Name: Marie E. Rognes
Born: October 7, 1982
Nationality: Norwegian
Gender: Female
Present position: Chief Research Scientist, Simula Research Laboratory, Norway

Academic degrees

2009	PhD in Applied Mathematics/Numerical Analysis (Date of conferred degree: 17.09.2009), Centre for Mathematics for Applications (Centre of Excellence), University of Oslo (UiO)
2005	MSc in Applied Mathematics, Department of Mathematics, UiO

Work experience

2016–	Chief Research Scientist, Simula Research Laboratory
2014–2017	Consultant, Melior Innovations, Houston, TX, USA
2012–2016	Head of Biomedical Computing Department, Simula Research Laboratory
2015–2016	Adjunct Associate Professor (20%), Department of Mathematics, UiO
2012–2016	Senior Research Scientist, Simula Research Laboratory, Norway
2012–2013	Lecturer, Department of Informatics, UiO
2009–2012	Postdoctoral fellow, Center for Biomedical Computing, Simula Research Laboratory
Jan–Jun 2007	Visiting scholar, University of Minnesota, Minneapolis, MN, USA
2005–2008	Research fellow, Centre for Mathematics for Applications, UiO

Fellowships, grants and awards

2018	2018 Royal Norwegian Society of Sciences and Letters Prize for Young Researchers within the Natural Sciences. This prize is awarded once annually to researchers in Norway below the age of 40 who have accomplished exceptional results within their field, with documented originality and talent.
2017–2022	ERC Starting Grant (PE1), European Research Council: Mathematical and computational foundations for modelling cerebral fluid flow (1.5 M EUR) (Project leader).
2016–2019	FRINATEK Research Grant, Research Council of Norway (Young Research Talent): The Numerical Waterscape of the Brain (8.7 MNOK) (Project leader). The proposal was evaluated as 7/7 (Outstanding).
2015	2015 Wilkinson Prize for Numerical Software. The Wilkinson prize for Numerical Software is the most prestigious prize in the numerical software research community, awarded once every four years to the authors of an outstanding piece of numerical software. I won the 2015 prize for the dolfin-adjoint project (dolfin-adjoint.org), together with my co-authors P. E. Farrell, S. W. Funke and D. A. Ham.
2015	Founding Member of the Young Academy of Norway. The Young Academy of Norway was initiated by the Norwegian Academy of Science and Letters and targets talented, young researchers interested in working interdisciplinarily with broader issues. Only 20 members were selected from all scientific disciplines out of 160 applicants.
2015	Simula Research Award. This award is presented annually to honour excellent contributions to research undertaken at Simula that lead to new insight within the field.
2015–2018	Research Grant from Nordforsk (the Nordic Council of Ministers): Automated uncertainty quantification for numerical solution of partial differential equations. (6.7 MNOK) (Project leader).
2014–2018	Research Grant from Horizon 2020 MSCA ITN: TheLink (34 MNOK) (Associated partner)
2015–2016	Research and Mobility Grant from Horizon 2020 MSCA RISE: Unique Biomaterial-Drug Solution for Multifunctional Central Venous Catheters (1.8 MNOK). (Work package leader)

Mobility and international collaboration

I have a well-established network of renowned international collaborators in numerical analysis and scientific computing, developed through personal mobility and international cooperation, in part through the extensive and vibrant FEniCS community (e.g. Anders Logg, Chalmers University of Technology; Garth N. Wells, University

of Cambridge). From January–June 2007, I visited Douglas N. Arnold and M.-Carme Calderer at the Institute for Mathematics and its Applications and the School of Mathematics at the University of Minnesota, Minneapolis, USA. I have a close working relationship with researchers at Imperial College London (David A. Ham) and University of Oxford (Patrick E. Farrell), with frequent mutual visits, including a longer joint research stay at the Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, during the fall of 2012.

Supervision of graduate students and postdoctoral fellows

2013 –
- I have supervised 2 postdoctoral fellows and am supervising 2 post doctoral fellows in the Waterscape and Waterscales projects. Dr. Simon Funke studied *predictive modeling in physiological flow* as a post doctoral fellow with me at Simula (2013–2015), and was subsequently awarded a FRIPRO Young Research Talent Grant; Dr. Rocio Rodriguez-Cantano studied *uncertainty quantification in cardiac electromechanics* as a post doctoral fellow with me in the AUQ-PDE project (2016–2018); Dr. Cécile Daversin-Catty studies *mixed dimensional mathematical and computational modelling* as a post doctoral fellow with me in the Waterscales project (2017-2020). Dr. Travis Thompson studies *mixed finite element methods for multiple-network poroelasticity* as a post doctoral fellow with me in the Waterscape project (2017-2019).

2009 –
- I have supervised 3 PhD students to completion: Dr. Gabriel Balaban completed his PhD under my supervision in 2017, he is now a post doctoral fellow at King's College London, UK; Dr. Andre Massing completed his PhD under my co-supervision in 2012, he is now an Assistant Professor at Umeå University, Sweden; Dr. Giulia Pizzichelli completed part of her PhD studies with me at Simula in 2015 and graduated from the School of Advanced Studies, Pisa/Istituto Italiano di Tecnologia, Italy in 2016.
- I am currently supervising 3 PhD students in the Simula-UiO-UCSD PhD programme on Computational Physiology, Waterscape and Waterscales projects: Ms. Eleonora Piersanti, Mr. Vegard Vinje, and Ms. Ada Ellingsrud. I am currently co-supervising 2 PhD students: Mr. Lars M. Valnes (with K.-A. Mardal, University of Oslo) and Mr. Matteo Croci (with M. Giles and P. E. Farrell, University of Oxford).

2011 – I have supervised 11 MSc students (of which 5 as the main supervisor) to completion at the Departments of Informatics and Mathematics at the UiO, and at the University of Trento, Italy.

Teaching activities

2015, 2016	Lecturer, EPSRC CDT NGCM Summer Academy, University of Southampton, UK
2015	Lecturer, UCSD/UiO/Simula 2015 Summer School in Computational Physiology
2015–2016	Lecturer, Solid mechanics (MEK2500, 10 ECTS), Department of Mathematics, UiO
2012–2013	Lecturer, Numerical methods (INF-MAT2351, 10 ECTS), Department of Informatics, UiO
2008–2013	Lecturer and demonstrator, FEniCS short courses, including at the American Institute of Mathematics, California, USA; Imperial College London, UK; King Abdullah University of Science and Technology, Saudi Arabia; and University of Southampton.

Organization of scientific meetings (selection since 2013)

2019 SIAM Conference on Computational Science and Engineering, Spokane, US (2019); PDESOFT 2018, Bergen, Norway (2018); FEniCS'16, Simula Research Laboratory, Norway (2016); Efficient Solvers for PDE-Constrained Optimization mini-symposium at SIAM CSE'15, Salt Lake City, UT, USA (2015); The 26th Nordic Seminar on Computational Mechanics, Simula, Norway (2013).

Other professional activities

- **Project leader** for the Mathematical and computational foundations for modelling cerebral fluid flow (Waterscales) project funded by the European Research Council as an ERC Starting Grant (P1), 2017–2022; for The Numerical Waterscape of the Brain project funded by the Research Council of Norway through the FRINATEK Young Research Talent scheme, 2016 – 2019; for the Automated Uncertainty Quantification for Numerical Solutions of Partial Differential Equations project, funded by Nordforsk/Nordic Council of Ministers, 2015–2017; for the Robust Solvers project at the Center for Biomedical Computing, 2013–2017; for the High Level Adjoints: Software and Applications project at the Center for Biomedical Computing, 2013–2017;

- **Work package leader** for the Unique Biomaterial-Drug Solution for Multifunctional Central Venous Catheters project funded by H2020 MSCA RISE, 2015–2016;
- Core developer (2007–) and **member of the FEniCS Steering Council** (2016 –), a collaborative project for the development of innovative concepts, software and tools for automated scientific computing;
- **Core member of the Dolfin-adjoint project** (2011 –), winner of the 2015 Wilkinson Prize for Numerical Software;
- Member of **PhD thesis evaluation committees** at the Politecnico di Milano, Milan, Italy (2018); Department of Mathematics and Computer Science, University of Southern Denmark, Denmark (2018); Department of Computer Science, Imperial College London, UK (2014); Department of Informatics, University of Grenoble, France (2013); and the Department of Informatics, University of Bergen, Norway (2012);
- Member of **faculty evaluation committees** at the Department of Mathematics/Informatics, Oslo and Akershus University College (2014), and the Department of Informatics, UiO (2001);
- **Reviewer** for *SIAM Journal on Scientific Computing, ACM Transactions on Mathematical Software, Mathematical Models and Methods in Applied Sciences, BIT Numerical Mathematics, Journal of Computational Physics* and *Geoscientific Model Development*.

Career breaks

June 17, 2013 – December 31, 2013: Maternity leave (6.5 months)
May 1, 2018 – December 31, 2018: Maternity leave (8 months)

Track record

My research spans numerical analysis, scientific computing and applications in soft tissue mechanics and electrophysiology. During 2009-2013 and 2014-2018, I have published 22 articles in international journals (plus 6 in review), 5 chapters in books, 3 refereed conference proceedings and given more than 60 scientific presentations at conferences and meetings, in addition to FEniCS training courses, non-academic presentations etc. For a complete list of scientific publications, see my Google Scholar profile (Marie E. Rognes), or the associated list.

During my time as Head of Department and as project leader for national and international research projects, I have gained significant experience with research leadership and supervision of young research talent. Moreover, I have demonstrated the ability to propose ground-breaking research, as exemplified by the High level adjoints: Software and Applications project at the CBC that I initiated in 2012, led from 2012-2017, and which results (dolfin-adjoint) received the prestigious 2015 Wilkinson Prize for Numerical Software. For other awards, and academy memberships, see the previous section on Fellowships, grants and awards.

Articles in international journals (selection of 10)

The below lists a selection of ten of my publications in chronological order, in particular publications that I consider to have gone extensively beyond the state of the art and in which my own contribution is particularly significant. I publish in top numerical analysis, scientific computing and bioengineering journals, where multiple authors are the standard and with non-unique authorship conventions (alphabetical, order of contribution etc.).

1. **M. E. Rognes**, R. C. Kirby and A. Logg. Efficient assembly of H(div) and H(curl) conforming finite elements. SIAM Journal on Scientific Computing, vol. 36(6), pp. 4130– 4151, 2009. *This paper describes the underlying algorithms and implementation of automated code generation for compatible finite element variational formulations in FEniCS. SIAM Journal on Scientific Computing is the top journal in scientific computing.*
2. **M. E. Rognes**, M. C. Calderer and C. A. Micek. Modelling of and mixed finite element methods for gels in biomedical applications. SIAM Journal of Applied Mathematics, vol. 70(4), pp. 1305–1329, 2009. *In this early paper, the first result of my collaboration with Prof. M.-C. Calderer at the University of Minnesota, I introduced and analyzed a new mixed finite element method for a hyperelastic model of a gel (a soft material that is a mixture of polymer and water). This was the first time that a nearly symmetric stress tensor was introduced in the context of compatible elasticity-like discretizations.*
3. **M. E. Rognes** and A. Logg. Automated goal-oriented error control I: stationary variational problems. SIAM Journal on Scientific Computing, vol. 35(3), pp. 173–193, 2013. *This ground-breaking paper presents an algorithm for automatically deriving goal-oriented (adjoint-based) a posteriori error estimates and indicators and was selected as the most important paper in the CoE Centre for Biomedical Computing*

(CBC) midterm evaluation. This concept is an example of the new type of high-level automated algorithms that I have pioneered in the last years.

4. P. E. Farrell, D. A. Ham, S. W. Funke and **M. E. Rognes**. Automated derivation of the adjoint of high-level transient finite element programs. SIAM Journal on Scientific Computing, vol. 35(4), pp. 369–393, 2013. *This paper describes the concept and implementation of dolfin-adjoint, which together won us the prestigious 2015 Wilkinson Prize for Numerical Software. The dolfin-adjoint idea is an another example of the new type of high-level automated algorithms that I have introduced in the last few years. This paper was selected as one of the five most important scientific publications of the CBC.*
5. M. S. Alnæs, A. Logg, K. B. Ølgaard, **M. E. Rognes** and G. N. Wells. Unified Form Language: A domain-specific language for weak formulations of partial differential equations. ACM Transactions on Mathematical Software, vol. 40(2), 2014. *This paper describes the design and implementation of the Unified Form Language (UFL), a core component in the FEniCS Project. UFL has had significant impact inside and outside the FEniCS Project and is currently emerging as the gold standard finite element specification language across finite element software projects including Firedrake and DUNE.*
6. A. Massing, M. G. Larson, A. Logg and **M. E. Rognes**. A stabilized Nitsche fictitious domain method for the Stokes problem. Journal of Scientific Computing, vol. 61(3), pp. 604–628, 2014. *In this paper, we introduce and analyze a new finite element method for discretizing viscous fluid flow (Stokes equations) on an implicitly described (fictitious) domain. This approach allows for much more flexible geometry and mesh representations compared to standard approaches.*
7. A. Massing, M. G. Larson, A. Logg and **M. E. Rognes**. A stabilized Nitsche overlapping mesh method for the Stokes problem. Numerische Mathematik, vol. 128(1), pp. 73–101, 2014. *In this paper, we introduce and analyze a new finite element method for discretizing viscous fluid flow (Stokes equations) on non-matching meshes, and implement generic software components for such methods. The paper is published in Numerische Mathematik which is one of the most prestigious numerical analysis journals.*
8. M. Alnæs, J. Blechta, J. Hake, A. Johansson, B. Kehlet, A. Logg, C. Richardson, J. Ring, **M. E. Rognes** and G. N. Wells. The FEniCS Project Version 1.5. Archive of Numerical Software, vol. 3(100), 2015. *This paper describes the FEniCS Project software and emerging new abstractions, algorithms and features. This paper illustrates the significant impact of FEniCS in the scientific computing community with more than 300 citations in 3 years.*
9. G. Balaban, H. N. Finsberg, H. H. Odland, **M. E. Rognes**, S. Ross, J. Sundnes and S. T. Wall. High-resolution data assimilation of cardiac mechanics applied to a dyssynchronous ventricle. International Journal for Numerical Methods in Biomedical Engineering, 2016. *This paper combines advanced numerical data assimilation with clinical patient data to calibrate an electro-mechanical model of a human heart, and is as such an example of bringing advanced computational tools to clinical use. This paper was also selected as one of the five most important publications of the Centre for Biomedical Computing CoE.*
10. A. Tveito, K. H. Jæger, M. Kuchta, K. A. Mardal, **M. E. Rognes**. A cell-based framework for numerical modelling of electrical conduction in cardiac tissue. Frontiers in Physics, vol. 5, 2017. *In this paper, we introduce and study new compatible and stable numerical discretizations of an emerging mathematical modeling framework for representing and simulating excitable cells in general and cardiac cells in particular. This emerging framework may be viewed as a paradigm shift in computational modelling of excitable cells in the heart and in the brain.*

Selected keynote and invited presentations

This is a selection of presentations and short courses that I have been invited to give in the last three years.

- Compatible discretizations in our hearts and minds, European Conference on Numerical Mathematics and Advanced Applications (keynote), Voss, Sept 2017.
- Impact of high abstraction/high performance finite element software in biomedical computing, 24th International Conference on Domain Decomposition Methods (keynote), Svalbard, Feb 2017.
- High-level abstractions, algorithms and applications in forward and inverse finite element solution of PDEs, Nordic Seminar on Computational Mechanics (keynote), Chalmers, Sweden, Oct 2016.
- 2-day FEniCS and Dolfin-Adjoint training course, NGCM Summer Academy, University of Southampton, June 2015; *This became the top rated course of the Academy*.

I was invited to give a TEDx talk on mathematical modelling in medicine to general audience: Mathematics that cures us TEDxOslo, Oslo, Norway, May 2017;