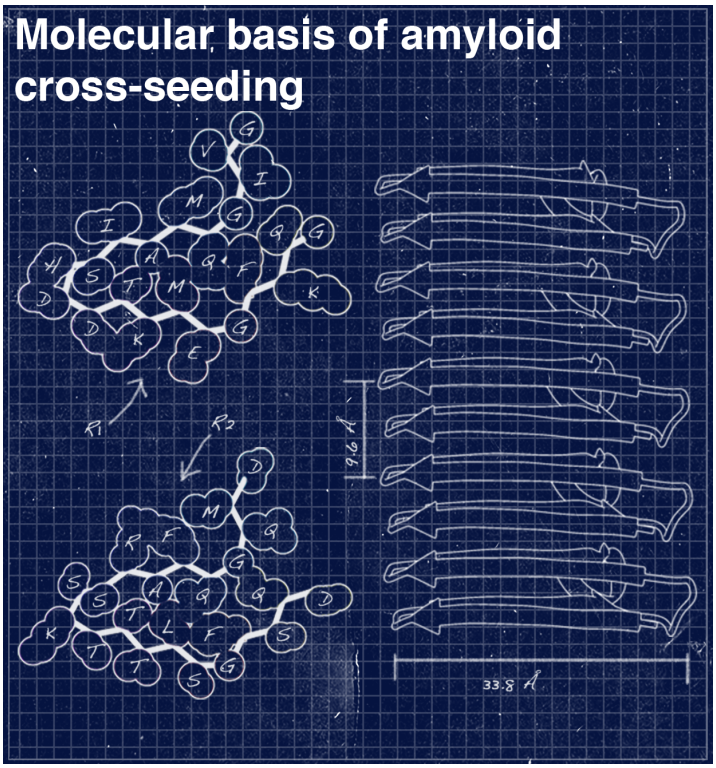

Figure: Atomic resolution structure of functional amyloids derived from solid-state NMR data.

During his talk at the EUROMAR " Structural biology of protein assemblies and pathogen cell surface by solid-state NMR spectroscopy ", Dr. Loquet presented solid-state NMR studies on three different systems. First, he showed how heterotypic amyloid-amyloid interface could be derived from solid-state NMR measurements combined with the design of synthetic functional amyloids. Then, he presented solid-state NMR data using proton detection and fast magic-angle spinning to study the molecular organization of the cell surface of a pathogen. The final part of his talk was dealing with the development of an approach using proton detection, carbon-13 double quantum detection and fast magic-angle spinning.

References:

(1) Identification of a novel cell death-inducing domain reveals that fungal amyloid-controlled programmed cell death is related to necroptosis.
Daskalov et al., Proc Natl Acad Sci U S A. 2016

(2) Identification of NLR-associated Amyloid Signaling Motifs in Bacterial Genomes. Dyrka et al., J Mol Biol. 2020 Nov 20;432(23):6005-6027.

(3) Structural and molecular basis of cross-seeding barriers in amyloids. Daskalov et al., Proc Natl Acad Sci U S A. 2021 Jan 5;118(1):e2014085118.

(4) Structures of Pathological and Functional Amyloids and Prions, a Solid-State NMR Perspective. Daskalov et al., Front Mol Neurosci. 2021 Jul 1;14:670513.

(5) Molecular architecture of bacterial amyloids in Bacillus biofilms.
El Mammeri et al., FASEB J. 2019 Nov;33(11):12146-12163.

(6) Novel self-replicating α-synuclein polymorphs that escape ThT monitoring can spontaneously emerge and acutely spread in neurons.
De Giorgi et al., Sci Adv. 2020 Oct 2;6(40):eabc4364.

(7) Structural dissection of amyloid aggregates of TDP-43 and its C-terminal fragments TDP-35 and TDP-16.
Shenoy et al., FEBS J. 2020 Jun;287(12):2449-2467.