

M2 research internship in Microtubule Dynamics

Lab	Regulation of microtubule dynamics and functions
Dates	4-6 months in 2020, timing flexible
Web	https://science.institut-curie.org/team-janke
Supervisor	Carsten JANKE (Carsten.Janke@curie.fr ; +33 169863127)
Address.....	Institut Curie, Centre Universitaire, Bât. 110, 91405 Orsay FRANCE
Salary	M2 monthly stipend 500-600 €
Follow-up	PhD studentship at the SDSV (www.ed-sdsv.u-psud.fr) or the FdV (https://cri-paris.org/fire) PhD programs

Internship project:

A role of the tubulin code in the making and breaking of microtubules

Context of research:

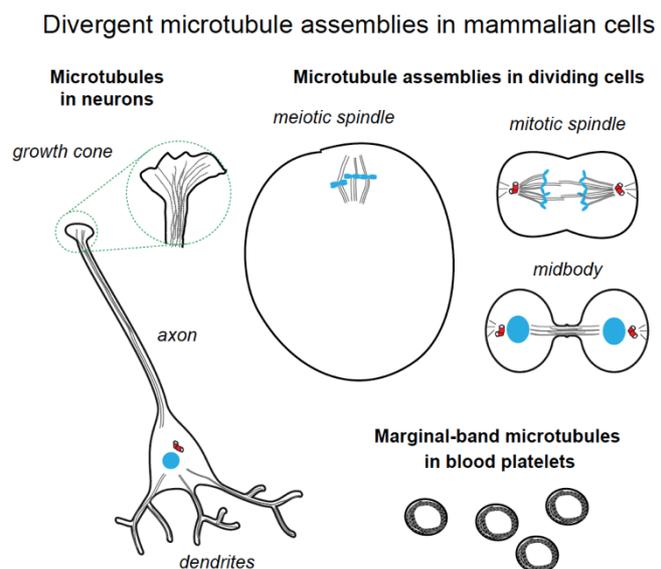
Microtubules are the key structural determinants of every eukaryotic cell. These filaments are unique in terms of their mechanical flexibility and rigidity. Microtubules can adapt numerous different conformations in cells to serve divergent functions (illustrated in the figure). At the same time, they are also rigid and strong filaments to bear the load of a myriad of proteins interacting with them.

How are microtubules able to adapt such a variety of structural configurations in the cells?

The tubulin code is an emerging mechanism that is expected to control microtubule functions by altering their biophysical and biochemical properties. The components of the tubulin code are different tubulin genes that allow the expression of different tubulin isoforms, and posttranslational modifications of tubulin.

Our team applies interdisciplinary approaches to understand how changes at the molecular level translate into cellular and organism-level functions of microtubules. We have demonstrated that tubulin posttranslational modifications are essential for the functions of nerve cells, cilia and flagella, and for cell division. Defects in tubulin modifications lead to neurodegeneration and ciliary dysfunctions.

To understand the molecular processes underlying the tubulin code, **we have now developed *in vitro* reconstitution approaches based on TIRF microscopy to directly measure how different tubulin isoforms and modifications contribute to the microtubule mechanics and dynamics.**



The successful candidate will use these established assays to determine the role of tubulin isoforms and posttranslational modifications on microtubule dynamics. This project is embedded in the work of our team, and the student will receive close guidance from experienced postdocs and PhD students. We want to understand how a highly critical characteristic of microtubules, their dynamic instability and cold-sensitivity, is controlled by their composition and posttranslational modification.

Background of the candidate:

The successful candidate will have a background in either biophysics, biochemistry or cell biology, preferably with some knowledge in cytoskeleton. Ideally, the successful candidate will apply for a PhD studentship at two PhD programs and continue the project into a PhD.

How to apply?

Please send a motivation letter, CV, copies of transcripts (which lectures followed, grades and ranking, level of English), and if possible reference letters to Carsten.Janke@curie.fr.

Relevant literature:

Souphron J, Bodakuntla S, Jijumon AS, Lakisic G, Gautreau AM, Janke C, Magiera MM (2019) Purification of tubulin with controlled post-translational modifications by polymerization–depolymerization cycles. *Nat Protoc* **14**: 1634–1660

Bodakuntla S, Jijumon AS, Villablanca C, Gonzalez-Billault C, Janke C (2019) Microtubule-Associated Proteins: Structuring the Cytoskeleton. *Trends Cell Biol* **29**: 804-819

Shashi V, Magiera MM, Klein D, ...Martini R, Janke C, Senderek J (2018) Loss of tubulin deglutamylase CCP1 causes infantile-onset neurodegeneration. *EMBO J* **37**: e100540

Magiera MM, Singh P, Janke C (2018) SnapShot: Functions of Tubulin Posttranslational Modifications. *Cell* **173**: 1552-1552 e1551

Magiera MM, Singh P, Gadadhar S, Janke C (2018) Tubulin Posttranslational Modifications and Emerging Links to Human Disease. *Cell* **173**: 1323-1327

Magiera MM, Bodakuntla S, Ziak J, Lacomme S, Marques Sousa P, Leboucher S, Hausrat TJ, Bosc C, Andrieux A, Kneussel M, Landry M, Calas A, Balastik M, Janke C (2018) Excessive tubulin polyglutamylation causes neurodegeneration and perturbs neuronal transport. *EMBO J* **37**: e100440

Belvindrah R, Natarajan K, Shabajee P, Bruel-Jungerman E, Bernard J, Goutierre M, Moutkine I, Jaglin XH, Savariradjane M, Irinopoulou T, Poncer J-C, Janke C, Francis F (2017) Mutation of the alpha-tubulin Tuba1a leads to straighter microtubules and perturbs neuronal migration. *J Cell Biol* **216**: 2443-2461

Chakraborti S, Natarajan K, Curiel J, Janke C, Liu J (2016) The emerging role of the tubulin code: From the tubulin molecule to neuronal function and disease. *Cytoskeleton (Hoboken)* **73**: 521-550

Barisic M, Silva e Sousa R, Tripathy SK, Magiera MM, Zaytsev AV, Pereira AL, Janke C, Grishchuk EL, Maiato H (2015) Microtubule deetyrosination guides chromosomes during mitosis. *Science* **348**: 799-803

Janke C, Bulinski JC (2011) Post-translational regulation of the microtubule cytoskeleton: mechanisms and functions. *Nat Rev Mol Cell Biol* **12**: 773-786

Rogowski K, van Dijk J, Magiera MM, Bosc C, Deloulme J-C, Bosson A, Peris L, Gold ND, Lacroix B, Bosch Grau M, Bec N, Larroque C, Desagher S, Holzer M, Andrieux A, Moutin M-J, Janke C (2010) A family of protein-deglutamylating enzymes associated with neurodegeneration. *Cell* **143**: 564-578