Johannes Borgqvist

Curriculum Vitae

Contact

Division of Applied Mathematics and Statistics,
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Working experience

Postdoctoral Research Fellow in Mathematical Biology, Mathematical Sciences, Chalmers University of Technology **2023-Current**

I continued with my research on the use of Lie symmetries in Mathematical Biology which was started in Oxford (see the subsequent bullet point). I also worked on two other modelling projects in Mathematical Biology involving a continuation work on a reaction diffusion model of Cdc42 mediated cell polarisation, and the analysis of so-called prions involved in neurodegenerative diseases such as Alzheimer's disease. Additionally, I had a larger role in terms of teaching as the examiner and lecturer of a first-year single-variable calcululs course for approximately 180 students. The position was fully financed for two years by the Wenner-Gren grant (see "Larger scholarships and grants" below), and it was extended slightly due to parental leave.

Postdoc in Mathematical Biology, Mathematical Institute, University of Oxford **2020-2023**

I worked as a postdoctoral researcher under the supervision of professor Ruth E. Baker in the department Wolfson Centre for Mathematical Biology (WCMB) of the Mathematical Institute of the University of Oxford. The topic was to to introduce so-called Lie symmetries, commonly used in mathematical physics, into the field of mathematical biology.

Researcher in Systems Biology, Mathematical Sciences, University of Gothenburg **2020**

The aim was to implement a FEM based algorithm for simulating Cdc42-mediated cell polarisation. The focus was to add bud scars on the surface of the cell in order to see how various ageing factors influence Cdc42-mediated cell polarisation.

Private tutor in Mathematics, MyAcademy **2013**

At MyAcademy I was a much appreciated private tutor in mathematics where I received the "study coach of the month"-award.

Teacher, "Astra Zenecas Summer School in Science" **2011-2013**

For three years, I was a teacher for high school students. I planned two weeks of lectures, laborations and activities in physics, chemistry, biology, programming and mathematics with the aim of inspiring them to pursue a career in science.

Education and Degrees

PhD in Applied Mathematics **2015-2020**
Department of Mathematical Sciences, University of Gothenburg

M.Sc. in Mathematics **2013-2015**

Masters program in Engineering Mathematics and Computational Science, Chalmers University of Technology

B.Sc. in Biotechnology **2009-2012**
Bachelor program in Biotechnology, Chalmers University of Technology

Publications

Borgqvist, J.G, Alexandersen, C.G., (2024) "HeMiTo-dynamics: a characterization of mammalian prion toxicity using non-dimensionalization, linear stability and perturbation analyses", doi: https://doi.org/10.1093/imammb/dqae024.

Borgqvist, J.G., Browning, A.P., Ohlsson, F., Baker, R.E., (2024) "Framing global structural identifiability in terms of parameter symmetries", doi: https://doi.org/10.48550/arXiv.2410.03757.

Ohlsson, F., **Borgqvist, J.G**, Baker R.E., (2024) "On the correspondence between symmetries of two-dimensional autonomous dynamical systems and their phase plane realisations", doi: https://doi.org/10.1016/j.physd.2024.134113.

Borgqvist, J.G, Gerlee, P., Lundholm, C., (2024) "Turing pattern formation on the sphere is robust to the removal of a hole", doi: https://doi.org/10.1007/s00285-023-02034-z.

Borgqvist, J.G, Ohlsson, F., Baker R.E., (2023) "Energy translation symmetries and dynamics of separable autonomous two-dimensional ODEs", doi: https://doi.org/10.1016/j.physd.2023.133876.

Borgqvist, J.G, Ohlsson, F., Zhou, X., Baker R.E., (2023) "Construction of integrable generalised travelling wave models and analytical solutions using Lie symmetries", doi: https://doi.org/10.48550/arXiv.2310.08296.

Borgqvist, J.G. and Palmer S., (2022) "Occam's razor gets a new edge: the use of symmetries in model selection", doi; https://doi.org/10.1098/rsif.2022.0324.

Borgqvist, J., Ohlsson, F. and Baker, R.E., (2022) "Symmetries of systems of first order ODEs: Symbolic symmetry computations, mechanistic model construction and applications in biology", doi: https://doi.org/10.48550/arXiv.2202.04935.

Borgqvist, J., Malik, A., Lundholm, C., Logg, A., Gerlee, P. & Cvijovic, M. (2021) "Cell polarisation in a bulk-surface model can be driven by both classic and non-classic Turing instability", *npj Systems Biology and Applications*, doi: https://doi.org/10.1038/s41540-021-00173-x.

Ohlsson, F.*, **Borgqvist, J.*** & Cvijovic, M. (2020) "Symmetry structures in dynamic models of biochemical systems". *Journal of the Royal Society Interface*, doi: https://doi.org/10.1098/rsif.2020.0204. The "*"-symbol means that the first-authorship is shared.

Schnitzer, B., **Borgqvist, J.** & Cvijovic, M. (2020) "The synergy of damage repair and retention promotes rejuvenation and prolongs healthy lifespans in cell lineages". *PLOS Computational Biology*, doi: https://doi.org/10.1371/journal.pcbi.1008314.

Borgqvist, J. (2020) "The construction, analysis and validation of mechanistic mathematical models of protein kinetics in the context of replicative ageing in budding yeast.", *PhD-thesis*, ISBN: 978-91-7833-910-5, URI: http://hdl.handle.net/2077/64055.

Borgqvist, J., Welkenhuysen, N. & Cvijovic, M. (2020) "Synergistic effects of repair, resilience and retention of damage determine the conditions for replicative ageing". *Scientific Reports*, doi: https://doi.org/10.1038/s41598-020-58444-2

Borgqvist, J., Dainese, R., & Cvijovic, M. (2017) "Systems Biology of Aging". Systems Biology, *Wiley-VCH Verlag p243-264*, doi: https://doi.org/10.1002/9783527696130.ch9

Welkenhuysen N., **Borgqvist J.** et al. (2017) "Single-cell study links glucose upshift with Snf1/Mig1 and reveals source of variability". *BMC Systems Biology*, doi: https://doi.org/10.1186/s12918-017-0435-z

Peer review

Reviewer for Bulletin of Mathematical Biology (2024), ISSN: 0092-8240.

Reviewer for Physica D: Nonlinear Phenomena (2024), ISSN: 0167-2789.

Reviewer for Nature Computational Science (2022), ISSN: 2662-8457.

Fellowships

Wenner-Gren Fellow with the *Wenner-Gren Foundations* **2020-Current**

Junior Research Fellow (**JRF**) at *Linacre College*, *University of Oxford* **2021-2023**

Scholarships and grants

The Wenner-Gren Fellow return grant for postdoctoral research (Grant number: FT2023-0005) **2023-Current**

The funding from the Wenner-Gren foundations includes a three-year long scholarship (see the previous bullet point) outside of Sweden followed by two years additional funding for a so-called return position where one is employed at a Swedish University. For my return position, I was employed at the Department of Mathematical Sciences at Chalmers University of Technology, and the position was slightly extended due to parental leave.

The Wenner-Gren Fellow scholarship for postdoctoral education **2020-2023**

I received the prestigious Wenner-Gren fellow scholarship (see https://www.swgc.org/wenner-gren-fellows.aspx). This financed my postdoctoral research position at the Mathematical Institute ot the University of Oxford under the supervision of Professor Ruth E. Baker.

Undergraduate Research Bursary, Grant Ref: URB-2023-46, funded by the London Mathematical Society **2023**

I received a prestigious Undergraduate Research Bursary of £1920 to supervise an undergraduate student at the Mathematical Institute of the University of Oxford. The student conducted a summer project during eight weeks with the following title: "Constructing travelling wave models of collective cell migration in two spatial dimensions using Lie symmetries.".

Landahl-Busenberg Travel Award **2022**

I recieved a travel grant for participation in the conference ECMTB 2022 in Heidelberg, Germany.

Travel grants as a PhD student **2015-2020**

I was awarded a total of SEK 109, 500 in travel grants used for financing my participation in seven international conferences.

Conferences & Workshops: *Arrangement*

Data-driven mechanistic mathematical modelling for life-science applications, Gothenburg, Sweden (*Organiser together with Professor Philip Gerlee and Doctor Sara Hamis*). Funded by the Wenner-Gren foundations. **2023**

Workshop on Modelling in Biology and Medicine (MBM), Gothenburg, Sweden (*Organising committee and founder*). **2019**

Awards

Participation in the "11th Heidelberg Laureate Forum" (HLF), held in Heidelberg, September 22–27, 2024. Based on a nomination by the Department of Mathematical Sciences at Chalmers University of Technology and the University of Gothenburg, I was chosen as a participant from several hundred applicants through an international, scientific selection process.	**2024**
Prize for my presentation at the virtual SMB 2021 annual meeting called "SMB Contributed Talk Award for Methods for Biological Modeling".	**2021**
Pedagogic award "*Guldkärnan 2019*" by "SNF$^{\text{TM}}$" which is a student organisation representing the students at Physics and Mathematics at Chalmers University of Technology (see https://ftek.se/snf/).	**2019**

Training in pedagogy and teaching

I took two courses in Pedagogical Development and Interactive Learning which aims to promote an engaging teacher practice at the University of Gothenburg.

Supervision Experience

During the summer of 2023, I supervised two undergraduate students in parallel who conducted summer projects on Lie symmetries of mechanistic models in biology over eight weeks. One of the students was funded by the Undergraduate Research Bursary with reference number URB-2023-46. After my PhD studies, I supervised a full year master thesis from the summer of 2020-2021 about symmetry methods in mathematical Biology. During my PhD studies, I supervised 22 students (20 bachelor students and 2 masters students) in total. I recruited these students during my teaching and I designed the projects as well. The supervision of these students was initiated on my own initiative.

Teaching Experience

As a postdoctoral research fellow at the Department of Mathematical Sciences of Chalmers University of Technology and the University of Gothenburg, I was the lecturer and examiner in a first-year course entitled ""single variable calculus and analytical geometry"". The course is taken by approximately 180 undergraduate students enrolled in the programs chemical engineering, chemical engineering with engineering physics and biotechnology. I implemented numerous active learning strategies such as interactive in-class problem solving based on Mentimeter presentations. After the course, both the *student performance* (measured by final grades) and *student satisfaction* (measured by course surveys taken by students) were significantly improved compared to previous years when the course was taught by means of traditional lectures.
During my PhD studies at the Department of Mathematical Sciences of Chalmers University of Technology and the University of Gothenburg, 20% of the time (corresponding to one full year) was dedicated to teaching university students at bachelor and master level.

Languages

Swedish - native language
English - fluent
French - intermediate

References

Are available upon request.