

# LINNÉA CHRISTIN FRANSSEN

---

## CONTACT INFORMATION

Mathematical Institute, University of St Andrews, North Haugh, KY16 9SS, UK  
LCF4@st-andrews.ac.uk, [www.linneafranssen.com](http://www.linneafranssen.com)

## 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 (Franssen et al. 2019) delivers insight into the invasion-metastasis cascade.

Computational implementation using C++ confirmed, *inter alia*, the hypothesis that cancer invasion is driven by membrane-bound MMPs.

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

Inverse parameter estimation is used to infer unknown experimental parameter values. 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. *A mathematical framework for modelling the metastatic spread of cancer*. Submitted to Bull Math Biol (Nov 2018).  
[doi.org/10.1101/469536](https://doi.org/10.1101/469536)

**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)

**Training:** *Programming with C++* and *Software design* module, University of Abertay (graded A, 20 ECTS); Scottish Mathematical Sciences Training Centre courses *Advanced Methods in Applied Mathematics* (graded A, 10 ECTS) and *Mathematical Models 1&2* (graded B/A, 20 ECTS; university-run teaching, public speaking and media training courses; version control, object-oriented design, Python and C++ online training).

**Awards:** Silver Badge at University of St Andrews' *Public Engagement with Research 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 (1<sup>st</sup> 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 & Poster: *A Novel 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: *Modelling Cancer Invasion using an Individual-based Game-theoretic Approach* (11 May 2017); *Adaptive Dynamics* (5 May 2016); *A Novel Mathematical Framework for Modelling the Metastatic Spread of Cancer* (13 Nov 2018)

## 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 ( $\times 2$ ).

### **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* ( $\times 3$ ) and *Tutoring & Demonstrating in the Arts* ( $\times 2$ ).

### **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.

### **2014-15 Secondary School Teacher** (Friedrich-Engels-Gymnasium, Germany)

- 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.

### **2009-10 Associate Trainer** (National Union of Students Scotland)

- Prepared and delivered training sessions to newly appointed course representatives in Higher Education throughout Scotland.

#### PUBLIC OUTREACH

**TakeAIM 2018 Award Ceremony** (5 Feb 2019, Imperial College, London)

Invited video-talk *PhD in Mathematical Oncology – My research & how I share it with 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](https://youtu.be/plhrZLpxk_I))

#### INTERNSHIPS

**Provinzial NordWest Life Insurance** Actuarial Department, Kiel (Jan–Apr 2015)

- Acquired basic knowledge of stochastic modelling and life insurance.

**Towers Watson** 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** 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** Service Office, Kiel (June–Aug 2009)

- Undertook computer-aided resource planning using SAP.

#### 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.

#### 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.

#### COMPUTING SKILLS

- *Proficient*: L<sup>A</sup>T<sub>E</sub>X, MS Word, MS PowerPoint, MS Excel;
- *Advanced*: C++, MATLAB, Git; *Basic*: Python, Bash.

#### 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 Unix shell, Python, 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)
- Fourteen university-run personal development courses, including:
  - Tutoring & demonstrating in the sciences, Adobe Illustrator – Introduction to vector graphics, Adobe Photoshop – Introduction to photo editing; Media training, Posters and graphical abstracts, Build a research website, Voice coaching, Diversity in the workplace, Assessment & academic misconduct, Mendeley.