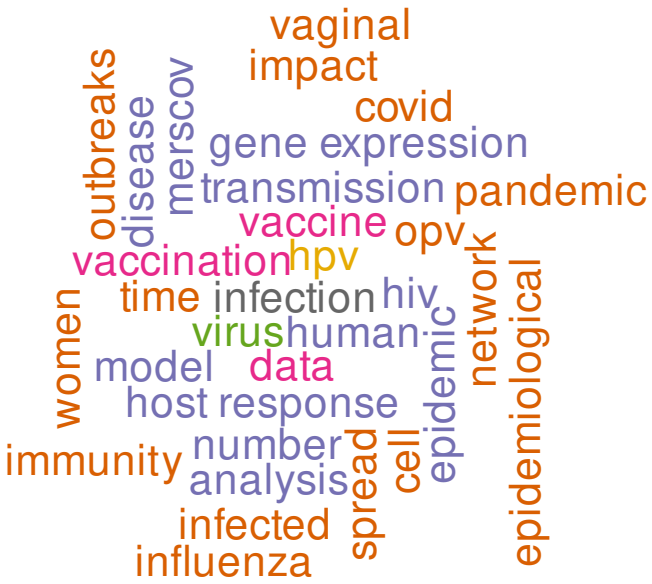
Christian Selinger, PhD

Disease modeling

A mathematician by trade, I have been working in disease modeling for the past 10 years.
I am interested in applying mathematical and statistical concepts to answer questions from the angle of public health:

- What is the role of host response to infection towards disease outcome?
- When does within-host heterogeneity matter for disease dynamics at the population level?
- How can we disentangle various sources of heterogeneity to evaluate intervention effectiveness?

I have been mainly working on pathogens and diseases affecting humans such as HIV, Influenza, Polio, HPV, Coronaviruses and Malaria.



E-mail: christian.selinger@gmail.com
Personal Web Page: christianselinger.github.io
Citizenship: Austria

Educational background

University of Luxembourg, Grand-Duchy of Luxembourg, 2006-2010

- Degree: Ph.D., Mathematics, November 2010
- Title: Geometry and Stochastic Calculus on Wasserstein spaces
- Advisor: Anton Thalmaier

University of Vienna, Austria, 2001-2006

- Degree: Mag. rer. nat., Mathematics, 2006
- Title: Gradient Flows on Spaces of Probability Measures
- Advisors: Walter Schachermayer, Josef Teichmann

Employment History

Swiss TPH, Basel, Switzerland
Senior Scientific Collaborator 2021 - present

IRD, Montpellier, France
Research Scientist (on leave) 2019 - present

CNRS, Montpellier, France
Postdoctoral Fellow 2017 - 2019

Institute for Disease Modeling, Bellevue, WA, USA
Research Scientist 2014 - 2017

Department of Microbiology, University of Washington, Seattle, WA, USA
Postdoctoral Fellow 2012 - 2014

Paris School of Neuroscience, Paris, France
Graduate Program Manager 2011 - 2012

Mathematics Research Unit, University of Luxembourg, Luxembourg
Research Assistant 2006 - 2010
Teaching assistant 2007 - 2009

Publications in peer-reviewed journals

Epidemiological modeling and Public Health

- Uysal IB et al.: **Concomitant and productive genital infections by HSV-2 and HPV in two young women: A case report** IDCases 2022.
- Tessandier N et al:: **Does exposure to different menstrual products affect the vaginal environment?** Molecular Ecology Oct 2022.
- Elie B, Selinger C, Alizon S: **The source of individual heterogeneity shapes infectious disease outbreaks.** Proc. R. Soc. B. 289: 2022023.
- Reyné B, Richard Q, Selinger C, Sofonea MT, Djidjou-Demasse R, Alizon S: **Non-Markovian modelling highlights the importance of age structure on Covid-19 epidemiological dynamics.** Math. Model. Nat. Phenom. 17 (2022) 7
- Alizon S, Selinger C, Sofonea MT, Haim-Boukobza S, Giannoli JM, Ninove L, Pillet S, Vincent T, de Rougement A, Tumiotto C, Solis M, Stephan R, Bressollette-Bodin C, Salmona M, L'Honneur S, Behillil S, Lefeuvre C, Dina J, Hantz S, Hartad C Veyer D, Delagreverie HM, Fourati S, Visseaux B, Henquell C, Lina B, Foulongne V, Burrel S: **Epidemiological and clinical insights from SARS-CoV-2 RT-PCR cycle amplification values.** Euro Surveill. 2022;27(6)
- Selinger C, Choisy M, Alizon S: **Predicting COVID-19 incidence in French hospitals using human contact network analytics.** International Journal of Infectious Diseases Volume 111, October 2021, Pages 100-107
- Reyné B, Selinger C, Sofonea MT, Miot S, Pisoni A, Tuaillon E, Bousquet JJ, Blain H, Alizon S: **Analysing different exposures identifies that wearing masks and establishing COVID-19 areas reduce secondary-attack risk in aged-care facilities** International Journal of Epidemiology 2021
- Sofonea MT, Reyné B, Elie B, Djidjou-Demasse R, Selinger C, Michalakis Y, Alizon S: **Memory is key in capturing COVID-19 epidemiological dynamics.** Epidemics Volume 35, June 2021, 100459
- Haim-Boukobza S, Roquebert B, Trombert-Paolantoni S, Lecorche E, Verdurme L, Foulongne V, Selinger C, Michalakis Y, Sofonea MT, Alizon S: **Rapid SARS-CoV-2 variants spread detected in France using specific RT-PCR testing** Emerging Infectious Diseases Volume 27, Number 5, May 2021
- Djidjou-Demasse R, Selinger C, Sofonea MT: **Épidémiologie mathématique et modélisation de la pandémie de Covid-19 : enjeux et diversité** Revue Francophone des Laboratoires 2020 (526) 63–69
- Guinat C, Tago D, Corre T, Selinger C, Djidjou-Demasse R, Paul M, Raboisson D, Thi Thanh TN , Inui K, Thanh Long P, Padungtod P, Vergne T: **Optimizing the early detection of low pathogenic avian influenza H7N9 virus in live bird markets** Journal of the Royal Society Interface 2021
- Murall CL, Reyné B, Selinger C, Bernat C, Boué V, Grasset S, Groc S, Rahmoun M, Bender N, Bonneau M, Foulongne V, Graf C, Picot E, Pict M-C, Tribout V, Waterboer T, Bravo IG, Reynes J, Segondy M, Boulle N, Alizon S: **HPV cervical infections and serological status in vaccinated and unvaccinated women** *Vaccine 2020*
- Murall CL, Rahmoun M, Selinger C, Baldellou M, Bernat C, Bonneau M, Boue V, Buisson M, Christophe G, D'Auria G, De Taroni F, Foulongne V, Froissart R, Graf C, Grasset S, Groc S, Hirtz C, Jaussent A, Lajoie J, Lorcy F, Picot F, Picot M-C, Ravel J, Reynes J, Rousset T, Seddiki A, Teirlinck M, Tribout V, Tuaillon E, Waterboer T, Jacobs N, Bravo I, Segondy M, Boulle N, Alizon S: **Natural history, dynamics, and ecology of human papillomaviruses in genital infections of young women: protocol of the PAPCLEAR cohort study** *BMJ Open, 2019;9:e025129.*
- Selinger C, Bershteyn A, Dimitrov D, Adamson BJ, Revill P, Hallett T, Phillips A, Bekker L, Rees H, Gray G: **Targeting and Vaccine Durability are Key for Population-level Impact and Economic Evaluation of the P5 HIV Vaccine in South Africa** *Vaccine 37 (16) 2258-2267, 2019*
- Selinger C, Dimitrov D, Eckhoff Ph, Bershteyn A: **The future of a partially effective HIV vaccine: assessing limitations at the population level** *International Journal of Public Health 64(6) 957–964*
- Famulare M, Selinger C, Chabot-Couture G, Eckhoff Ph, McCarthy KA, : **Assessing the stability of polio eradication after the withdrawal of oral polio vaccine.** *PLoS Biology 16(4): e2002468*

- Kirtane AR, Abouzid O, Minahan D, Bensel T, Hill AL, Selinger C, Bershteyn A, Mo SS, Craig M, Mazdiyasni H, Cleveland C, Rogner J, Lee YAL, Booth L, Javid F, Wu SJ, Grant T, Bellinger AM, Nikolic B, Hayward A, Wood L, Eckhoff PA, Nowak MA, Langer R, Traverso G: **Development of an oral once-weekly drug delivery system for HIV antiretroviral therapy.** *Nature Communications 9(1), 2018*

- Selinger C and Katze MG: **Mathematical Models of Viral Latency.** *Current Opinion in Virology 3 (2013), pp. 402–407.*

Computational Biology

- Tessandier N et al.: **Viral and immune dynamics of HPV genital infections in young women** medRxiv 2023: 2023.05.11.23289843v2

- Beneteau Th, Selinger C, Sofonea, MT, Alizon S: **Episome partitioning and symmetric cell divisions: quantifying the role of random events in the persistence of HPV infections.** PLoS Comput Biol 17(9): e1009352.

- Selinger C, Alizon S: **Reconstructing contact network structure and cross-immunity patterns from multiple infection histories.** PLoS Comput Biol 17(9): e1009375.

- Selinger C, Rahmoun M, Murall CL, Bernat C, Boué V, Bonneau M, Graf C, Grasset S, Groc S, Reynes J, Hirtz C, Jacobs N, Alizon S: **Cytokine response following perturbation of the cervicovaginal milieu during HPV genital infection.** Immunologic Research volume 69, pages 255–263 (2021)

- Tisoncik-Go J, Gasper DJ, Kyle JE, Eisfeld AJ, Selinger C, Hatta M, Morrison J, Korth MJ, Zink EM, Kim YM, Schepmoes A, Nicora CD, Purvine SO, Weitz KK, Peng X, Green RR, Tilton SC, Webb-Robertson BJ, Waters KM, Metz TO, Smith RD, Kawaoka Y, Suresh M, Josset L, Katze MG: **Integrated omics analysis of pathogenic host responses during pandemic H1N1 influenza virus infection: the crucial role of lipid metabolism.** Cell Host & Microbe 19(2) 2016, 254–266

- Forero A, Tisoncik-Go J, Watanabe T, Zhong G, Hatta M, Tchitchek N, Selinger C, Chang J, Barker K, Morrison J, Berndt JD, Moon RT, Josset L, Kawaoka Y, Katze MG: **The 1918 PB2 protein enhances virulence through the disruption of inflammatory and Wnt-mediated signaling in mice.** Journal of Virology 90(5) 2015, 2240–2253

- Selinger C, Tisoncik-Go J, Menachery VD, Agnihothram S, Law GL, Chang J, Kelly SM, Sova P, Baric RS and Katze MG: **Cytokine systems approach demonstrates differences in innate and pro-inflammatory host responses between genetically distinct MERS-CoV isolates.** BMC Genomics 15 2014, 1161.

- Selinger C, Strbo N, Gonzalez L, Aicher L, Weiss JM, Law GL, Palermo RE, Vaccari M, Franchini G, Podack ER, Katze MG: **Multiple Low-dose Challenges in a Rhesus Macaque AIDS Vaccine Trial Result in an Evolving Host Response that affects Protective Outcome.** Clinical and Vaccine Immunology 21(12) 2014, 1650–1660.

- Ghosh T, Aprea J, Nardelli J, Engel H, Selinger C, Mombereau C, Lemonnier T, Moutkine I, Schwendimann L, Dori M, Irinopoulou T, Henrion-Caude A, Benecke AG, Arnold SJ, Gressens P, Calegari F, Groszer M: **MicroRNAs establish robustness and adaptability of a critical gene network to regulate progenitor fate decisions during cortical neurogenesis.** Cell Reports 7(6) 2014, 1779–88.

Mathematics

- Selinger C: **Brenier's solution to the optimal transport problem in the Euclidean case, Polar factorization of vector-valued maps.** Oberwolfach Report No. 18/2009, 991–992.

- Selinger C: **Zeta Function regularized Laplacian on the smooth Wasserstein space above the unit circle.** Theory of Stochastic Processes 17 (2011), 109–118.

Poster presentations

- Goers R, Selinger C, Winkel M, Tittmann L, Champagne C, Pothin E: Country-specific individual-based malaria modeling, a standardized workflow in R. ASTMH 2022

- Selinger C, Alizon S: Multiple infection patterns as indicators of contact network properties and cross-immunity. Roscoff Ecology and Evolution 2019

- Nikolov M, Selvaraj P, Selinger C, Wenger E, Eckhoff P: Optimal release algorithms and propagation bounds for population replacement gene drives over spatial vector meta-population networks. EPIDEMICS 2017
- Selinger C, Famulare M, McCarthy K: Spatial patterns of vaccine reversion under declining immunity. Roscoff Ecology and Evolution 2017
- Selinger C, Kirtane A, Abouzid O, Langer R, Traverso C, Bershteyn A: Anticipated Adherence, Efficacy, and Impact of weekly oral Pre-Exposure Prophylaxis. CROI2017
- Selinger C, Bershteyn A, Dimitrov D, Hallett T, Bekker L-G, Rees H, Gray G: Population-level Impact and Cost-Effectiveness of an HIV Vaccine in South Africa. CROI2017
- Selinger C, Bershteyn A, Daniel Wood, Gilbert P, Dimitrov D: Population-level Impact of an ALVAC/AIDSVAX Vaccine Augmented with Additional Booster Through Targeted Campaigns in South Africa. R4P 2016 Chicago
- Selinger C, Bershteyn A, Oishi K, Eckhoff Ph: Intra-host Model of Transmitted Tenofovir Resistance after Breakthrough Infection with Topical HIV PrEP. R4P 2015 Cape Town
- Selinger C, Strbo N, Gonzalez L, Aicher L, Weiss JM, Law GL, Palermo RE, Vaccari M, Franchini G, Podack ER, Katze MG: Genomics analysis of a non-human primate model of a gp96-Ig AIDS vaccine. 31st Annual Symposium on Non-Human Primate Models for AIDS 2013 Atlanta

Technical Reports

- Analyse rétrospective 2012-2022 des activités de lutte contre le paludisme en Côte d'Ivoire, 2023 (forthcoming)

Service to the scientific community

Peer reviewer for: *Annals of Probability, Bulletin of Mathematical Biology, Pathogens and Disease, Journal of Applied Probability, Bioinformatics, PLoS Biology, PLoS Medicine, Epidemics, PLoS Computational Biology, Vaccine, Proccedings of the Royal Academy*
Evaluation board member: *Computational Life Sciences (CompLS) program of the German Federal Ministry of Education and Research (BMBF)*
Program coordinator: *MaModAfrica* PhD program at AIMS-Rwanda

Talks

- 2022/12/08: Reconstructing contact network structure and cross-immunity patterns from multiple infection histories (Ecole Polytechnique de Thiès, Senegal)
- 2022/11/05: Model-based evaluation of the potential epidemiological impact of introducing Seasonal Malaria Chemoprevention in Northern Côte d'Ivoire (ASTMH2022, Seattle, USA)
- 2021/06/29: Using Facebook colocation data for COVID-19: Time series forecasting for hospital incidence and optimal spatial control (Pasteur Institute, Paris)
- 2020/11/04: Activités de modélisation Covid19 et données de mobilité humaine dans le contexte de modèles épidémiologiques spatiaux (Labex Numev, Montpellier)
- 2019/07/17: Multiple infection patterns as indicators of contact network properties and cross-immunity (MMEE2019, Lyon)
- 2019/03/28: Modeling Multiple Infection on Networks (Séminaire Mivegec, Montpellier)
- 2018/09/27: Mathematical modeling of episomal replication (AFIPP2018, Obernai)
- 2018/06/26: Multiple Infections on Networks (ECMTB Lisbon 2018)
- 2017/12/05: Modeling Population-level Impact and Cost-effectiveness of a Pox-Protein vaccine in South Africa (CAVD meeting Gates Foundation, Seattle)

- 2017/03/06: Modeling Population-level Impact and Cost-effectiveness of the HVTN702 vaccine in South Africa: Targeting and Vaccine Durability (Fred Hutch VTN, Seattle)
- 2017/01/11: Targeting and Vaccine Durability are Key for Population-level Impact of the HVTN702 HIV Vaccine in South Africa (ICRC/UW seminar)
- 2016: Modeling population-level impact and cost-effectiveness of an ALVAC P5 HIV vaccine in South Africa (P5 HIV vaccine modeling stakeholder meeting 2016, Cape Town, South Africa)
- 2016: Projected effectiveness of mass HIV vaccination with multi-dose regimens to be tested in South Africa (Institute for Disease Modeling Symposium 2016, Bellevue, WA)
- 2016: Branching processes on graphs with application to disease eradication (2016, Worcester Polytechnic Institute, MA)
- 2012: Du transport optimal à la dynamique des populations (Université de Toulouse Paul Sabatier)
- 2010: Regularized Wasserstein Laplacian (IRMA Strasbourg)
- 2010: Diffusion processes on histograms via optimal transport (Regen Winter school)
- 2009: Renormalized Laplacians on smooth Wasserstein spaces above tori ('Stochastic Analysis and Random Dynamical Systems 2009' University of L'viv)
- 2009: Brenier's solution to the optimal transport problem in the Euclidean case, Polar factorization of vector-valued maps (Oberwolfach)
- 2006: Lie bracket on smooth Wasserstein space (University of Bonn)

Teaching

2023 Simulation algorithms and numerics for infectious disease models, 10h, AIMS-Senegal, Mbour

2023 Simulation algorithms and numerics for infectious disease models, 8h, AIMS-Rwanda, Kigali

2022 Inférence de paramètres et algorithmes de simulation pour les modèles de maladies infectieuses, 8h, Ecole Polytechnique de Thiès, Senegal

2021 Inférence de paramètres et algorithmes de simulation pour les modèles de maladies infectieuses, 12h, Université Nazi Boni, Bobo-Dioulasso, Burkina Faso

2020 Introduction à la modélisation mathématique des maladies infectieuses, 12h, Université Nazi Boni, Bobo-Dioulasso, Burkina Faso

2019 Branching processes, Master 2, Theoretical Biology, 3h, Université de Montpellier

2018 Evolutionary Epidemiology, Master 2, Theoretical Biology, 3h, Université de Montpellier

2017 Introduction to EMOD, an agent-based network model for HIV, 6h, ICRC at University of Washingon

2009 Introduction to mathematical finance models in discrete time, 30h, Master 2, Mathematics, Université de Metz

2008 Hyperbolic geometry, 3rd year, 30h Mathematics, Université du Luxembourg

2008 Introduction to Probability and Statistics, 2nd year, 60h, Mathematics, Université du Luxembourg

Mentoring

- Co-supervision of Amelia Bertozzi-Villa's MSc thesis on *Disentangling the impact of seroconversion age and set-point viral load on ART-free HIV survival* at the University of Washington, 2016
- Co-supervision of Thomas Beneteau's MSc thesis on *Modélisation de la dynamique intra- et inter-cellulaire des papillomavirus humains* at AgroParisTech, 2019
- Co-supervision of Dorian Vlaeminck's MSc1 Physics and engineering in life science project on epidemics on networks, 2019.

- Co-supervision of Baptiste Elie's MSc thesis on *Individual heterogeneity in outbreak modeling* at ENS Paris Saclay, 2020
- Co-supervision of Jean Pachebat's internship on analysing COVID-19 time series, 2020
- Co-supervision of Thomas Beneteau's PhD thesis on *Modélisation mathématique des infections HPV : quel rôle du hasard dans la persistance et l'oncogénèse* at Université de Montpellier, (ongoing, defense in 2022)
- Co-supervision of Bastien Reyné's PhD thesis on *Modélisation mathématique de vaccination: approches EDP* at Université de Montpellier, (ongoing, defense in 2023)

Outreach/press/civil society

HIV vaccine modeling work: Die Zeit (20150810)
Covid-19 modeling: Le Figaro (20200423), Libération (20200424), Sciences et Avenir (20210205)
Médecins Amis des Malades Afrique, Abidjan, Côte d'Ivoire (member, fundraising)
Żydowski Instytut Historyczny, Warsaw, Poland (volunteer)
Gedenkdienst, Vienna, Austria (member, formerly on the board)

Fellowships

- Erasmus fellowship (EU), 2004-2005, mathematics at the University of Paris 6 (France)
- Research semester at Felix Hausdorff Institute in Bonn (Germany) (fall 2007)
- research stay at ETH Zürich (Switzerland) (September 2009) with J Teichmann
- research stay at TU Berlin (Germany) (April and May 2010) with M von Renesse

Language and computer skills

- English, German, French (all full working proficiency), Polish (fairly good), Russian and Italian (notions)
- Python, R, LaTeX, unix, Matlab, bash