Natacha Kremer

Office Address

Université Lyon 1
Laboratoire de Biométrie et Biologie Évolutive (LBBE)
16, rue Raphaël Dubois; Bat. G. Mendel, 1er étage
69622 Villeurbanne Cedex. FRANCE
Phone: (+33) 4 72 81 01

Current Position

Research scientist CNRS CR2 (starting October 2014)
Department of Biometry and Evolutionary Biology, University Lyon 1, France.

Education

2009 **Ph. D.** in Evolution and Molecular Biology
Laboratory of Biometry and Evolutionary Biology. University Lyon 1. France

2005 **Master's Degree** in Biology (Interdisciplinary Approaches of Life Science)
École Normale Supérieure. Paris. France

2003 **Bachelor's Degree** in Biology
École Normale Supérieure. Paris. France

2002 Admission to **École Normale Supérieure**. Paris. France

1999 Baccalauréat (equivalent to a **A-levels** in Mathematics, Physics and Biology). France

Research Experience

2013-2014

Research associate - Department of Biometry and Evolutionary Biology, University Lyon 1, France.
Post-doctoral project: "Symbiox: Role of the oxidative environment in the stability of symbiotic associations"
Research advisor: Dr. Fabrice Vavre

2010-2013

Research associate - Department of Medical Microbiology and Immunology, UW-Madison, WI (USA)
Post-doctoral project: "Establishment and maintenance of the squid/vibrio symbiosis"
Research advisor: Pr. Margaret McFall-Ngai

One-month stay with:
- *Dr. Stéphane Hourdez,* **Laboratory of Adaptation & Diversity in Marine Environment, Roscoff (France).**
- *Pr. Philippe Rosenstiel,* **Institute of Molecular and Clinical Biology, Christian-Abrechts University, Kiel (Germany)**.

2006-2009

PhD student - Laboratory of Biometry and Evolutionary Biology. University Lyon 1 (France)
"Evolutionary genetic of host-parasite interactions" Group
PhD project: "Evolution of dependence in *Wolbachia* symbioses: Study of the genus *Asobara* (Hymenoptera: Braconidae)"
Research advisor: Dr. Fabrice Vavre

April-June 2005

Master's student - Laboratory of Biometry and Evolutionary Biology. University Lyon 1 (France)
"Evolutionary genetic of host-parasite interactions" Group.
Project: "Genotype-by-Genotype-by-Environment interactions: effect of temperature on co-evolution between host and symbiont".
Research advisor: Dr. Fabrice Vavre

January-March 2005

Master's student - Laboratory of Ecology, ENS, Paris (France)
Project: "Modelling local adaptation of bacteria and bacteriophages".
Research advisor: Dr. Minus van Baalen

September-December 2004

Master's student - Laboratory of Evolutive and Medical Molecular Genetics, Paris (France)
Project: "Senescence in the model *Caenorhabditis elegans / Escherichia coli*".
Research advisor: Dr. François Taddei

February-June 2004

Undergraduate research assistant - Evolutionary Biology Centre, Uppsala (Sweden).
Project: "Sexual conflict, senescence and evolution of female resistance in the bean weevil *A. obtectus*".
Research advisors: Dr. Alexei Maklakov and Pr. Göran Arnqvist

July-August 2003

Undergraduate research assistant - Institute of Ecology, Lausanne (Switzerland).
Project: "Nestmate recognition and genetic distance in the super-colonial ant *Formica paralugubris*".
Research advisors: Dr. Barbara Holzer, Dr. Michel Chapuisat and Pr. Laurent Keller

Research Skills

Conceptual framework

Ecology
Evolution (coevolution, molecular evolution)
Genetics (Mendelian genetics, non-Mendelian genetics, population genetics)
Immunology - parasitology
Molecular Biology

Laboratory skills

Ecology: insect (ants, beetles, wasps, flies) and squid rearing, behavioural ecology, life-history traits measurements.

Molecular biology: Gene characterization (DNA extraction, Molecular cloning, PCR, Real-time PCR, RACE), Gene expression study (RNA extraction, Reverse transcription, Real-time RT-PCR, *in situ* hybridization), Comparative Transcriptomics (cDNA library construction, SSH (Suppression Subtractive Hybridization), differential screening, RNAseq (Illumina, 454)), Genotyping of natural populations (microsatellites)

Biochemistry: Protein extraction, HPLC purification, SDS-PAGE, western blot, oxyblot®, iron measurements, oxygen affinity measurements

Microbiology: bacterial culture, genetic transformation of *Escherichia coli*, micro-injection of bacteria, antimicrobial test assays (MIC).

Epifluorescence and confocal **microscopy**: Live imaging, TUNEL staining, LacZ staining, Immunostaining.

Experience in **bio-informatics** (Primer design, Sequence analysis, phylogenetic reconstruction, RNASeq sequencing data analysis,), **statistics** (R software) and **modelling** (Berkeley Madonna), HTML programing.

Scientific expertise

Writing of scientific papers, oral and poster presentation of scientific results
Writing of grants and project reports
Review editor for *Frontiers in Microbiology – Frontiers in microbial symbioses*

Review of scientific papers (*Antioxidant Redox Signalling, BMC microbiology, Comparative Biochemistry and Physiology, Journal of the Entomological Research Society, Heredity, mBio, Molecular ecology, Nucleic Acid Research, PLoS One).*

Other Skills

Languages French: mother tongue
English: fluent
German: basic knowledge

Teaching **Teaching position** at Lyon 1 University (2006-2009, 64 h/year)
Level: Bachelors in Biology
Topics: Mendelian and non-Mendelian genetics, population genetics. Practical courses in Genetics.

Mentoring of Justine Bisson (Bachelor's student), Ami Yamamoto and Lawrence Zhou (Undergraduate students)

Grants and Fellowships

July 2011- June 2014
Outgoing Marie Curie Fellowship FP7-PEOPLE-2010-IOF / 272684 / SymbiOx
"Role of the oxidative environment in the stability of symbiotic associations"
Outgoing phase: MMI, Madison, WI, USA (Pr. McFall-Ngai) – Return phase: LBBE, Lyon, France (Dr. Vavre)

June 2008
US-NSF for support to participate at the 5th international *Wolbachia* conference

September 2006 - August 2009
French ministry of education and research. PhD grant

September 2002 - August 2006
French ministry of education and research. Grant for study in Ecole Normale Supérieure (civil-servant trainee)

Publications

Original articles published in international peer-reviewed journal

16- Schwartzman J., Koch E., Heath-Heckman E.A.C., Zhou L., Kremer N., McFall-Ngai M.J., Ruby, E.G. (2015). The chemistry of negotiation: rhythmic, glycan-driven acidification in a symbiotic conversation. ***PNAS***. 112 :566-571.
+ Highlight 'Nature Review Microbiology' (http://dx.doi.org/10.1038/nrmicro3424)

15- Kremer N., Schwartzman J., Augustin R., Zhou L., Ruby E.G., Hourdez S., McFall-Ngai M.J. (2014) The dual nature of hemocyanin in the establishment and persistence of the squid-vibrio symbiosis. ***Proceedings of the Royal Society series B,*** 281:20140504.

14- Brennan C.A., Hunt J.R., Kremer N., Krasity, B.C., Apicella M.A., McFall-Ngai M.J., Ruby E.G. (2014) A model symbiosis reveals a role for sheathed-flagellum rotation in the release of immunogenic lipopolysaccharide. ***eLife,*** 3:e01579.

13- Altura M.A., Heath-Heckman E., Gillette A., Kremer N., Krachler A.-M., Brennan C., Ruby E.G., Orth K., McFall-Ngai M.J., 2013. First contact: Attachment of few *V. fischeri* cells during symbiosis onset demonstrates exquisite sensitivity of initial partner interactions. ***Environmental Microbiology,*** 15(11):2937-50.

12- Kremer N., Philipp E., Carpentier M.C., Brennan C.A., Kraemer L., Altura M.A., Augustin R., Haesler R., Heath-Heckman E.A.C., Peyer S.M., Schwartzman J., Rader B., Ruby E.G., Rosenstiel P., McFall-Ngai M.J. (2013) Initial symbiont contact orchestrates host-organ-wide transcriptional changes that prime tissue colonization. ***Cell Host & Microbe,*** 14:183-194.

+ Preview (J. Wernegreen, http://dx.doi.org/10.1016/j.chom.2013.07.015*)*
+ Highlight 'Nature Review Microbiology' (http://dx.doi.org/10.1038/nrmicro3114)

11- McFall-Ngai M.J., Hadfield M.G., Bosch T.C.G., Carey H.V., Domazet-Loso T., Douglas A.E., Dubilier N., Eberl G., Fukami T., Gilbert S.F., Hentschel U., King N., Kjelleberg S., Knoll A.H., Kremer N., Mazmanian S.K., Metcalf J.L., Nealson K.H., Pierce N.E., Rawls J.F., Reid A.H., Ruby E.G., Rumpho M.E., Sanders J.G., Tautz D., Wernegreen J.J., 2013. Animals in a Bacterial World: A New Imperative for the Life Sciences. ***PNAS,*** 110(9): 3229-36.

10- Rader B., Kremer N., Apicella M.A., Goldman W.E., McFall-Ngai M.J., 2012. Modulation of symbiont lipid A signaling by host alkaline phosphatases in the squid-vibrio symbiosis. ***mBio,*** 3(3):e00093-12.

9- Kremer N., Charif D., Henri H., Gavory F., Wincker P., Mavingui P., Vavre F.,2012. Influence of *Wolbachia* on host gene expression in an obligatory symbiosis. ***BMC Microbiology,*** 12(Suppl 1): S7.

8- Kraaijeveld K., Reumer B., Mouton L., Kremer N., Vavre F., van Alphen J. 2011. Vestigial CI induction by a parthenogenesis - inducing *Wolbachia*. ***Naturwissenschaften***, 98(3): 175-180.

7- Kremer N., Dedeine F., Charif D., Finet C., Allemand R., Vavre F., 2010. Do variable compensatory mechanisms explain the polymorphism of the dependence phenotype in the *Asobara tabida - Wolbachia* association? ***Evolution***, 64(10): 2969–2979.

6- Kremer N., Voronin D., Charif D., Mavingui P., Mollereau B., Vavre F., 2009. *Wolbachia* interferes with iron metabolism and iron homeostais in insects. ***PloS Pathogens,*** 5(10): e1000630. doi:10.1371/journal.ppat. 1000630.

5- Kremer N., Charif D., Henri H., Bataille M., Prévost G., Vavre F., 2009. A new case of *Wolbachia* dependence in the genus *Asobara*: Evidence for parthenogenesis induction in *A. japonica*. ***Heredity,*** 103(3): 248-256.
+ News & commentary (A. Hoffmann, http://dx.doi.org/10.1038/hdy.2009.50)

4- Maklakov A. A., Kremer N., Arnqvist G., 2007. The effect of age at mating on female life-history traits in a seed beetle. ***Behavioral Ecology***, 18(3):551-555.

3- Holzer B., Chapuisat M., Kremer N., Finet C., Keller L., 2006. Unicoloniality, recognition and genetic differenciation in a native *Formica* ant. ***Journal of Evolutionary Biology,*** 19:2031-2039.

2- Maklakov A. A., Kremer N., Arnqvist G., 2006. Ageing and the evolution of female resistance to remating in seed beetles. ***Biology letters***, 2:62-64.

1- Maklakov A. A., Kremer N., Arnqvist G., 2005. Adaptive male effects on female ageing in bean weevils. ***Proceedings of the Royal Society series B,*** 272(1580): 2485-2489.

Review articles

4- Vavre F., Kremer N. (2014) Microbial impacts on insect evolutionary diversification: From patterns to mechanisms. ***Current Opinion in Insect Science***, 4:29-34.

3- Moné Y.*, Monnin D.*, Kremer N. (2014) The oxidative environment: a mediator of inter-species communication that drives symbiosis evolution. **Proceedings of the Royal Society series B,** 281:20133112.

2- Kremer N. & M.E. Huigens. 2011. Perspective: Vertical and horizontal transmission drive bacterial invasion***.*** ***Molecular Ecology,*** 20(17):3496-3498.

1- Vavre F., Kremer N., Pannebakker B., Loppin B., Mavingui P. 2008. Is symbiosis evolution influenced by the pleiotropic role of Programmed Cell Death in immunity and development? In ***Insect symbiosis,*** volume 3. (Eds K. Bourtzis & T.A. Miller), CRC Press, Boca Raton. pp. 57-77.

Congress report

1- Vavre F., Kremer N., Pannebakker B. Role of apoptosis in *Wolbachia*-controlled oogenesis, 2007. ***Entomological Research,*** 37 (Suppl. 1: International Congress of Insect Biotechnology & Industry) A41-A42.

Scientific Communications

Invited seminars

Establishment and maintenance of the squid-vibrio association. 2010. Invited by Pr. Thomas Bosch. University of Kiel (Germany).

Establishment and maintenance of the squid-vibrio association. 2010. Invited by Dr. Franck Melzner. IFM Geomar, Kiel (Germany).

Evolution of dependence in *Wolbachia* symbioses: study of the genus *Asobara*. 2010. Microbes in Health and Disease Seminar**.** Madison, WI (USA).

Oral presentations in scientific meetings

Réseau Ecologie des Interactions Durables (REID). Montpellier (France). 2014. *Fiat Lux*: Establishment of the specificity between squid and bioluminescent bacteria.

2nd **Congress of environmental genomics**. Rennes (France). 2013. *Fiat Lux*: First molecular conversation between squid and bioluminescent bacteria.

ESF-EMBO symposium "Integrated Insect Immunology: From Basic Biology To Environmental Applications", Pultusk (Poland). 2013. First contact in the squid-vibrio symbiosis: a physical and molecular point of view.

25th **Pow-wow** (squid/vibrio meeting). Madison, WI (USA). 2013. Stress & Symbiosis: Modulation of the oxidative environment in response to symbiosis.

7th **International Symbiosis Society** (ISS) congress, Krakow (Poland). 2012. Initial 'conversation' between the bobtail squid and its specific partner during the establishment of the symbiosis.

111th General meeting of the **American Society for Microbiology** (ASM), New Orleans, LA (USA). 2011. Deciphering the first "words" during the establishment of symbiosis between the squid *Euprymna scolopes* and its partner *Vibrio fischeri*.

Gordon Conference '**Bacterial adhesion and signal transduction'**. Newport, RI (USA). 2011. Maximizing signal-to-noise: Molecular events underlying host recognition of the specific partner during initiation of the squid-vibrio symbiosis.

23rd Pow-wow (squid/vibrio meeting). Madison, WI (USA). 2011. Deciphering the first 'words' during the establishment of symbiosis.

22nd Pow-wow (squid/vibrio meeting). Loyola University, IL (USA). 2010. Does the oxidative environment play a role in maintaining the symbiosis?

Immuninv. Poitiers (France). 2009. Influence of *Wolbachia* on iron metabolism in insects.

Réseau Ecologie des Interactions Durables (REID). Amiens (France). 2009. Evolutionary transition in a eukaryote-prokaryote association: Pleiotropic role of apoptosis in immunity and development.

5th international *Wolbachia* conference, Kolimbary (Crete, Greece). 2008. Evolutionary transition towards dependence in the *Asobara tabida* / *Wolbachia* association: the role of apoptosis.

Immuninv. Montpellier (France). 2008. Evolutionary transition in a eukaryote-prokaryote association: Pleiotropic role of apoptosis in immunity and development.

7th International meeting "Cell death in development and aging", Paris (France). 2007. Apoptosis, evasion of immune system, host development and evolutionary transition in a eukaryote-prokaryote association.

Immuninv. Amiens (France). 2006. Molecular mechanisms of *Wolbachia* dependence for oogenesis in *Asobara tabida.*

28th edition of "**Petit Pois Déridé**". Lille (France). 2006. Molecular mechanisms of oogenesis dependence in *Asobara tabida / Wolbachia* model system.

34th "**journées des entomophagistes**". Lyon (France). 2006. Diversity of *Wolbachia* effects in the genus *Asobara*.

Poster presentations in scientific meetings

Conference Jacques Monod **"Infectious diseases as drivers of evolution: the challenge ahead",** Roscoff (France). 2014. 'Dialogues' between squid and luminous bacteria during the establishment of the symbiosis and the building of the extended phenotype.

12th congress of the **European Society of Evolutionary Biology** (ESEB), Turin (Italy). 2009. Evolution of dependence upon *Wolbachia* symbiosis in two parasitoid wasps.

International workshop "Immunity and Symbiosis". Aussois (France). 2009. Evasion of immune system, host development and evolutionary transition in a eukaryote-prokaryote association.

11th congress of the **European Society of Evolutionary Biology** (ESEB), Uppsala (Sweden). 2007. Evasion of immune system, host development and evolutionary transition in a eukaryote-prokaryote association.

Outreach

Darwin day 2013 "The Mating Game - Reproductive Evolution in the Natural World", Wisconsin Institute of Discovery, Madison, WI.

2nd French-American Science Festival (2012) "Sharing Experiences, for a New Insight on Sustainable Development", Chicago, IL.

Darwin day 2012 "Unnatural history: What bizarre biology can teach us about evolution", Wisconsin Institute of Discovery, Madison, WI.

Darwin day 2011 "Know thyself: Humans & Evolution", Wisconsin Institute of Discovery, Madison, WI.

Fondation **"La Main à la Pâte"**, for science education (2004). Topic: "Plant growth" with 8-years old kids (CE_2)