

Simon Labarthe

Junior Researcher INRAE, Biogeco/Pléiade - Cestas/Talence, (France)

Mathematical modeling applied to microbial ecology

Education

- U. Bordeaux** Bordeaux, FR
PhD in applied mathematics and scientific computing 2010-2013
– Title : mathematical modeling of the electrical activity of the atria and pulmonary veins.
– Phd supervisor : Yves Coudière et Jacques Henry .
- Agrégation de mathématiques** 2013
National competitive examination for Secondary and University teachers.
- UPMC (cohabilitation Univ. Paris Nord, ENPC, ENS, Ecole Polytechnique)** Paris, FR
Master of Applied Mathematics : Numerical analysis and PDEs 2008-2010
– Internship : reaction diffusion equation with Allee's effect: geometry influence.
– Phd supervisor : Jean-Michel Roquejoffre and Henry Berestycki.
- Concours de Recrutement de Professeur des écoles** 2004
Competitive examination for Primary teachers.

Experience

- Permanent researcher (CRCN)** Cestas/Talence, FR
INRAE (Biogeco) & Inria (Pléiade) & University of Bordeaux 2021 –...
- Permanent researcher (CRCN)** Jouy-en-Josas, FR
INRAE (MaIAGE) & University of Paris Saclay 2014 –2021
- Visiting scholar** Davis, US
UC Davis. Visiting scholar (10 months) at A.Bäumler's lab 2017 –2019
- Temporary research assistant (ATER)** Bordeaux, FR
U. Bordeaux & INP Bordeaux in applied mathematics 2013 –2014
- PhD student** Bordeaux, FR
U. Bordeaux & Inria BSO & IHU Liryc. 2010 –2013
– applied mathematics and scientific computing : study of heart arrhythmias
- Primary teacher** Paris, FR
Primary teachers in different regions of France 2004 –2010

📍 Biogeco/Pléiade, Pierroton, 33610 Jouy-en-Josas, France

✉ simon.labarthe@inrae.fr

🌐 Personal website



0000-0002-5463-7256



simon-labarthe

- [1] K. Cerk *et al.*, “Community-scale models of microbiomes: Articulating metabolic modelling and metagenome sequencing”, *Microbial Biotechnology*, vol. 17, no. 1, e14396, 2024.
- [2] M. Lecomte *et al.*, “Revealing the dynamics and mechanisms of bacterial interactions in cheese production with metabolic modelling”, *Metabolic Engineering*, S1096717624000302, 2024.
- [3] A. Paulay *et al.*, “Design of a proteolytic module for improved metabolic modeling of *Bacteroides caccae*”, *mSystems*, N. Chia, Ed., e00153–24, 2024.
- [4] L. Darrigade *et al.*, “Deterministic limit of a PDMP model of epithelial tissue interacting with diffusing chemicals and application to the intestinal crypt”, 2023.
- [5] C. Frioux *et al.*, “Accelerating metabolic models evaluation with statistical metamodells: Application to *Salmonella* infection models”, *ESAIM: Proceedings and Surveys*, vol. 73, V. Ehrlacher *et al.*, Eds., pp. 187–217, 2023.
- [6] C. Frioux *et al.*, *Modéliser les communautés bactériennes pour mieux comprendre leur fonctionnement*. 2023.
- [7] **S. Labarthe** *et al.*, “Four functional profiles for fibre and mucin metabolism in the human gut microbiome”, *Microbiome*, vol. 11, no. 1, p. 231, 2023.
- [8] D. Marra *et al.*, “Migration of surface-associated microbial communities in spaceflight habitats”, *Biofilm*, vol. 5, p. 100 109, 2023.
- [9] L. Darrigade *et al.*, “A PDMP model of the epithelial cell turn-over in the intestinal crypt including microbiota-derived regulations”, *Journal of Mathematical Biology*, vol. 84, no. 7, p. 60, 2022.
- [10] P. Fournier *et al.*, “The functional microbiome of grapevine throughout plant evolutionary history and lifetime”, in *Advances in Ecological Research*, vol. 67, Elsevier, 2022, pp. 27–99.
- [11] G. Ravel *et al.*, “Inferring characteristics of bacterial swimming in biofilm matrix from time-lapse confocal laser scanning microscopy”, *eLife*, vol. 11, e76513, 2022.
- [12] M. Bourgin *et al.*, “Exploring the Bacterial Impact on Cholesterol Cycle: A Numerical Study”, *Frontiers in Microbiology*, vol. 11, p. 1121, 2020.
- [13] **S. Labarthe** *et al.*, “A multi-scale epidemic model of salmonella infection with heterogeneous shedding”, *ESAIM: Proceedings and Surveys*, vol. 67, pp. 261–284, 2020.
- [14] **S. Labarthe** *et al.*, “A mathematical model to investigate the key drivers of the biogeography of the colon microbiota”, *Journal of theoretical biology*, vol. 462, pp. 552–581, 2019.
- [15] A. Bridier *et al.*, “Spatial Organization Plasticity as an Adaptive Driver of Surface Microbial Communities”, *Frontiers in Microbiology*, vol. 8, p. 1364, 2017.
- [16] C. Cherbuy *et al.*, “The contribution of intestinal gluconeogenesis to glucose homeostasis is low in 2-Day-Old pigs”, *The Journal of nutrition*, vol. 147, no. 3, pp. 361–366, 2017.
- [17] Y. Coudière *et al.*, “An Asymptotic Two-Layer Monodomain Model of Cardiac Electrophysiology in the Atria: Derivation and Convergence”, *SIAM Journal on Applied Mathematics*, vol. 77, no. 2, pp. 409–429, 2017.
- [18] T. El Bouti *et al.*, “A mixture model for the dynamic of the gut mucus layer”, *ESAIM: Proceedings and Surveys*, vol. 55, E. Frénod *et al.*, Eds., pp. 111–130, 2016.
- [19] Isaac Newton Institute Fellows *et al.*, “Challenges in microbial ecology: Building predictive understanding of community function and dynamics”, *The ISME Journal*, vol. 10, no. 11, pp. 2557–2568, 2016.
- [20] Y. Coudière *et al.*, “A two layers monodomain model of cardiac electrophysiology of the atria”, *Journal of Mathematical Biology*, 2015.
- [21] **S. Labarthe**, “Mathématiques et cardiologie : Modéliser pour mieux comprendre les arythmies auriculaires”, in *5 Jeunes Chercheurs d’avenir 2015*, ser. Promesses de La Science 1, Editions le Pommier, 2015, p. 192.
- [22] **S. Labarthe** *et al.*, “A bilayer model of human atria: Mathematical background, construction, and assessment”, *Europeace*, vol. 16, no. suppl 4, pp. iv21–iv29, 2014.
- [23] **S. Labarthe**, “Modélisation de l’activité électrique des oreillettes et des veines pulmonaires”, Ph.D. dissertation, Université Victor Segalen-Bordeaux II, 2013.
- [24] **S. Labarthe** *et al.*, “A Computational Bilayer Surface Model of Human Atria”, in *FIMH 2013 - 7th International Conference on Functional Imaging and Modeling of the Heart*, ser. Lecture Notes In Computer Sciences, London, United Kingdom: Springer, 2013.
- [25] **S. Labarthe** *et al.*, “Influence of transmural slow-conduction zones on the long-time behaviour of atrial arrhythmia: A numerical study with a human bilayer atrial model”, in *Computing in Cardiology 2013*, IEEE, 2013, pp. 1187–1190.
- [26] E. Vigmond *et al.*, “A bilayer representation of the human atria”, in *2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2013, pp. 1530–1533.
- [27] R. Dubois *et al.*, “Global and directional activation maps for cardiac mapping in electrophysiology”, in *2012 Computing in Cardiology*, IEEE, 2012, pp. 349–352.
- [28] **S. Labarthe** *et al.*, “A semi-automatic method to construct atrial fibre structures: A tool for atrial simulations”, in *2012 Computing in Cardiology*, IEEE, 2012, pp. 881–884.
- [29] N. Zemzemi *et al.*, “From body surface potential to activation maps on the atria: A machine learning technique”, in *Computing in Cardiology (CinC)*, 2012, 2012, pp. 125–128.

Awards

- Poster award, CANUM 2012
- Thesis award, “Thes’AQT Region Aquitaine” 2013
- Poster award, “Printemps de la Cardiologie” (national conference on cardiology) 2012
- Thesis award, “le Monde de la recherche universitaire” du journal “Le Monde” 2014

Grants & Projects

- MEM/INRA, MODCHOCYCLE. Amount : 50 K€. co-PI (with M.Rhimi). Bacterial impact on cholesterol cycle. 2016-2018
- Mathnum/INRAE, Bioswimmers, PI. 2021. Post-doc fellowship. Modeling microbial swimmers in biofilms. Amount: 60K€
- Agreenskills+ fellowship . (Marie-Sklodowska-Curie program). Amount: 30K€, PI. Mathematical modeling of Salmonella infection. 2017-2019
- Action Exploratoire Inria, SLIMMEST, co-PI (with C.Frioux). Surrogate modeling of metabolic models. 2021-2023. Amount: 200K€
- France-Berkeley Fund, Articulate. Amount : 12 K\$. co-PI (with A.Bäumler). articulation of mathematical and experimental models to study gut microbiota ecology 2019-2021
- ANR (PPR-PCA), Pherosensor. WP leader. Early detection of insect pests using pheromone olfactory sensors 2021-2026. Amount: 1,5M€
- ANR (PEPR Agroécologie numérique), Mystic. WP leader. Computational models of crop plant microbial biodiversity 2023-2028. Amount: 1,5M€
- ANR (PPR-PCA), VITAE, WP co-leader. Cultivating the grapevine without pesticides : towards agroecological wine- producing socio-ecosystems. 2021-2026. Amount: 3M€
- Digit-bio+MICA/INRAE, MODOSAO, co-PI. 2023-2026. PhD fellowship. Modeling bioprocesses integrating metabolic modeling. Amount: 110K€
- Digit-bio/INRAE, Artemis. PI. Digital twins of microbial communities 2024-2025. Amount: 20K€

Internship mentoring

Internships

- Tagathy Goswany, 2014, stage M2
population dynamic model of gut microbiota. With B.Laroche, M.Ribot, T.Goudon
- Cloé Mendoza, 2019, stage M1
Modeling the impact of diffusion in epidemic spreading
- CEMRACS 2015: 6 weeks internship with 4 PhD/post-doc
Modeling the fluid mechanics of the gut mucus layer. With B.Laroche, M.Ribot, T.Goudon
- Amandine Paulay, 2019, stage M2
Modeling protein metabolism in intestinal bacteria. With B.Laroche, G.Grimaud, M.Leclerc
- Leo Darrigade, 2016, stage M2
modeling the gut microbiota in its environment. With B.Laroche
- Maxime Lecomte, 2020, stage M2
Modeling lactic bacteria for cheese organoleptic qualities improvement. With C.Frioux
- Melanie Bourgin, 2016, stage M2
Whole-body model of cholesterol metabolism, including gut microbiota. With M.Rhimi
- CEMRACS 2021: 6 weeks internship with 2 PhD/post-doc
Surrogate modelling of metabolic models. With D.Sherman, C.Frioux
- Marie-Ange Rasendra, 2016, stage M1
Modeling diffusion in biofilms
- Arie Worstman, 2022, stage M2
Accelerating metabolic models with surrogate modelling. With C.Frioux, P.Ugalde
- Arthur Braune, 2017, stage M1
Modeling bacterial swimmers in biofilms
- Rafael Kaempfer Danin, 2023, stage M2
Surrogate modelling for a host-microbiota model. With C.Frioux, P.Ugalde
- CEMRACS 2018: 6 weeks internship with 3 PhD/post-doc

📍 Biogeco/Pléiade, Pierroton, 33610 Jouy-en-Josas, France

✉️ simon.labarthe@inrae.fr

🌐 Personal website

🆔 0000-0002-5463-7256

🏠 HAL [simon-labarthe](https://hal.inrae.fr/)

PhD supervision

- Leo Darrigade, 2017-2020, EDMH Paris Saclay, *Host-microbiota cross-talk near distal intestinal epithelium, with B.Laroche et C.Cherbuy*
- Amandine Paulay, 2019-2022, Abies UPS, CIFRE *Modeling protein degradation in the gut microbiota, with B.Laroche, M.Leclerc, E.Maguin, G.Grimaud*
- Sahak Yeghiazaryan, 2023-2026, U.Montpellier *Coupling genome-based models with a thermodynamic framework of microbial syntrophy in anaerobic digestion, with E.Le Quemener, N.Bernet*
- Sthlyve Tatho, 2024-2027, EDMI U.Bordeaux *Integration multi-omics time-series in dynamic models of microbial community, with V.Baldazzi*

Post-doc supervision

- Floriane Colas, 2019-2020, API-SMAL (U.Saclay BASC Labex project) *Multimodel analysis of the effects of semi-natural habitat increase in agricultural landscapes, with F.Accatino*
- Guillaume Ravel, 2021, MathNum fellowship *Modeling of bacterial swimmers to enhance diffusion in biofilms, with M.Bergmann, A.Iollo, A.Trubuil, R.Briandet*
- Pablo Ugalde Salas, 2021-2023, SLIMMEST *RKHS metamodeling for metabolic models fast approximation*
- Thibault Malou, 2022-2024, Pherosensor *Locating insect pests by solving an inverse problem for pheromon dispersion*

Teaching

- **U. Paris Saclay**, *master 2 MSV*, 2017 *system dynamics, PDEs, model reduction. TD (6h)*
- **U. Evry Val-d'Essonne**, *L2*, 2015-2017 *analysis, probability. TD (56h/an)*
- **U. Bordeaux**, *L1-L2*, 2014 *analysis. TD (96h)*
- **IPB, Bordeaux.**, *L2*, 2013 *Scientific computing in Fortran 90. TD (96h)*
- **IUT HSE, Bordeaux**, *L2*, 2012-2013 *Probability and statistics. TD (128h)*
- **Ecole primaire, MEN**, 2004-2010 *Primary teacher. Full time*

Responsibilities, Expertise & Collective duties

INRAE level

- Elected to CSS MISTI (Commission Scientifique Spécialisée: INRAE evaluation comity), 2020-2024. Nominated to the steering comity (Bureau).
- Steering comity of Metaprogram Holoflux (since 2022).
- Jury: CRCN competitive selection (2021, 2022, 2024). President of competitive selection: IR (2024).
- Representation of INRAE Bordeaux Center in R3IA Regional network (2022-).

Other institutes

- Jury: MCF, Univ. Côte d'Azur (2020).
- Scientific comity for GDR MathSav Conference (2022)

Reviews

- Journals: ISME, Plos ONE, mSystems, NPJ Biofilm, Journal of Theoretical Biology, Journal of Biological Systems, Computers in Biology and Medicine
- Expertise for grants: Max Plank Institute (2023), KFG (Austrian science funding agency, 2024), U.Paris Saclay (ABIES, doctoral grant, 2024), annual AMI of Holoflux metaprogram.

Other

- Biogeco Unit: "Groupe animation". Seminary organization comity.
- Member of Jobim 2025 organization comity.

📍 Biogeco/Pléiade, Pierroton, 33610 Jouy-en-Josas, France

✉️ simon.labarthe@inrae.fr

Posters

- Journées MathSav, 10/2022, Besançon, France
- JOBIM, 07/2022, Rennes, France
- ECMTB, 07/2018, Lisbon, Portugal
- Agreenskills meeting, 06/2018, Edimburgh.
- Workshop Liryc, 10/2013, Pessac.
- Computing in Cardiology, 09/2012, Krakow, Poland.
- Mayneord Phillips Summer School Cardiac Imaging & Modelling, 07/2012, Oxford, UK.
- National congress of numerical analysis (CANUM 2012), 05/2012, Super Besse.
- National congress of cardiology « Printemps de la Cardiologie » , 04/2012, Bordeaux.

Presentations

- Workshop Metabolisme, 03/2024, Toulouse, France, **invited**
- Ferment'IA, 09/2023, Saclay, France, **invited**
- Mini-Symposium Micalis, 06/2023, Jouy-en-Josas, France
- Séminaire EGFV, 02/2023, Bordeaux, France
- ModStatsAP, 12/2022, Paris, France, **invited**
- Journées Françaises de la Nutrition, 11/2022, Toulouse, France, **invited**
- IBSB, 09/2022, Jena, Germany (hybrid)
- Workshop Gut models, 11/2021, Besançon, France, **invited**
- Séminaire LABRI, 03/2022, Bordeaux, France
- Séminaire MIAT, 03/2021, Toulouse, France
- Workshop ENS, 10/2020, on-line
- Séminaire IMB (with C.Tiffany), 03/2020, Bordeaux, France
- Séminaire IMB, 02/2020, Bordeaux, France
- Séminaire MaIAGE, 01/2020, Jouy, France
- Séminaire M2 MathSV, Ecole Polytechnique, 09/2019, Palaiseau, France
- Séminaire Biogeco, 09/2019, Cestas, France
- Bäumlér's lab meeting, 03/2019, Davis, USA
- CEMRACS, 08/2018, Marseille France
- Workshop, Fields institute, 05/2018, Toronto, Canada.
- ECMTB, 07/2016, Nottingham, UK.
- CEMRACS, 08/2015, Marseille, France.
- Séminaire MaIAGE, 10/2014, Jouy, France.
- Franco-Romanian symposium of Applied Mathematics, 08/2014, Lyon, France.
- PhD defense, 12/2013, Talence, France.
- CINC 2013, 09/2013, Zaragoza, Espagne.
- EMBC 2013, 07/2013, Osaka, Japon.
- FIMH 2013, 06/2013, London, UK.
- symposium "AF: Clinical challenges for biophysical modelling". 06/2013, London .
- PlaFrim day. 04/2013 ,LABRI.
- Print. de la Cardiologie, 04/2013, Marseille.
- Séminaire Etudiant. LMAP. 02/2013. Pau.
- Journal Club IHU Liryc, 01/2013. Bordeaux.
- Summer School on Cardiac Imaging & Modelling. 07/2012, Oxford, UK.
- Print. de la Cardiologie, 04/2012, Bordeaux.
- Séminaire IHU Liryc, 04/2012, Bordeaux.
- Séminaire Etudiant, IMB, 01/2012, Bordeaux.