



Curriculum
 Vitae



**Personal
 information**

First name / Family name	Antoine Fruleux		
Address(es)			
Telephone			
Mobile			
E-mail	fruleux@phare.normalesup.org		
Nationality	French		
Date of birth			
Gender	Male		

Personal statement and statement of intent	<p>I started my research career by doing an internship with Laurent Limat at the University Paris Diderot. Laurent Limat offered me to develop an experiment on a drop under non-coalescence moving inside a circular hydraulic jump, and, as I had interest for modeling, I performed also an effort on modeling of what we observed. In the continuity of what I did with Laurent Limat, I did a second internship with Tomas Bohr at the Technical University of Denmark. I studied the formation process of a linear hydraulic jump and the development of instabilities of the free surface of a rotating liquids. This has been the opportunity to develop more experimental skills and to discover another research environment.</p> <p>At the end of my masters, I took the decision to reorient my research toward statistical physics and I entered in contact with Ken Sekimoto at the Ecole Supérieure de Physique et de Chimie Industrielle (ESPCI) to work on a set of Brownian object called "Brownian Ratchet". The dynamics of those objects has been studied in different papers via stochastic descriptions but we felt unsatisfied with this approach, thinking it was missing the underlying mechanism for the motion of these objects. I have been able to show that Brownian Ratchets are similar to the so called <i>Adiabatic Piston</i>. Finally, I found, by general considerations on momentum and energy conservation, the physical mechanism at play in this class of system.</p> <p>I then started to study the collective behavior of cell aggregates motivated by some intriguing experimental results on the migration of the amoeba <i>Dictyostelium Discoideum</i>. We wanted to understand better the migration stage of this organism when the amoebas aggregate themselves and form a migrating slug. Our question where, how can cells inside the aggregate efficiently</p>
---	---



	<p>contribute to the collective motion. I understood the peculiar role of angular momentum transfers in those cell aggregates and I developed a formalism to take it into account. I rediscovered the Cosserat relation written in terms of microscopic quantities and I showed how angular momentum transfers could contribute to the sensing of the external medium by cells inside the aggregate and improve the locomotive action of those cells.</p> <p>I then started a post-doc with Rhoda Hawkins at The University of Sheffield on the physical role of the nucleus in cell motility. This work was motivated by recent experiments of cell migration in confinement showing the limitation of cell migration by the nucleus. I proposed a model of rigid body immersed in an active fluid. By this simple model, we are able to relate the cell shape and its velocity to the shape of the nucleus, and the boundary conditions with a view to understand how the cytoskeleton surrounding the nucleus is influenced by the properties of the nucleus and its coupling to the extracellular medium and the nucleus. In parallel to this work, I developed Molecular Dynamics models for a preliminary study on ATPases. It has been the opportunity to develop a collaboration with Sarah Harris, Martin Cann, Jim Reid and Rhoda Hawkins. I also started a collaboration with Simon Johnston and Rhoda Hawkins on the role of a polymer coat in phagocytosis. This work, was motivated by observations of Simon Johnston on the phagocytosis of Cryptococcus. I developed a model in which the phagocytosis kinetics of Cryptococcus is controlled by the polymer coat opening. Two articles are in preparation on the work I did during my postdoc. One, on the role of the nucleus in cell migration, is written but needs to be ameliorated. The other, on the phagocytosis of Cryptococcus is in preliminary state. None of those have been submitted.</p> <p>During my first postdoc, I considered to apply to different postdoc offers but I wasn't satisfied by those possibilities. I wanted to recover the independence I had during my PhD and to come back to the study of collective motions and multi-cellular organisms. I also wanted to work in a closer relationship with experimentalists. I asked the status of honorary member of The University of Sheffield to write articles on my postdoc subjects and to formalize, in collaboration with Ken Sekimoto, ideas I had on multi-cellular organisms with a view to write an article. In the same time, I contacted Arezki Boudaoud asking him if I could work in his team as I knew and appreciated his work and the way he works. He proposed me to apply to postdoc programs and he offered me six month of salary to start working on the control of plant heterogeneity by cell variability. In Arezki Boudaoud's team, I find a work environment perfectly adapted to what I needed: I am surrounded by experimentalists and as I can interact with theoreticians like Arezki. The Agreenskills program would allow me to develop my own research in the continuation of my scientific work.</p>
--	---

Education and training

Location and dates	Paris, sept2011-oct2014
Title of qualification awarded	PhD es Physics (With honours)



Principal subjects/occupational skills covered	-Statistical Physics / Momentum transfers in active multicellular media. -Conceptual analysis of 'Brownian Ratchets' -Analytical modelling of multicellular media -I took part to meetings, summer schools and National conferences
Name of Institute	Ecole Supérieure de Physique et de Chimie Industrielle (ESPCI)

Location and dates	Paris sept2010-sept2011
Title of qualification awarded	Master de Physique Théorique des Systèmes Complexes (With honours)
Principal subjects/occupational skills covered	Courses in Statistical Physics / Biophysics/ Soft mater/ Numerical simulations. 3 month Internship
Name of Institute	Paris Universities, Ecole Polytechnique, ENS Cachan



Work experience

Location and dates	Lyon 03/10/2016 -31/03/2017
Occupation or position held	Research Associate
Main activities and responsibilities	- Analytical modelling for Sepal growth.
Name of employer	Ecole Normale Supérieure de Lyon

Location and dates	Sheffield 01/06/2016 -30/09/2016
Occupation or position held	Honorary researcher
Main activities and responsibilities	Article and grant proposal writing.
Name of employer	The University of Sheffield

Location and dates	Sheffield 01/11/2014 -31/05/2016
Occupation or position held	Research Associate
Main activities and responsibilities	-Analytical modeling - Molecular Dynamics simulation of a protein. - I took part to collaborations, meetings and National / International conferences. - Article writing
Name of employer	The University of Sheffield

Location and dates	Lyngby (DK) 01/02/2010 -30/06/2010
Occupation or position held	Intern Student
Main activities and responsibilities	Data analysis and analytical modelling.
Name of employer	Danish Institute of Technology

Location and dates	Paris 01/06/2014 -30/07/2016
Occupation or position held	Intern Student
Main activities and responsibilities	Data analysis and analytical modelling.
Name of employer	Paris Diderot University

Languages

Mother tongue(s)	French				
Other language(s)	Understanding		Speaking		Writing
<i>European level (*)</i>	Listening	Reading	Spoken interaction	Spoken production	



English	C1	B2	C1	B2	B2
<i>Add more languages if relevant</i>					
<i>(*) Common European Framework of Reference for Languages</i> http://europass.cedefop.europa.eu/en/resources/european-language-levels-cefr					

Academic Record

Add as many lines as needed, delete fields which are not relevant to your profile

Publications <ul style="list-style-type: none"> <i>The list of your publications must be numbered in chronological order with the most recent first.</i> <i>Publication details must be according to standard systems of referencing e.g. Authors (x, y, z...), year, title, journal, issue n°/volume/page range.</i> <i>Please specify all contributing authors, highlighting your name in bold and respecting the authors' order.</i> <i>Provide any other essential details that will help us to fully assess your contribution to the publication.</i> 	Accepted, in press and published articles / papers: <ol style="list-style-type: none"> Fruleux, A., & Sekimoto, K. (2016). Mesoscopic formulas of linear and angular momentum fluxes. <i>Phys. Rev. E</i> 94, 013004. Fruleux, A., & Hawkins, R. J. (2016). Physical role for the nucleus in cell migration. <i>Journal of Physics: Condensed Matter</i>, 28(36), 363002. Sekimoto, K., Fruleux, A., Kawai, R., & Ridling, N. (2013). From adiabatic piston to non-equilibrium hydrodynamics. <i>Acta Physica Polonica B</i> 44, 847. Kawai, R., Fruleux, A., & Sekimoto, K. (2012). A hard disc analysis of momentum deficit due to dissipation. <i>Physica Scripta</i>, 86(5), 058508. Fruleux, A., Kawai, R., & Sekimoto, K. (2012). Momentum transfer in nonequilibrium steady states. <i>Physical review letters</i>, 108(16), 160601. Pirat, C., Lebon, L., Fruleux, A., Roche, J. S., & Limat, L. (2010). Gyroscopic instability of a drop trapped inside an inclined circular hydraulic jump. <i>Physical review letters</i>, 105(8), 084503.
	Submitted publications:
Presentations as invited speaker	<ol style="list-style-type: none"> SHAMROK Seminar Series : The Physics of Phagocytosis. The University of Sheffield. 27/05/2016. Physics and Biology of Active Systems Workshop. The University of Aberdeen. 23 and 24/06/2015. Theory group, Physico-Chimie Curie, Curie Institut, Paris, 14/11/2014. Max Plank Institut für Komplexer Systeme. Dresden. 04/09/2014.
Graduate teaching as lecturer or training coordinator	2011-2014 : Teaching assistant, Paris Descartes University (64 hours per year). Problem and practical classes.

Collaboration and Networking

Participation in collaborative projects funded by competitive programmes	<ol style="list-style-type: none"> 01/03/16-01/06/16: SHAMROK Program : Collaboration with Rhoda Hawkins and Simon Johnston (University of Sheffield). Study of the phagocytosis of Cryptococcus. (Pump-Priming project) 01/01/16-01/03/2016 : Collaboration Fund of The University of Sheffield : from Molecules to Systems. Collaboration with Sarah Harris (University of Leeds), Martin Cann (University of Durham), Rhoda Hawkins and Jim Reid (The University of Sheffield). Preliminary study of ATPases : How the ATP binding and hydrolysis provide energy to a protein ?
---	--

Scientific References *Add up to 3 references*

Full name	Ken Sekimoto
-----------	--------------



Position	Professor
Institution	Paris Diderot University (Paris 7)
Email address	Ken.sekimoto@espci.fr

Full name	Rhoda Hawkins
Position	Lecturer
Institution	The University of Sheffield
Email address	rhoda.hawkins@sheffield.ac.uk

Full name	Bohr Tomas
Position	Professor
Institution	Danish Institut of Technology (DTU)
Email address	Tomas.bohr@fysik.dtu.dk