

CURRICULUM VITAE (2016)

EL-KIRAT-CHATEL Sofiane

Lab : *Birth date* : 02 September 1982

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I did my PhD in microbiology-immunology in Bordeaux (France) (2007-2010). During my thesis, I have used **molecular biology** tools to construct mutants of *Candida* yeast cells by random and directed mutagenesis. Then, I developed **fluorescent** methodologies (flow cytometry, microscopy and video-microscopy) to study the interaction of those **pathogenic** yeasts with immune cells (macrophages cell lines and neutrophils purified from human blood). Since 2011, I have been working in **nanobiophysics** in the Dufrene group (Belgium). I have used advanced **atomic force microscopy** (AFM) techniques, in combination with my skills in biology, to address microbial cell surfaces to molecular resolution. In particular, I have deciphered *Candida*-macrophage interactions on the nanoscale, and I have unravelled the mechanisms of bacterial adhesion at the single-molecule and single-cell level. I am now using these skills to elaborate bio-inspired antibiofilm surfaces.

Education

Ph.D. (Biology and Health Sciences), 2010, University of Bordeaux 2, France.

Cellular and molecular characterization of the interactions between yeast Candida species and macrophages or neutrophils.

Supervisor: Pr. Thierry Noël

M. Sc. (research in biology and health, microbiology-immunology), 2007, University of Bordeaux 2, France.

Origin, evolution and highlighting of a mitochondrial POLB gene in Agaricus bitorquis; Expression in Saccharomyces cerevisiae.

Supervisor: Dr. Gérard Barroso

M. Sc. (vocational in biology and health, microbiology-immunology, fungal biotechnologies), 2006, University of Bordeaux 2, France.

Construction of an interspecific hybrid of the two oenological yeast species Saccharomyces cerevisiae and Torulaspora delbrueckii.

Supervisor: Dr. Philippe Marullo

B. Sc. (biochemistry, cellular and molecular biology), 2005, University of Lyon 1, France.

Research

POSTDOCTORAL LEVEL

- **Postdoc researcher**, Nov. 2011- Sep. 2015, Catholic University of Louvain, Louvain la Neuve, Belgium.

Nanoscale analysis of host-pathogens interactions

Supervisor: Pr. Yves F. Dufrêne

- **Lecturer**, 2010-2011, Insitute of wine and vine, Bordeaux, France.

Development of tools for efficient transformation of the lactic acid bacteria Oenococcus oeni.

Supervisors: Dr. Philippe Lucas and Dr. Claire Le Henaff

DOCTORAL LEVEL

- **Ph.D. student**, 2007-2010, University of Bordeaux 2, France.

Qualitative and quantitative analysis of interactions between pathogenic yeast cells and immune phagocytes. Directed mutagenesis of yeast genes for virulence factors identification.

Supervisor: Pr. Thierry Noël

MASTERS LEVEL

- **Master student**, 2006-2007, University of Bordeaux 2, France.

Analysis of POLB gene encoding a mitochondrial DNA polymerase in Agaricus bitorquis.

Supervisor: Dr. Gérard Barroso

- **Master student**, 2005-2006, University of Bordeaux 2 and Laffort oenology, France.

Hybrids of Saccharomyces cerevisiae and Torulaspora delbrueckii for oenology improvment.

Supervisor: Dr. Philippe Marullo

UNDERGRADUATE LEVEL

- **Lab training**, 2004-2005, University of Lyon 1, France.

Cloning and expression of palH gene encoding a pH sensor in Botrytis cinerea .

Supervisor: Pr. Christophe Briel

Technical skills

Atomic Force Microscopy:

- Imaging in air and liquid
- Single molecule force measurement on live cells and model surfaces
- Single cell force measurement
- Correlative AFM and fluorescence microscopy
- Analysis and processing of AFM data (Nanoscope)

Fluorescent microscopy / flow cytometry:

- Analysis of interactions between yeast cells and phagocytes by flow cytometry and fluorimetry
- Analysis and processing of images obtained by ccd camera (Metamorph 3.5, Photoshop, Axiovision)
- Fluorescent video-microscopy

Molecular Biology:

- Extraction and manipulation of genomic and mitochondrial fungal DNA and bacterial plasmidic DNA. Directed and random mutagenesis. PCR, overlap PCR, inverted PCR. Southern-blot, hybridization on bacterial colony, clonage, Pulsed Field Gel Electrophoresis.

Microbiology:

- Construction and analysis of yeast mutants
- Fungal, yeast and bacterial culture
- Yeast and bacterial transformation
- Fermentation
- Protoplast fusion

Cellular culture:

- Macrophages and pneumocytes cell lines
- Neutrophils separation from whole blood
- Infection of phagocytes by yeasts and fluorescent staining

Biochemistry:

- Production of recombinant proteins in *S. cerevisiae*
- Protein extraction, western-blot and purification by affinity chromatography

Computer:

- Common practice of Word, Excel, Power-point, Origin and Photoshop softwares
- Common practice of sequences analysis, data bank servers and PHYLIP software

Language :

- French (native speaker)
 - English (read, spoken and written)
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Publications

ARTICLES IN PEER REVIEWED JOURNALS

- 1- Chan CXJ, **El-Kirat-Chatel S**, Joseph IG, Jackson DN, Ramsook CB, Dufrêne YF, Lipke PN. Force Sensitivity in *Saccharomyces cerevisiae* Flocculins. *mSphere*, 2016, 1(4):e00128-16.
- 2- Le Cigne A, Chieze L, Beaussart A, **El-Kirat-Chatel S**, Dufrêne YF, Dedieu S, Schneider C, Martiny L, Devy J, and Molinari M. Analysis of the effect of LRP-1 silencing on the invasive potential of cancer cells by nanomechanical probing and adhesion force measurements using atomic force microscopy. *Nanoscale*, 2016, 8:13, 7144-7154.
- 3- Beaussart A, Abellan-Flos M, **El-Kirat-Chatel S**, Vincent SP, and Dufrêne YF. Force nanoscopy as a versatile platform for quantifying the activity of antiadhesion compounds targeting bacterial pathogens. *Nano Letters*, 2016, 16:2, 1299-1307.
- 4- **El-Kirat-Chatel S**, and Dufrêne YF. Nanoscale adhesion forces between the fungal pathogen *Candida albicans* and macrophages. *Nanoscale Horizons*, 2016, accepted doi: 10.1039/c5nh00049a.
- 5- Beaussart A, **El-Kirat-Chatel S**, Fontaine T, Latgé JP, and Dufrêne YF. Nanoscale biophysical properties of the cell surface galactosaminogalactan from the fungal pathogen *Aspergillus fumigatus*. *Nanoscale*, 2015, accepted doi: 10.1039/c5nr04399a.
- 6- Herman P*, **El-Kirat-Chatel S***, Foster TJ, Geoghegan JA, and Dufrêne YF. *Staphylococcus aureus* fibronectin-binding protein A mediates cell-cell adhesion through low affinity hemophilic bonds. *mBio*, 2015, 6:3, e00413-15. * *contributed equally*.
- 7- **El-Kirat-Chatel S***, Beaussart A*, Derclaye S, Alsteens D, Kucharíková S, Van Dijck P, and Dufrêne YF. Force nanoscopy of hydrophobic interactions in the fungal pathogen *Candida glabrata*. *ACS Nano*, 2015, 24:9, 1648-1655. * *contributed equally*.
- 8- Heim KP, Sullan RM, Crowley PJ, **El-Kirat-Chatel S**, Beaussart A, Tang W, Besingi R, Dufrêne YF, and Brady LJ. Identification of a supramolecular functional architecture of *Streptococcus mutans* adhesin P1 on the bacterial cell surface. *Journal of Biological Chemistry*, 2015, Feb 9. pii: jbc.M114.626663.
- 9- Beaussart A and **El-Kirat-Chatel S**. Atomic force microscopy and spectroscopy: a versatile toolbox to decipher *Candida albicans* pathogenicity. *Journal of Bionanoscience*, 2014, 8, 419-427. *Review*.

- 10- **El-Kirat-Chatel S**, Beaussart A, Vincent SP, Flos MA, Hols P, Lipke PN, and Dufrêne YF. Forces in yeast flocculation. *Nanoscale*, 2015, 7, 1760-1767.
- 11- Beaussart A, Baker AE, Kuchma SL, **El-Kirat-Chatel S**, O'Toole GA, and Dufrêne YF. Nanoscale adhesion forces of *Pseudomonas aeruginosa* type IV pili. *ACS Nano*, 2014, 8:10, 17723-17733.
- 12- Gabriel F, Sabra A, **El-Kirat-Chatel S**, Pujol S, Fitton-Ouhabi V, Brêthes D, Dementhon K, Accoceberry I, Noël T. Deletion of the uracil permease gene confers cross-resistance to 5-fluorouracil and azoles in *Candida lusitaniae* and highlights antagonistic interaction between fluorinated nucleotides and fluconazole. *Antimicrobial Agents and Chemotherapy*, 2014, 58:8, 4476-4485.
- 13- Herman P*, **El-Kirat-Chatel S***, Beaussart A, Geoghegan JA, Foster TJ, and Dufrêne YF. The binding force of the staphylococcal adhesin SdrG is remarkably strong. *Molecular Microbiology*, 2014, 93:2, 356-368. * *contributed equally*.
- 14- Boyd CD, Smith TJ, **El-Kirat-Chatel S**, Newell PD, Dufrêne YF and O'Toole GA. Structural features of the *Pseudomonas fluorescens* biofilm adhesin LapA required for LapG-dependent cleavage, biofilm formation, and cell surface localization. *Journal of Bacteriology*, 2014, 196:15, 2775-2788.
- 15- Beaussart A, **El-Kirat-Chatel S**, Sullan RMA, Alsteens D, Herman P, Derclaye S and Dufrêne YF. Quantifying the forces guiding microbial cell adhesion using single-cell force spectroscopy. *Nature Protocols*, 2014, 9, 1049–1055. *Featured protocol*.
- 16- **El-Kirat-Chatel S**, Boyd CD, O'Toole GA and Dufrêne YF. Single-molecule analysis of *Pseudomonas fluorescens* footprints. *ACS Nano*, 2014, 8:2, 1690–1698.
- 17- Sullan RMA, Beaussart A, Tripathi P, Derclaye S, **El-Kirat-Chatel S**, Schneider YJ, Lebeer S, Vanderleyden J and Dufrêne YF. Single-cell force spectroscopy of pili-mediated adhesion. *Nanoscale*, 2013, 6:2, 1134-1143.
- 18- **El-Kirat-Chatel S**, Beaussart A, Boyd CD, O'Toole GA and Dufrêne YF. Single-cell and single-molecule analysis deciphers the localization, adhesion and mechanics of the biofilm adhesin LapA. *ACS Chemical Biology*, 2014, 9:2, 485-494.
- 19- Herman P, **El-Kirat-Chatel S**, Beaussart A, Geoghegan JA, Vanzielegem T, Foster TJ, Hols P, Mahillon J and Dufrêne YF. Forces driving the attachment of *Staphylococcus epidermidis* to fibrinogen-coated surfaces. *Langmuir*, 2013, 29, 13018-13022.
- 20- Beaussart A, Herman P, **El-Kirat-Chatel S**, Lipke PN, Kucharíková S, Van Dijck P and Dufrêne YF. Single-cell force spectroscopy of the medically important *Staphylococcus epidermidis*–*Candida albicans* interaction. *Nanoscale*, 2013, 5, 10894-10900. *Back cover*.
- 21- Alsteens D, Beaussart A, **El-Kirat-Chatel S**, Sullan RMA and Dufrêne YF. Atomic force microscopy: A new look at pathogens. *Plos Pathogens*, 2013, 9:9, e1003516. *Pearls Review*.
- 22- Alsteens D, Beaussart A, Derclaye S, **El-Kirat-Chatel S**, Park HR, Lipke PN and Dufrêne YF. Single-cell force spectroscopy of Als-mediated fungal adhesion. *Analytical Methods*, 2013, 5:15, 3657-3662. *Cover*.
- 23- Beaussart A, Rolain T, Duchêne MC, **El-Kirat-Chatel S**, Andre G, Hols P and Dufrêne YF. Binding mechanism of the peptidoglycan hydrolase acm2: low affinity, broad specificity. *Biophysical Journal*, 2013, 105:3, 620-629.
- 24- **El-Kirat-Chatel S**, Mil-Homens D, Beaussart A, Fialho AM and Dufrêne YF. Single-molecule atomic force microscopy unravels the binding mechanism of a *Burkholderia cenocepacia* trimeric autotransporter adhesin. *Molecular Microbiology*, 2013, 89:4, 649-659.

- 25- Beaussart A, **El-Kirat-Chatel S**, Herman P, Alsteens D, Mahillon J, Hols P and Dufrêne YF. Single-cell force spectroscopy of probiotic bacteria, *Biophysical Journal*, 2013, 104, 1886-1892. *Featured article*.
- 26- **El-Kirat-Chatel S**, Beaussart A, Alsteens D, Sarazin A, Jouault T and Dufrêne YF. Single-molecule analysis of the major glycopolymers of pathogenic and non-pathogenic yeast cells. *Nanoscale*, 2013, 5:11, 4855-4863.
- 27- **El-Kirat-Chatel S**, Beaussart A, Alsteens D, Jackson DN, Lipke PN and Dufrêne YF. Nanoscale analysis of caspofungin-induced cell surface remodelling in *Candida albicans*. *Nanoscale*, 2013, 5:3, 1105-1115.
- 28- **El-Kirat-Chatel S** and Dufrêne YF. Nanoscale imaging of the *Candida*-macrophage interaction using correlated fluorescence-atomic force microscopy. *ACS Nano*, 2012, 6:12, 10792-10799.
- 29- Beaussart A, Alsteens D, **El-Kirat-Chatel S**, Lipke PN, Kucharíková S, Van Dijck P and Dufrêne YF. Single-molecule imaging and functional analysis of Als adhesins and mannans during *Candida albicans* morphogenesis. *ACS Nano*, 2012, 6:12, 10950-10964.
- 30- Heinisch JJ, Lipke PN, Beaussart A, **El-Kirat-Chatel S**, Dupres V, Alsteens D and Dufrêne YF. Atomic force microscopy - Looking at mechanosensors on the cell surface. *Journal of Cell Science*, 2012, 125:18, 4189-4195. *Review*.
- 31- Dementhon K*, **El-Kirat-Chatel S*** and Noël T. Development of an *in vitro* model for the multi-parametric quantification of the cellular interactions between *Candida* yeasts and phagocytes. *Plos One*, 2012, 7:3, e32621. * *contributed equally*.
- 32- Dementhon K, **El-Kirat-Chatel S**, Gabriel F, Accoceberry I, and Noël T. Caractérisation moléculaire et cellulaire de l'interaction entre les levures *Candida* et les macrophages. *Journal of Medical Mycology*, 2012, 22 :1, 105-106.
- 33- Noël T, Pujol S, Fitton-Ouhabi V, **El-Kirat-Chatel S**, Gabriel F, Brethes D, Dementhon K and Accoceberry I. Characterisation of transporters of the nucleobase cation symporter family in *Candida lusitaniae* and of their possible role in fluoropyrimidines and fluconazole antagonism. *Mycoses*, 2011, 54, 174-175.
- 34- **El-Kirat-Chatel S**, Dementhon K and Noël T. A two-step PCR-based method for the disruption of specific genes in the opportunistic pathogenic yeast *Candida lusitaniae*. *Yeast*, 2011, 28:4, 321-330.
- 35- Ferandon C, **El-Kirat-Chatel S**, Castandet B, Castroviejo M and Barroso G. The *Agrocybe aegerita* mitochondrial genome contains two inverted repeats of the nad4 gene arisen by duplication on both sides of a linear plasmid integration site. *Fungal Genetic and Biology*, 2008, 45:3, 292-301.

Conferences

- NanoInBio, Guadeloupe, June 2016, Oral presentation.
- SPM on SPM, Toronto, Canada, Sept 2014, Oral presentation.
- Belgian Interdisciplinary Biofilm Research, UCL, Louvain la Neuve, Belgium, Dec 2014, Invited oral and poster.

- Belgian Interdisciplinary Biofilm Research, UCL, Louvain la Neuve, Belgium, Dec 2014, Poster.
 - Cellular and molecular nanomechanics by Atomic Force Microscopy, Inserm, Paris, France, May 2013, Invited speaker.
 - AFM biomed (International Meeting on AFM in Life Science and medicine), Shanghai, China, Apr 2013, Oral presentation.
 - Forum Sondes Locales, Spa, Belgium, Mar 2013, Oral presentation.
 - AFM Bruker Users Meeting, Louvain-la-neuve, Belgium, Nov 2012, Poster.
 - Annual Linz Winter Workshop, Linz, Austria, Feb 2012, Attendee.
 - LMO Yeast symposium, Strasbourg, France, Jun 2010, Oral presentation.
 - IFR66 Pathogens and Immunity Symposium, Bordeaux, France, Dec 2010, Oral presentation.
 - IFR66 Pathogens and Immunity Symposium, Bordeaux, France, Apr 2009, Oral presentation.
 - IFR66 Pathogens and Immunity Symposium, Bordeaux, France, Dec 2009, Poster.
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Grants and awards

- 2016: Young researcher **grant for Interdisciplinary Research**, Institute of Chemistry, CNRS.
 - 2016: Collaborator in 1 **ANR project** (French National Research Agency): Magenta.
 - 2016: Collaborator in 1 **Carnot Institutes project**: KillMAT.
 - 2015: **Irish research council** (IRC) grant for 2-year postdoc fellowship in the Bionano group (Prof. G. Lee), Univ. College of Dublin, Ireland (Award declined for the CNRS position).
 - 2015: **AMOLF** Institute grant (FOM) for 1-year postdoc fellowship in Nanobiophysics group (Prof. V. Subramaniam), Amsterdam, The Netherlands (Award declined for the CNRS position).
 - 2013: **Belgium Society of Microscopy** grant to attend the AFM-Biomed conference in Shanghai, China.
 - 2009: Best poster award, Immunity and Pathogenicity Symposium, Bordeaux, France.
 - 2007: **French ministry grant** for 3 years PhD (MNERT), doctoral school of Microbiology and Immunology, Bordeaux, France.
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Others

- Reviewer for Nanoscale, Plos One, Journal of Visualized Experiments (JoVE) and Journal of Bionanoscience, Journal of Ind. Crop Prod.
- Guest editor in Letters in applied nanobioscience.