Luiz Max Fagundes de Carvalho

`lmax.fgv@gmail.com`

School of Applied Mathematics (EMAp), Getúlio Vargas Foundation, Brazil.

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Summary

Natural biological processes emit signals, which are often too "high" or too "low" for us to "hear". My goal as a scientist is to develop and apply statistical and mathematical tools to decode and quantify these biological signals. I hope a better understanding of these entities can lead to a progressive reduction of the world's disease burden. Bringing state-of-the-art statistical practice to the Life Sciences has been a major focus of my career in recent years. My interests lie in **Biostatistics**, ranging from complex networks to spatial analysis to statistical phylogenetics.

As you will notice if you continue reading, I am a big fan of collaboration, interacting with colleagues around Brazil and abroad. My current interests are:

- Bayesian inference of deterministic models;

- Combining (pooling) probability distributions;

- Phylogeny estimation: MCMC exploration of time-tree space – characterising time-tree space, new transition kernels;

- Coupling mathematical models to coalescent-based population reconstructions;

Please feel free to contact me if your interests lie anywhere near these topics.

Google Scholar: `https://scholar.google.com/citations?user=y2mxpbcAAAAJ&hl=en`

Currículo Lattes : `http://lattes.cnpq.br/7282202947621572`

PDFs of my publications can be found at `https://github.com/maxbiostat/papers/tree/master/PAPERS`

Publications

Published/Accepted – peer reviewed

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[1] F. P. Camara, A. L. Gomes, Carvalho, L. M., and L. G. Castello, "Dynamic behavior of sylvatic yellow fever in Brazil (1954-2008)," *Rev. Soc. Bras. Med. Trop.*, vol. 44, no. 3, pp. 297–299, 2011.

[2] Carvalho, L. M. and F. P. Camara, "Epidemiological aspects of acquired immunodeficiency syndrome in older Brazilians: a comparative approach," *Braz J Infect Dis*, vol. 16, no. 1, pp. 34–37, 2012.

[3] F. P. Camara, Carvalho, L. M., and A. L. Gomes, "Demographic profile of sylvatic yellow fever in Brazil from 1973 to 2008," *Trans. R. Soc. Trop. Med. Hyg.*, vol. 107, pp. 324–327, May 2013.

[4] Carvalho, L. M., L. B. Santos, N. R. Faria, and W. de Castro Silveira, "Phylogeography of foot-and-mouth disease virus serotype O in Ecuador," *Infect. Genet. Evol.*, vol. 13, pp. 76–88, Jan 2013.

[5] F. Bielejec, P. Lemey, Carvalho, L. M., G. Baele, A. Rambaut, and M. A. Suchard, "$\pi-$BUSS: a parallel BEAST/BEAGLE utility for sequence simulation under complex evolutionary scenarios," *BMC Bioinformatics*, vol. 15, p. 133, 2014.

[6] D. Mir, H. Romero, Carvalho, L. M., and G. Bello, "Spatiotemporal dynamics of DENV-2 Asian-American genotype lineages in the Americas," *PLoS ONE*, vol. 9, no. 6, p. e98519, 2014.

[7] F. C. Coelho and Carvalho, L. M., "Estimating the attack ratio of dengue epidemics under time-varying force of infection using aggregated notification data," *Scientific reports*, vol. 5, 2015.

[8] A. Rambaut, T. T. Lam, Carvalho, L. M., and O. G. Pybus, "Exploring the temporal structure of heterochronous sequences using tempest (formerly Path-O-Gen)," *Virus Evolution*, vol. 2, no. 1, p. vew007, 2016.

[9] A. Rambaut, G. Dudas, Carvalho, L. M., D. J. Park, N. L. Yozwiak, E. C. Holmes, and K. G. Andersen, "Comment on "Mutation rate and genotype variation of Ebola virus from Mali case sequences"," *Science*, vol. 353, no. 6300, pp. 658–658, 2016.

[10] C. Codeço, D. Villela, M. F. Gomes, L. Bastos, O. Cruz, C. Struchiner, Carvalho, L. M., and F. Coelho, "Zika is not a reason for missing the Olympic Games in Rio de Janeiro: response to the open letter of Dr Attaran and colleagues to Dr Margaret Chan, director-general, WHO, on the Zika threat to the Olympic and Paralympic Games," *Memórias do Instituto Oswaldo Cruz*, vol. 111, no. 6, pp. 414–415, 2016.

[11] W. E. Diehl, A. E. Lin, N. D. Grubaugh, Carvalho, L. M., K. Kim, P. P. Kyawe, S. M. McCauley, E. Donnard, A. Kucukural, P. McDonel, *et al.*, "Ebola virus glycoprotein with increased infectivity dominated the 2013–2016 epidemic," *Cell*, vol. 167, no. 4, pp. 1088–1098, 2016.

[12] F. C. Coelho, B. Durovni, V. Saraceni, C. Lemos, C. T. Codeco, S. Camargo, Carvalho, L. M., L. Bastos, D. Arduini, D. A. Villela, *et al.*, "Higher incidence of Zika in adult women than adult men in Rio de Janeiro suggests a significant contribution of sexual transmission from men to women," *International Journal of Infectious Diseases*, vol. 51, pp. 128–132, 2016.

[13] D. A. Villela, L. Bastos, Carvalho, L. M., O. G. Cruz, M. F. Gomes, B. Durovni, M. C. Lemos, V. Saraceni, F. C. Coelho, and C. T. Codeco, "Zika in Rio de Janeiro: Assessment of basic reproduction number and comparison with dengue outbreaks," *Epidemiology and Infection*, pp. 1–9, 2017.

[14] G. Dudas, Carvalho, L. M., T. Bedford, A. J. Tatem, G. Baele, N. R. Faria, D. J. Park, J. T. Ladner, A. Arias, D. Asogun, *et al.*, "Virus genomes reveal factors that spread and sustained the Ebola epidemic," *Nature*, vol. 544, no. 7650, pp. 309–315, 2017.

[15] G. Dudas, Carvalho, L. M., A. Rambaut, and T. Bedford, "MERS-CoV spillover at the camel-human interface," *eLife*, vol. 7, p. e31257, 2018.

[16] L. R. Vasconcellos, Carvalho, L. M., I. Gonçalves, F. Coelho, F. Silveira, T. A. Silva, L. S. Bastos, M. Sorgine, L. Reis, F. Dias, C. J. Struchiner, F. Gazos-Lopes, and A. Hampshire, "Natural infection by the protozoan leptomonas wallacei impacts the morphology, physiology, reproduction, and lifespan of the insect oncopeltus fasciatus," *Scientific Reports*, 2019.

[17] L. B. L. Santos, Carvalho, Luiz Max, W. Seron, F. C. Coelho, E. E. Macau, M. G. Quiles, and A. M. Monteiro, "How do urban mobility (geo) graph's topological properties fill a map?," *Applied Network Science*, vol. 4, no. 1, pp. 1–14, 2019.

[18] D. S. Candido, I. M. Claro, J. G. de Jesus, W. M. Souza, F. R. R. Moreira, S. Dellicour, T. A. Mellan, L. du Plessis, R. H. M. Pereira, F. C. S. Sales, E. R. Manuli, J. Thézé, L. Almeida, M. T. Menezes, C. M. Voloch, M. J. Fumagalli, T. M. Coletti, C. A. M. da Silva, M. S. Ramundo, M. R. Amorim, H. H. Hoeltgebaum, S. Mishra, M. S. Gill, Carvalho, Luiz M., L. F. Buss, C. A. Prete, J. Ashworth, H. I. Nakaya, P. S. Peixoto, O. J. Brady, S. M. Nicholls, A. Tanuri, Á. D. Rossi, C. K. V. Braga, A. L. Gerber, A. P. de C. Guimarães, N. Gaburo, C. S. Alencar, A. C. S. Ferreira, C. X. Lima, J. E. Levi, C. Granato, G. M. Ferreira, R. S. Francisco, F. Granja, M. T. Garcia, M. L. Moretti, M. W. Perroud, T. M. P. P. Castiñeiras, C. S. Lazari, S. C. Hill, A. A. de Souza Santos, C. L. Simeoni, J. Forato, A. C. Sposito, A. Z. Schreiber, M. N. N. Santos, C. Z. de Sá, R. P. Souza, L. C. Resende-Moreira, M. M. Teixeira, J. Hubner, P. A. F. Leme, R. G. Moreira, M. L. Nogueira, , N. M. Ferguson, S. F. Costa, J. L. Proenca-Modena, A. T. R. Vasconcelos, S. Bhatt, P. Lemey, C.-H. Wu, A. Rambaut, N. J. Loman, R. S. Aguiar, O. G. Pybus, E. C. Sabino, and N. R. Faria, "Evolution and epidemic spread of SARS-CoV-2 in Brazil," *Science*, vol. 369, no. 6508, pp. 1255–1260, 2020.

[19] M. Karcher, M. A. Suchard, G. Dudas, Carvalho, L. M., and V. Minin, "Estimating effective population size changes from preferentially sampled genetic sequences," *PLoS Computational Biology*, 2020.

[20] R. P. Niquini, R. M. Lana, A. G. Pacheco, O. G. Cruz, F. C. Coelho, Carvalho, Luiz Max, D. A. M. Villela, M. F. d. C. Gomes, and L. S. Bastos, "Description and comparison of demographic characteristics and comorbidities in SARI from COVID-19, SARI from Influenza, and the Brazilian general population," *Cadernos de Saúde Pública*, vol. 36, p. e00149420, 2020.

[21] Carvalho, Luiz M. and J. G. Ibrahim, "On the normalized power prior," *Statistics in Medicine*, vol. 40, no. 24, pp. 5251–5275, 2021.

[22] R. M. Lana, L. P. Freitas, C. T. Codeço, A. G. Pacheco, Carvalho, Luiz M., D. A. M. Villela, F. C. Coelho, O. G. Cruz, R. P. Niquini, V. B. G. Porto, *et al.*, "Identification of priority groups for covid-19 vaccination in Brazil," *Cadernos de Saúde Pública*, vol. 37, 2021.

[23] Carvalho, Luiz M., D. A. Villela, F. C. Coelho, and L. S. Bastos, "Bayesian inference for the weights in logarithmic pooling," *Bayesian Analysis*, vol. 1, no. 1, pp. 1–29, 2022.

[24] C. V. B. Dos Santos, N. C. M. Valiati, T. G. de Noronha, V. B. G. Porto, A. G. Pacheco, L. P. Freitas, F. C. Coelho, M. F. da Costa Gomes, L. S. Bastos, O. G. Cruz, *et al.*, "The effectiveness of covid-19 vaccines against severe cases and deaths in brazil from 2021 to 2022: a registry-based study," *The Lancet Regional Health–Americas*, vol. 20, 2023.

Under review

[25] R. Kubinec and Carvalho, Luiz Max, "A retrospective Bayesian model for measuring covariate effects on observed COVID-19 test and case counts," *SocArXiv preprint*, 2020.

[26] L. M. Carvalho and G. A. Moreira, "Adaptive truncation of infinite sums: applications to statistics," *arXiv preprint arXiv:2202.06121*, 2022.

[27] L. M. Moschen and L. M. Carvalho, "Bivariate beta distribution: parameter inference and diagnostics," *arXiv preprint arXiv:2303.01271*, 2023.

Conference papers

[28] Carvalho, L.M., L. Santos, P. Pereira, and W. Silveira, "Phylodynamics of foot-and-mouth disease virus: a complex network approach," in *Proceedings of the 10th Brazilian Conference on Dynamics, Control and Their Applications*, Brazilian Society for Applied and Computational Mathematics, 2011.

[29] Y. Yao, L. M. Carvalho, and D. Mesquita, "Locking and quacking: Stacking bayesian models predictions by log-pooling and superposition," in *NeurIPS 2022 Workshop on Score-Based Methods*.

Book chapters

[30] F. Camara and Carvalho, L. M., "Febres Hemorrágicas virais [Viral hemorrhagic fevers]," in *Introdução à Virologia Humana* (N. Santos, M. T. Romanos, and M. D. Wigg, eds.), Rio de Janeiro: Guanabara Koogan, 3rd ed., 2014.

[31] Carvalho, L. M., "Métodos bayesianos para inferir o padrão de dispersão de agentes patogénicos : filogeografia do vírus da febre aftosa na América do Sul como um caso de estudo [Bayesian methods to infer spread patterns for pathogens: the phylogeography of Foot-and-Mouth Disease virus in South America as a case study]," in *Abordagens Moleculares em Veterinária* (M. V. Cunha and J. Inácio, eds.), Lisbon: Lidel Editora, 1st ed., 2014.

[32] Carvalho, L. M., C. Struchiner, and L. Bastos, "Bayesian inference of deterministic population growth models," in *Interdisciplinary Bayesian Statistics* (A. Polpo de Campos, F. Neto, L. Ramos-Rifo, J. Stern, and M. Lauretto, eds.), vol. 118, pp. 217–228, Springer Verlag, 1st ed., 2015.

[33] L. S. Bastos, L. M. Carvalho, and M. F. Gomes, "Modelling misreported data," in *Building a Platform for Data-Driven Pandemic Prediction: From Data Modelling to Visualisation-The CovidLP Project* (D. Gamerman, M. O. Prates, T. Paiva, and V. D. Mayrink, eds.), ch. 7, pp. 113–131, Boca Raton, Florida: CRC Press, 2021.

Tech reports

[34] C. Codeço, D. Villela, F. Coelho, L. Bastos, Carvalho, LM, M. Gomes, O. Cruz, and R. Lana, "Risco de espalhamento da covid-19 em populações indígenas: considerações preliminares sobre vulnerabilidade geográfica e socioeconômica," *Rio de Janeiro: Fiocruz: FGV*, vol. 18, 2020.

[35] F. C. Coelho, L. M. Carvalho, R. M. Lana, O. G. Cruz, L. S. Bastos, C. T. Codeco, M. F. Gomes, and D. Villela, "Modeling the post-containment elimination of transmission of COVID-19," *medRxiv*, 2020.

[36] D. A. Villela, T. G. de Noronha, L. S. Bastos, A. G. Pacheco, O. G. Cruz, L. M. Carvalho, C. T. Codeço, M. F. Gomes, F. C. Coelho, L. P. Freitas, *et al.*, "Effectiveness of mass vaccination in Brazil against severe COVID-19 cases," *medRxiv*, 2021.

Miscellaneous

[37] Y. Shen, L. M. Carvalho, M. A. Psioda, and J. G. Ibrahim, "Optimal priors for the discounting parameter of the normalized power prior," *arXiv preprint arXiv:2302.14230*, 2023.

Work in progress[1]

L. Zimmermann, Carvalho, L.M., L. Vasconcellos, L. Bastos, C. Struchiner, and A. H. Lopes, "Temperature-dependent oviposition and egg eclosion of Chagas disease vector *Rhodnius prolixus*", In preparation.

Carvalho, L.M., G. Baele, M.A. Suchard, A. Rambaut, "An efficient, tunable time-tree transition kernel for Bayesian phylogenetics", In preparation.

Carvalho, L.M., Dudas, G., Stadler, T., Rambaut, A., Bedford, T. "Bayesian estimation of R_0 from sub-critical chains of transmission under observation error", In preparation.

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[1]Drafts in final phase of preparation

Education

2009–2012	BSc (hons.) Microbiology and Immunology, Federal University of Rio de Janeiro, Brazil.
2014–2018	PhD Evolutionary Biology, University of Edinburgh, UK. Thesis committee: Richard Everitt (Reading) and Jarrod Hadfield (Edinburgh).

Professional Experience

2010–2013	Pan American Health Organization (PAHO) Position: Statistical Assistant Role: Developed and analysed quality control experiments for veterinary diagnostic tests; Research on Foot-and-Mouth Disease virus (FMDV) phylodynamics

Academic Experience

2009–2011	Infectious Diseases Epidemiology Division (SEDI), Institute of Microbiology, Federal University of Rio de Janeiro Position: Scientific initiation student Supervisor: Prof. Dr. Fernando Portela Câmara Role: research on the epidemiology of AIDS, sylvatic yellow fever and dengue.
2012–2013	Programme for Scientific Computing (PROCC), Oswaldo Cruz Foundation (Fiocruz) Position: Scientific initiation student Supervisor: Prof. Dr. Oswaldo Gonçalves Cruz Role: research on spatial partition methods for health areal data.
2013–2014	Programme for Scientific Computing (PROCC), Oswaldo Cruz Foundation (Fiocruz) Position: Scientific initiation student Supervisors: Prof. Dr. Claudio Struchiner and Dr. Leonardo Bastos Role: research on Bayesian inference of deterministic population growth models, multilevel binary regression and opinion pooling.
2014–2018	Institute of Evolutionary Biology (SBS), University of Edinburgh Position: PhD student Supervisors: Andrew Rambaut and Darren Obbard Role: research on statistical phylogenetics methods for RNA virus phylodynamics.
2018–2019	Programme for Scientific Computing (PROCC) and National School of Public Health (ENSP), Oswaldo Cruz Foundation Position: Postdoctoral Researcher Supervisor: Claudio Struchiner Role: research on statistical methods applied to Public Health.
2020–	School of Applied Mathematics (EMAp), Getúlio Vargas Foundation (FGV) Position: Lecturer Role: research on Biostatistics and teaching Statistics at the graduate and undergraduate levels.

Conferences[2]

Presented work

2009	Gomes, A.L.B.B; Carvalho, L.M.; Camara, F.P. **Dinâmica Espacial da Dengue no Rio de Janeiro: 1986 a 2009 [Spatial dynamics of dengue in Rio de Janeiro: 1986 to 2009]**, 2009, II International Congress on Geography of Health, Uberlândia -MG, Brazil.
2011	Vianez Jr., J.L.; Carvalho, L. M.; Bisch, P. **Development of a workflow for large-scale epitope prediction: dengue virus as a study of case**. In: X Meeting 2011, 2011, Florianópolis–SC, Brazil. X Meeting 2011 Abstract Book, 2011. v. ID 234.
2011	Carvalho,L.M.; Santos, L.B.; Silveira, W.C. **Phylodynamics of Foot-and-Mouth Disease Virus: a Complex Network approach**. XXII Meeting of the Brazilian Society of Virology, Águas de Lindóia – SP, Brazil.
2012	Carvalho, L. M.; Santos, L.B.; Faria, N.R.; Silveira, W.C. **Phylogeographic Dynamics of foot-and-mouth disease virus in Ecuador 2002 to 2010**, 2012 In 17th International BioInformatics Workshop on Virus Evolution and Molecular Epidemiology, Belgrade, Serbia.
2012	Carvalho, L.M.; Faria, N.R.; Silveira, W.C. **Phylodynamics of Foot-and-Mouth Disease Virus in South America: a Comprehensive Analysis**. XXIII Brazilian Congress of Virology, Foz do Iguaçu – PR, Brazil.
2012	Vasconcellos, L.R.C.; Dias, F.A.; Soares, J. B. R. C.; Carvalho, L. M.; Oliveira, M. M.; Alves e Silva, T. L.; Gonçalves, I.; Oliveira, M. F.; Lopes, F.G.; Lopes, A. H. C. S. **Interaction of the hemipteran Oncopeltus fasciatus with the trypanosomatid Leptomonas wallacei: an insight into parasitism**. In: Gordon Research Conference on Biology of Host-Parasite Interactions, 2012, Newport, RI, USA. Annals of the Gordon Research Conference on Biology of Host-Parasite Interactions, 2012. v. 1. p. 1-2.
2013	Zimmermann, L.T.; Carvalho, L.M.; Vasconcellos, L.R.; Bastos, L.S.; Struchiner, C.J.; Lopes, A.H. **Temperature-dependent oviposition and egg eclosion of Chagas disease vector *Rhodnius prolixus*** In XXIX Annual Meeting of the Brazilian Society of Protozoology, 2013, Caxambu-MG, Brazil. Abstract book of the XXIX Annual Meeting of the SBPz, p. 159, ID V004.
2014	Carvalho, L. M.; Struchiner, C.J.; Bastos, L.S. **Bayesian inference of deterministic population growth models** In XII Brazilian Meeting on Bayesian Statistics (EBEB), 2014, Atibaia-SP, Brazil. Abstract book of the XII Brazilian Meeting on Bayesian Statistics, p. 63
2014	Bastos, L. S.; Carvalho, L. M. **Random Effects Binary Model with Misclassified Response** In Joint Statistical Meetings, 2014, Boston MS, USA.

Participated

2012	VIII Brazilian Congress of Epidemiology, São Paulo–SP, Brazil.
2013	1st Symposium on Big Data and Public Health, Rio de Janeiro–RJ, Brazil.

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[2]Main conferences I have attended to or had work presented at. For a complete list please visit my Lattes CV.

Invited Talks[3]

2011	*Phylodynamics of Foot-and-Mouth Disease Virus: a Complex Network approach.* XXII Meeting of the Brazilian Society of Virology.
2011	*Playing Dumb: The Misuse of Statistics in Biology.* Institute of Microbiology, Federal University of Rio de Janeiro.
2012	*Knowledge Discovery in Databases through Complex Networks: application to phylodynamics.* WaFIS 2012.
2014	*Bayesian inference of deterministic population growth models.* XII Brazilian Meeting on Bayesian Statistics.
2015	*Phylodynamics: how Genetics and Mathematics are changing our understanding of infectious diseases.* 30rd Brazilian Mathematics Colloquium.
2015	*Choosing the weights for the logarithmic pooling of probability distributions.* 60th World Statistics Congress.
2016	*On the choice of the weights for the logarithmic pooling of probability distributions.* XIII Brazilian Meeting on Bayesian Statistics.
2019	*Recent advances in the phylodynamics of infectious diseases.* Institute of Microbiology, Federal University of Rio de Janeiro.
2019	*On the choice of weights for logarithmic pooling of probability distributions.* School of Applied Mathematics, Getúlio Vargas Foundation.
2020	*Modelando a COVID-19: extraindo o máximo de dados ruins.* School of Applied Mathematics, Getúlio Vargas Foundation.
2020	*Efficient brute-force marginalisation of discrete variables in an epidemic model of sub-critical transmission.* StanCon2020.
2020	*Adaptive Markov chain Monte Carlo on the space of time-calibrated trees.* 14th International Conference in Monte Carlo & Quasi-Monte Carlo Methods in Scientific Computing (MCQMC 2020).
2021	*Adaptive truncation of Infinite Series: Applications to Statistics.* Joint Statistical Meetings (JSM) 2021.

Memberships

Brazilian Statistical Association (ABE), Analytical Methods in Epidemiological Surveillance Group (MAVE).

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[3]An up-to-date is given in `https://github.com/maxbiostat/presentations`.

Teaching Experience

2007–2011	**High School Chemistry and Biology** I was a voluntary teacher of whole-year high school courses on organic chemistry, general chemistry and biology.
2010–2013	**Basics of Mathematics and Statistics for Microbiology** Federal University of Rio de Janeiro Supervisor: Prof. Dr. Fernando Portela Câmara Basic calculus; descriptive statistics, Gaussian distribution and hypothesis testing.
2010	**Topics in Human Physiology** Federal University of Rio de Janeiro Supervisor: Prof. Dr. Pedro Paulo Elsas By means of seminars and group discussions, we approach particular aspects of human physiology and stimulate the students to draw general conclusions about the subjacent biological processes.
2012	**Bioinformatics** Federal University of Rio de Janeiro Supervisor: Prof. Andrew Macrae, PhD Basics on Bioinformatics: basic genome annotation, databases, alignment, phylogenetics.
2014-2017	**Molecular Evolution** University of Edinburgh Supervisor: Prof. Andrew Rambaut, PhD Molecular phylogenetics.
2017	**Statistics for Genetics** University of Edinburgh Supervisor: Ian White TA in the Bayesian module
2020–	**Statistical inference** School of Applied Mathematics (EMAp) Undegraduate course (60 hours).
2020–	**Computational Statistics** School of Applied Mathematics (EMAp) PhD course (45 hours).
2021–	**Bayesian Statistics** School of Applied Mathematics (EMAp) PhD course (45 hours).

Awards

2010	Honourable Mention - XVI Week of Microbiology and Immunology, Federal University of Rio de Janeiro.
2011	Honourable Mention - XVII Week of Microbiology and Immunology, Federal University of Rio de Janeiro.
2011	Selected for Oral presentation – XXII National Meeting of the Brazilian Society for Virology.
2012	Honourable Mention - XVIII Week of Microbiology and Immunology.
2014	Selected for Oral presentation – XII Brazilian Meeting on Bayesian Statistics.
2014	Principal's Career Development Scholarship, University of Edinburgh.

Languages

Portuguese	Native
English	Fluent (CAE – Grade A)
Spanish	Advanced

References

Reference	What for	email
Prof. Dr. Fernando Portela Câmara	Research and Teaching	fp3camara@yahoo.com.br
Prof. Ângela Hampshire Lopes, PhD	Research	angela.lopes@micro.ufrj.br
Prof. Andrew Macrae, PhD	Teaching	amacrae@biologia.ufrj.br
Prof. Dr. Pedro Paulo Xavier Elsas	Teaching	pxelsas@micro.ufrj.br
Prof. Claudio Struchiner, PhD	Research and Teaching	stru@fiocruz.br
Leonardo Bastos, PhD	Research	lsbastos@fiocruz.br
Prof. Philippe Lemey, PhD	Research	philippe.lemey@rega.kuleuven.be
Prof. Flavio Codeço Coelho, PhD	Research	fccoelho@fgv.br
Prof. Andrew Rambaut, PhD	Research and Teaching	a.rambaut@ed.ac.uk
Jarrod Hadfield, PhD	Research	j.hadfield@ed.ac.uk
Prof. Richard Everitt, PhD	Research	richard.g.everitt@gmail.com