

LINNEA CHRISTIN FRANSSSEN

CONTACT INFORMATION

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RESEARCH

Over 90% of cancer-related deaths arise due to secondary spread in the form of metastases. The first mathematical modelling framework that I developed to capture the interlinked processes of invasion and metastatic spread of individual cancer cells in a spatially explicit manner delivers insight into the invasion-metastasis cascade.

Computational implementation of the agent-based model using C++ confirmed, *inter alia*, the hypothesis that cancer invasion is driven by membrane-bound metalloproteases.

A three-dimensional hybrid deterministic-stochastic approach to modelling of cancer invasion by explicitly accounting for the transition from collective to individual cancer cell invasion, and vice versa, is a further focus of my research.

Inverse parameter estimation is used to infer unknown experimental parameter values and a parameter sensitivity analysis is performed. Results match *in vitro* HSC-3 cell invasion of myoma organotypic assays both qualitatively and quantitatively.

Cardiovascular haemodynamic models and prediction of evolutionary trait evolution using Adaptive Dynamics techniques are further projects I have worked on.

PUBLICATIONS

L.C. Franssen, T. Lorenzi, A.E.F. Burgess, M.A.J. Chaplain (in press).

A mathematical framework for modelling the metastatic spread of cancer. B Math Biol.
www.doi.org/10.1101/469536

→ Nominated for Lighthill-Thwaites Prize (awarded in April 2019)

L.C. Franssen. *Using mathematics to outsmart cancer*. Mathematics Today. Vol 54(4), August 2018. pp. 135-137. Print.

EDUCATION

2016-2019 PhD in Mathematics, University of St. Andrews

Thesis: Mathematical modelling of cancer invasion and metastatic spread (Expected submission date: 26 Aug 2019)

Supervisors: Prof Mark Chaplain and Dr Tommaso Lorenzi

Funding: EPSRC research studentship (£14,500/annum, Feb 2016-Aug 2019)

Courses: – Two C++ modules (*Programming with C++* and *Software Design*),
Abertay University (graded A, 20 ECTS);
– *Advanced Methods in Applied Mathematics* and *Mathematical Models 1&2*,
Scottish Mathematical Sciences Training Centre (graded A/B/A, 30 ECTS).

Awards: – Finalist for Lighthill-Thwaites Prize (award: April 2019);
– Finalist in *STEM for BRITAIN* competition held in Parliament (2019);
– Silver Badge at St Andrews' *Public Engagement Newcomer Award 2018*;
– *L'Oréal-UNESCO For Women in Science* Poster Competition Finalist (2018);
– *Holy Rood Hall of Fame Competition* Winner (2017);
– *TakeAIM 2016* public outreach competition winner (£1250).

2008-2013 MSci in Mathematics, University of Glasgow (1st Class Degree)

Masters project: Windkessel and structured tree models for cardiovascular haemodynamics (Supervisor: Prof Nicholas A. Hill; graded 21/22)

Honours project: The theory of Adaptive Dynamics and its application to a mutualism-parasitism continuum Lotka-Volterra system, which involves a trade-off (Supervisor: Dr Christina Cobbold; graded 22/22)

Awards: *Matthew A Muir Bursary* (twice) and *Dougall Prize* (twice) for most distinguished student in Mathematics

1999-2008 Allgemeine Hochschulreife, Kieler Gelehrtenschule (Germany)

GPA of 1.1 (1 is the highest, 6 the lowest grade)

Exchange student at Madras College, St Andrews, Scotland, in 2005
Awards: Federal prizes in Mathematical Olympiad and English competition

CONFERENCES, SEMINARS & PRESENTATIONS

- University of St Andrews School Research Day** (24 Jan 2019)
Talk: *A Mathematical Framework for Modelling the Metastatic Spread of Cancer*;
- SofTMech Mid-Term Review, Glasgow** (24 May 2018)
Flash-talk & poster: *Mathematical Modelling of Cancer Invasion and Metastatic Spread*
- Core-to-Core Meeting Mathematical Oncology** (19-20 Mar 2018)
Talk: *Mathematical Modelling of Cancer Invasion and Metastatic Spread*
- British Applied Mathematics Colloquium (BAMC)** (26-29 Mar 2018)
Poster: *Mathematical Modelling of Cancer Invasion and Metastatic Spread*
- Postgraduate Interdisciplinary Mathematics Symposium** (29 Jan-1 Feb 2018)
Talk: *Using Mathematics to Outsmart Cancer* [On organising committee]
- Society of Mathematical Biology Meeting, Salt Lake City** (17-20 Aug 2017)
- Edinburgh Mathematical Society Postgraduate Meeting** (7-9 July 2017)
Talk: *Modelling Cancer Invasion using an Individual-based Game-theoretic Approach*
- Postgraduate Interdisciplinary Mathematics Symposium** (20-22 Jan 2017)
Talk: *An Introduction to Mathematical Biology*
- Young Researchers in Mathematics Conference** (1-4 Aug 2016)
- Fourth Scottish Partial Differential Equations Colloquium** (9-10 June 2016)
- St Andrews Mathematical Biology Weekly Seminars** (2016-18)
Talks:
 - *Adaptive Dynamics* (5 May 2016);
 - *Individual-based Game-theoretic Modelling of Cancer Invasion* (11 May 2017);
 - *A Novel Mathematical Framework for Modelling the Metastatic Spread of Cancer* (13 Nov 2018).

PUBLIC OUTREACH

- STEM for Britain** (13 March 2019, House of Commons, Westminster)
Invited poster finalist: *Using Mathematics to Outsmart Cancer*
- TakeAIM 2019 Award Ceremony** (5 Feb 2019, Imperial College, London)
Invited video-presentation: *Taking Aim after TakeAIM – My research & how I communicate it to the public*
- L'Oréal–UNESCO For Women in Science Awards** (24 May 2018, London)
Invited poster finalist: *Using Mathematics to Outsmart Cancer*
- Associate Researcher (by appt., £500)** (Feb-May 2018, St Leonards College)
Designed curriculum for lecture series *Theory of Knowledge and Mathematics* part of International Baccalaureate Diploma Programme and delivered content as five formal interactive lectures and two tutorials
- Holy Rood High School** (21 Sept 2017, Edinburgh)
Invited 'Hall of Fame' Prize Talk *Mathematics in the Real World*; Seminar with (Advanced) Higher mathematics students: *Mathematics in your Future*
- Ann-Taylor Day** (28 Nov 2016, St Catherine's College, Oxford)
Invited video-presentation about winning 'TakeAIM' contribution: *Using Mathematics to Outsmart Cancer* (see youtu.be/plhrZLpxk_I)

COMPUTING SKILLS

- MATLAB, C++, Git;
- L^AT_EX, MS Word, MS PowerPoint, MS Excel.

LANGUAGE SKILLS

- Proficient in English and German (formerly freelance translator German ↔ English with specialisation in IT and medical device manuals);
- Basic knowledge of Spanish;
- Latin and ancient Greek.

PROFESSIONAL SKILLS DEVELOPMENT

- University of Abertay computer science modules (20 ECTS):
 - *Programming with C++* (graded A);
 - *Software Design* with focus on object-oriented programming (ongoing);
- Scottish Mathematical Sciences Training Centre courses (30 ECTS):
 - *Advanced Methods in Applied Mathematics* (graded A);
 - *Mathematical Models 1&2* (graded B/A);
- Software Carpentry Workshop (2 days) covering Python, Unix shell, Git;
- Certified online courses: Python, version control, object-oriented design, C++.

PERSONAL DEVELOPMENT

- TEDxUniversityofStAndrews public speaking workshop (9 Apr 2017)
- Workshop for Early Career Researchers, Salt Lake City (16 Aug 2017)
- 14 university-run personal development courses, including:
 - *Adobe Illustrator: Vector graphics;*
 - *Adobe Photoshop: Photo editing;*
 - *Posters design & graphical abstracts;*
 - *'Funny research' workshop;*
 - *Media training;*
 - *Voice coaching;*
 - *Build a research website;*
 - *Mendeley.*

WORK EXPERIENCE

Secondary School Teacher Friedrich-Engels-Gymnasium, Berlin (Aug 2014-Dec 2015)

- Taught students aged 15 to 19 mathematics and economics;
- Drafted and marked exams according to own marking schemes;
- Supervised projects and prepared students for final exams;
- Attended 10 hours/week of teacher training.

Provinzial NordWest Life Insurance Actuarial Department, Kiel (Jan-Apr 2014)

- Acquired basic knowledge of stochastic modelling and life insurance.

Towers Watson – Intern Risk Consulting and Software, Cologne (June-July 2011)

- Derived insurance market trends using Excel and VBA;
- Analysed trends in statutory health insurance premiums;
- Researched for and developed presentations using Power Point.

INTERCOPE – Intern Development division HSM for Windows, Hamburg (June-July 2010)

- Acquired basic C++ knowledge;
- Took part in high level and graphical user interface design;
- Set up a test system.

Stadtwerke Kiel AG – Intern Service Office, Kiel (June-Aug 2009)

- Undertook computer-aided resource planning using SAP.

TEACHING EXPERIENCE

- 2018 Python Lab Demonstrator** (University of St Andrews)
- Assisted students of *MT2000: Introduction to Python* module with ad hoc problems.
- 2017-18 Course Coordinator** (University of St Andrews, CAPOD)
- Co-designed curriculum for course *Key Skills in Applied Mathematics*;
 - Trained honours students in deriving mathematical models in biology (×2).
- 2017-18 Associate Researcher (by appt.)** (St Leonards College, £500 stipend)
- Designed curriculum for lecture series *Theory of Knowledge and Mathematics* part of International Baccalaureate Diploma Programme (TOK);
 - Delivered content as five formal interactive lectures and two tutorials.
- 2016-18 Session Facilitator** (University of St Andrews, CAPOD)
- Facilitated mandatory CAPOD courses *Tutoring & Demonstrating in the Sciences* (×3) and *Tutoring & Demonstrating in the Arts* (×2).
- 2016-17 Teaching Assistant** (University of St Andrews)
- Delivered three sets of semester-long tutorials for undergraduate students in module *MT1002: Mathematics* and marked homework.
- 2009-10 Associate Trainer** (National Union of Students Scotland)
- Prepared and delivered training sessions to newly appointed course representatives in Higher Education throughout Scotland.

REPRESENTATIVE ROLES

- Currently postgraduate representative on the School Safety Committee;
- Student representative for four years at the University of Glasgow;
- Year prefect during the last two years of secondary school as well as class representative and member of the student board for many years beforehand.