

**Vincent Calvez**

CNRS young researcher (CR1)

Project team Inria NUMED

Unité de Mathématiques Pures et Appliquées

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Born on August 20th, 1981, Saint-Malo, France

**EDUCATION**

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- (2015) Habilitation à Diriger des Recherches (HDR), Ecole Normale Supérieure de Lyon.  
*Quantitative analysis of structured population models in biology: Chemotaxis, Invasion fronts, Polymerisation, Cell polarization.*  
Ref: Laurent Desvillettes, Odo Diekmann, Emmanuel Trélat.
  - (2007) PhD in mathematics, University of Paris 6 and Ecole Normale Supérieure, Paris.  
*Mathematical models and analysis for the collective motion of cells*  
Supervisor: Benoît Perthame. Jury: J.A. Carrillo, J. Dolbeault (Ref.), Th. Goudon, E. Grenier (Ref.), B. Perthame, L. Saint-Raymond and C. Villani.
  - (2005) Agrégation de mathématiques with rank 6 (high-level national competitive examination for professorship).
  - (2004) Master degree in PDE and numerical analysis, University of Paris 6.
  - (2001-2005) Ecole Normale Supérieure, Paris. Interdisciplinary programme in mathematics and biology.

**CURRENT POSITIONS**

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- (since 2014) Partial affiliation to DMA, Ecole Normale Supérieure, Paris.
  - (since 2009) Member of the Inria project team NUMED (head: Emmanuel Grenier).
  - (since 2008) CNRS young researcher at UMPA, Ecole Normale Supérieure de Lyon (ENS de Lyon).

**PREVIOUS POSITIONS**

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- (2009) Long term visitor at the CRM, Barcelona, during the thematic Program on Mathematical Biology (6 months).
  - (2003) Internship at the Centre for Mathematical Biology, Oxford (6 months). Supervisor: Philip Maini.

**FELLOWSHIPS, PROJECTS AND AWARDS**

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- (2015-2020) PI of the ERC starting grant "Mesoscopic models for propagation in biology".
  - (2014) CNRS bronze medal in mathematics.
  - (2012-2014) PI of the ANR project "Mathematical models for cell polarization".
  - (2009) Bellman prize "Best paper in Mathematical Biosciences, 2008-2009".
  - (2008) EPDI post-doctoral fellowship (declined for the CNRS long term position).

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**SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS**


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- (2015-2016) Supervision of Thibault Bourgeron, post-doctoral fellow, *Maladaptation in age-structured populations*
- (since 2014) Co-supervision of Nils Caillerie's PhD thesis with Julien Vovelle, *Deterministic and stochastic kinetic models: front propagation, large deviations*.
- (2013-2014) Supervision of Laetitia Giraldi, post-doctoral fellow, *Coupling mechanics and growth: the yeast cell *S. pombe* as a case study*.
- (since 2013) Co-supervision of Alvaro Mateos González' PhD thesis with Hugues Berry, *Mathematical analysis and numerical simulations of anomalous diffusion*.
- (2011-2014) Supervision of Emeric Bouin's PhD thesis, *Mathematical analysis of propagation phenomena in kinetic equations arising in biology*.

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**ORGANISATION OF SCIENTIFIC MEETINGS**


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- (2013) Principal coordinator of the thematic trimester *Mathematical Biology*, ENS Lyon and University of Lyon 1, March-June 2013: 4 conferences, 1 workshop and 1 summer school, >400 participants, focus on interdisciplinary conferences with biologists and theoretical physicists (evolutionary biology, cell biology, drug development, systems biology). Funded by the Labex MILYON (head: Bertrand Rémy). Supported by the ANR, the CNRS, the SMAI, and the initiative Mathematics for Planet Earth 2013. Budget: 125 k€.
- (2009) Co-organization of the *CEMRACS 2009* (14th edition) with Paul Vigneaux, *Mathematical Modelling in Medicine*, July-August 2009, CIRM, Marseille: 6-week international summer school and training research center, 110 participants. Supported by the SMAI. Budget: 180 k€.

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**ACADEMIC RESPONSIBILITIES**


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- (since 2014) Associate editor of the Journal of Mathematical Biology, Springer.
- (since 2011) Coordinator of MathàLyon, a monthly two-days mathematical exhibition in public highschools.
- (since 2010) Participation in 10 hiring committees for assistant professor positions (*Maître de Conférences*).
- (since 2010) Jury member of 7 PhD committees: A. Trescases, ENS de Cachan (2015); J. Bouhours, Univ. Paris 6 (2014), N. Hoze, Univ. Paris 6 (2013); L. Giraldi, Ecole Polytechnique (2013); N. Muller, Univ. Paris 5 (2013); A. Roudneff-Chupin, Univ. Paris 11 (2011); M.A. Ebde, Univ. Paris 6 (2010);
- (since 2009) Organizer of the joint seminar in PDE and applications, University of Lyon 1 and ENS Lyon.

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**CONFERENCES**


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- Mini-courses at two CIMPA schools: La Habana, Cuba (2013) and Hammamet, Tunisia (2012);
- Invited talk at the CMO-BIRS (2015); KI-Net Conference, Imperial College London (2014); IFIP Conference, Austria (2013); ICERM, Providence (2011); ICMS, Edinburgh (2010-2011); ICIAM Conference, Vancouver (2011); Newton Institute, Cambridge (2010); SIAM Conference, Barcelona (2010); BIRS, Banff (twice in 2010); IHP Paris (2009); WPI, Vienna (2007).

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**PUBLICATIONS**


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- [1] Nicolas Muller, Matthieu Piel, Vincent Calvez, Raphael Voituriez, Joana Goncalves-Sa, Chin-Lin Guo, Xingyu Jiang, Andrew Murray, and Nicolas Meunier. A Predictive Model for Yeast Cell Polarization in Pheromone Gradients. *PLOS Comput Biol*, 12(4):e1004795, April 2016.

- [2] Vincent Calvez and Thomas Gallouet. Blow-up phenomena for gradient flows of discrete homogeneous functionals. *arXiv:1603.05380 [math]*, March 2016. arXiv: 1603.05380.
- [3] Vincent Calvez. Chemotactic waves of bacteria at the mesoscale. *arXiv:1607.00429 [cond-mat]*, July 2016. arXiv: 1607.00429.
- [4] Emeric Bouin, Vincent Calvez, Emmanuel Grenier, and Grégoire Nadin. Large deviations for velocity-jump processes and non-local Hamilton-Jacobi equations. *arXiv:1607.03676 [math]*, July 2016. arXiv: 1607.03676.
- [5] Vincent Calvez, Gaël Raoul, and Christian Schmeiser. Confinement by biased velocity jumps: Aggregation of *Escherichia coli*. *Kinetic and Related Models*, 8(4):651–666, July 2015.
- [6] Vincent Calvez and Laetitia Giraldi. Pattern selection in a biomechanical model for the growth of walled cells. *arXiv:1502.05638 [cond-mat]*, February 2015. arXiv: 1502.05638.
- [7] Emeric Bouin, Vincent Calvez, and Grégoire Nadin. Propagation in a Kinetic Reaction-Transport Equation: Travelling Waves And Accelerating Fronts. *Archive for Rational Mechanics and Analysis*, 217(2):571–617, August 2015.
- [8] Vincent Calvez and Thomas Gallouët. Particle approximation of the one dimensional Keller-Segel equation, stability and rigidity of the blow-up. *arXiv:1404.0139 [math]*, April 2014. arXiv: 1404.0139.
- [9] Vincent Calvez, Pierre Gabriel, and Stéphane Gaubert. Non-linear eigenvalue problems arising from growth maximization of positive linear dynamical systems. In *Decision and Control (CDC), 2014 IEEE 53rd Annual Conference on*, pages 1600–1607. IEEE, 2014.
- [10] Emeric Bouin and Vincent Calvez. Travelling waves for the cane toads equation with bounded traits. *Nonlinearity*, 27(9):2233–2253, September 2014.
- [11] R. H. Khonsari, J. Olivier, P. Vigneaux, S. Sanchez, P. Tafforeau, P. E. Ahlberg, F. Di Rocco, D. Bresch, P. Corre, A. Ohazama, P. T. Sharpe, and V. Calvez. A mathematical model for mechanotransduction at the early steps of suture formation. *Proceedings of the Royal Society of London B: Biological Sciences*, 280(1759):20122670, May 2013.
- [12] Vincent Calvez, Nicolas Meunier, Nicolas Muller, and Raphael Voituriez. Numerical simulation of the dynamics of molecular markers involved in cell polarization. In *Integral Methods in Science and Engineering*, pages 75–89. Springer, 2013.
- [13] Vincent Calvez and Lucilla Corrias. Blow-up dynamics of self-attracting diffusive particles driven by competing convexities. *Discrete and Continuous Dynamical Systems - Series B*, 18(8):2029–2050, July 2013.
- [14] Emeric Bouin, Vincent Calvez, and Grégoire Nadin. Hyperbolic traveling waves driven by growth. *Math. Models Methods Appl. Sci.*, 24(06):1165–1195, October 2013.
- [15] Benjamin Ribba, Gentian Kaloshi, Mathieu Peyre, Damien Ricard, Vincent Calvez, Michel Tod, Branka Čajavec-Bernard, Ahmed Idbaih, Dimitri Psimaras, Linda Dainese, Johan Pallud, Stéphanie Cartalat-Carel, Jean-Yves Delattre, Jérôme Honnorat, Emmanuel Grenier, and François Ducray. A Tumor Growth Inhibition Model for Low-Grade Glioma Treated with Chemotherapy or Radiotherapy. *Clin Cancer Res*, 18(18):5071–5080, September 2012.
- [16] Vincent Calvez and Pierre Gabriel. Optimal growth for linear processes with affine control. *arXiv:1203.5189 [math]*, March 2012.
- [17] Vincent Calvez, Marie Doumic, and Pierre Gabriel. Self-similarity in a general aggregation–fragmentation problem. Application to fitness analysis. *Journal de mathématiques pures et appliquées*, 98(1):1–27, 2012.

- [18] Vincent Calvez, Lucilla Corrias, and Mohamed Abderrahman Ebde. Blow-up, Concentration Phenomenon and Global Existence for the Keller–Segel Model in High Dimension. *Communications in Partial Differential Equations*, 37(4):561–584, 2012.
- [19] Vincent Calvez and José Carrillo. Refined asymptotics for the subcritical Keller–Segel system and related functional inequalities. *Proceedings of the American Mathematical Society*, 140(10):3515–3530, 2012.
- [20] V. Calvez, R. Hawkins, N. Meunier, and R. Voituriez. Analysis of a Nonlocal Model for Spontaneous Cell Polarization. *SIAM J. Appl. Math.*, 72(2):594–622, January 2012.
- [21] Nikolaos Bournaveas and Vincent Calvez. Kinetic models of chemotaxis. In *Evolution Equations of Hyperbolic and Schrödinger Type*, pages 41–52. Springer, 2012.
- [22] Emeric Bouin, Vincent Calvez, Nicolas Meunier, Sepideh Mirrahimi, Benoît Perthame, Gaël Raoul, and Raphaël Voituriez. Invasion fronts with variable motility: phenotype selection, spatial sorting and wave acceleration. *C. R. Math. Acad. Sci. Paris*, 350(15-16):761–766, 2012.
- [23] Emeric Bouin and Vincent Calvez. A kinetic eikonal equation. *C. R. Math. Acad. Sci. Paris*, 350(5-6):243–248, 2012.
- [24] O. Bénichou, V. Calvez, N. Meunier, and R. Voituriez. Front acceleration by dynamic selection in Fisher population waves. *Phys. Rev. E*, 86(4):041908, October 2012.
- [25] J. Saragosti, V. Calvez, N. Bournaveas, B. Perthame, A. Buguin, and P. Silberzan. Directional persistence of chemotactic bacteria in a traveling concentration wave. *PNAS*, 108(39):16235–16240, September 2011.
- [26] Jonathan Saragosti, Vincent Calvez, Nikolaos Bournaveas, Axel Buguin, Pascal Silberzan, and Benoît Perthame. Mathematical Description of Bacterial Traveling Pulses. *PLoS Comput. Biol.*, 6(8):e1000890, 2010.
- [27] Vincent Calvez, Jean Gabriel Houot, Nicolas Meunier, Annie Raoult, and Gabriela Rusnakova. Mathematical and numerical modeling of early atherosclerotic lesions. In *ESAIM: Proceedings*, volume 30, pages 1–14. EDP Sciences, 2010.
- [28] V. Calvez, N. Lenuzza, M. Doumic, J.-P. Deslys, F. Mouthon, and B. Perthame. Prion dynamics with size dependency–strain phenomena. *Journal of Biological Dynamics*, 4(1):28–42, January 2010.
- [29] Nikolaos Bournaveas and Vincent Calvez. A review of recent existence and blow-up results for kinetic models of chemotaxis. *Can. Appl. Math. Q.*, 18(3):253–265, 2010.
- [30] Nikolaos Bournaveas and Vincent Calvez. The one-dimensional Keller–Segel model with fractional diffusion of cells. *Nonlinearity*, 23(4):923–935, April 2010.
- [31] Vincent Calvez, Natacha Lenuzza, Dietmar Oelz, Jean-Philippe Deslys, Pascal Laurent, Franck Mouthon, and Benoît Perthame. Size distribution dependence of prion aggregates infectivity. *Mathematical biosciences*, 217(1):88–99, 2009.
- [32] Vincent Calvez, Abderrhaman Ebde, Nicolas Meunier, and Annie Raoult. Mathematical modelling of the atherosclerotic plaque formation. In *ESAIM: Proceedings*, volume 28, pages 1–12. EDP Sciences, 2009.
- [33] Nikolaos Bournaveas and Vincent Calvez. Critical mass phenomenon for a chemotaxis kinetic model with spherically symmetric initial data. *Annales de l’Institut Henri Poincaré (C) Non Linear Analysis*, 26(5):1871–1895, September 2009.
- [34] V. Calvez and R. H. Khonsari. Mathematical description of concentric demyelination in the human brain: Self-organization models, from Liesegang rings to chemotaxis. *Mathematical and Computer Modelling*, 47(7–8):726–742, 2008.

- [35] V. Calvez and L. Corrias. The parabolic-parabolic Keller-Segel model in  $\mathbb{R}^2$ . *Commun. Math. Sci.*, 6(2):417–447, June 2008.
- [36] Nikolaos Bournaveas, Vincent Calvez, Susana Gutiérrez, and Benoît Perthame. Global Existence for a Kinetic Model of Chemotaxis via Dispersion and Strichartz Estimates. *Communications in Partial Differential Equations*, 33(1):79–95, January 2008.
- [37] Nikolaos Bournaveas and Vincent Calvez. Global existence for the kinetic chemotaxis model without pointwise memory effects, and including internal variables. *Kinetic and Related Models*, 1(1):29–48, February 2008.
- [38] A. Blanchet, V. Calvez, and J. Carrillo. Convergence of the Mass-Transport Steepest Descent Scheme for the Subcritical Patlak–Keller–Segel Model. *SIAM J. Numer. Anal.*, 46(2):691–721, January 2008.
- [39] Roman H. Khonsari and Vincent Calvez. The Origins of Concentric Demyelination: Self-Organization in the Human Brain. *PLoS ONE*, 2(1):e150, January 2007.
- [40] Vincent Calvez, Benoît Perthame, and Mohsen Sharifi tabar. Modified Keller-Segel system and critical mass for the log interaction kernel. In *Stochastic analysis and partial differential equations*, volume 429 of *Contemp. Math.*, pages 45–62. Amer. Math. Soc., Providence, RI, 2007.
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- [42] V. Calvez and B. Perthame. A Lyapunov function for a two-chemical species version of the chemotaxis model. *Bit Numer Math*, 46(1):85–97, September 2006.
- [43] V. Calvez, A. Korobeinikov, and P. K. Maini. Cluster formation for multi-strain infections with cross-immunity. *Journal of Theoretical Biology*, 233(1):75–83, March 2005.