

# Nicolas Flament

## Geodynamics/Geology

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### Contact details

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[Google Scholar](#) [Research Gate](#)  
Citizenship France/Australia

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### Research experience

- 2016 - **ARC DECRA Fellow, School of Geosciences [www](#), The University of Sydney**  
*The geodynamics of past sea level changes*
- 2013 - 2016 **Research Fellow, School of Geosciences, The University of Sydney [www](#)**  
*Dynamic Earth Models and Surface Maps for Frontier Hydrocarbon Exploration* (sponsor: Statoil)
- 2010 - 2013 **Postdoctoral Fellow, School of Geosciences, The University of Sydney**  
*Dynamic Earth Models and Surface Maps for South America* (sponsor: Statoil [www](#))
- 2006 - 2010 **PhD in Earth Sciences, ENS Lyon [www](#) and The University of Sydney**  
*Secular cooling of the solid Earth, emergence of the continents, and evolution of Earth's external envelopes [pdf](#)* with Prof. Nicolas Coltice and A/Prof. Patrice Rey
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### Teaching experience

- Lecturing, demonstrating and field expeditions in 2<sup>nd</sup> and 3<sup>rd</sup> year units, The University of Sydney (2010-): Geophysical methods [www](#); Earth's structure and evolution [www](#); Fossils and Tectonics (field expedition to Yass) [www](#); Volcanoes, Hot Rocks, and Minerals [www](#)
  - Coursework for Honours students, The University of Sydney (2010-)
  - Casual assistant lecturer, University of Sydney (2007-2008)
  - Assistant lecturer, Université Lyon 1 [www](#) (2006-2009)
  - Geoscience tutorials, mapping and field geology (Lyon and Sydney)
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### Scientific interests

**Keywords:** mantle and lithospheric processes, sea level evolution, dynamic topography, Archean

**Topics**

- Interaction between lithospheric and mantle processes
- Long-term and secular evolution of sea level
- Landscape evolution
- Phanerozoic dynamic topography
- Phanerozoic global tectonics
- Thermal evolution of the solid Earth

**Methods**

- Geodynamic modeling (*CitcomS*, *Ellipsis*)
  - Spatio-temporal data analysis (*GPlates*)
  - Analytical solutions of physical problems
  - Field work:
    - structural geology
    - geochemical sampling
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### Higher education

- 2006 **Masters of Science (Research; Earth Sciences), ENS Lyon-Université Lyon 1 [www](#)**  
*Secular evolution of sea level [pdf](#)* with Dr. Nicolas Coltice
- 2003 - 2005 **Bachelor of Science (Earth Sciences), École Normale Supérieure (ENS) Lyon [www](#)**  
Competitive entry (July 2003)  
Spring semester (2005) at Uppsala Universitet, Sweden [www](#)
- 2001 - 2003 **"Classes préparatoires aux grandes écoles" [www](#), S<sup>te</sup> Geneviève, Versailles [www](#)**  
Intensive training in mathematics, physics, chemistry, biology and Earth sciences
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## Grants

2016 - 2019	Australian Research Council Discovery Early Career Research Award DE160101020 - \$350,821
Flament, N.	<i>The geodynamics of past sea level changes</i>
2013 - 2016	Statoil ASA - Industry Grant - \$1,638,945
Müller, Seton, Flament	<i>Dynamic Earth Models and Surface Maps for Frontier Hydrocarbon Exploration</i>

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## Publications

Underlined names denote research students.

### Peer-reviewed articles

1. Hassan, R., Müller, R. D., Gurnis, M., Williams, S. & **Flament, N.**. A rapid burst in hotspot motion through the interaction of plate tectonics and deep mantle convection, *Nature*, *accepted 16 Feb.*
2. Williams, S., **Flament, N.** & Müller, R. D., 2016. Alignment between seafloor spreading directions and absolute plate motions through time, *Geophysical Research Letters*; [doi:10.1002/2015GL067155](https://doi.org/10.1002/2015GL067155).
3. Müller, R. D., **Flament, N.**, Matthews, K., Williams, S. & Gurnis, M., 2016. Formation of Australian continental margin highlands driven by plate-mantle interaction, *Earth and Planetary Science Letters*, *accepted 12 Feb.*
4. Müller, R. D., Qin, X., Sandwell, D. T., Dutkiewicz, A., Williams, S. E., **Flament, N.**, Maus, S. & Seton, M. The GPlates Portal: Cloud-based interactive 3D visualization of global geophysical and geological data in a web browser, *PLOS ONE*, *accepted 27 Feb.*
5. **Flament, N.**, Gurnis, M., Müller, R. D., Bower, D. J. & Husson, L., 2015. Influence of subduction history on South American topography, *Earth and Planetary Science Letters* 430, 9-18; [doi:10.1016/j.epsl.2015.08.006](https://doi.org/10.1016/j.epsl.2015.08.006).
6. Hassan, R., **Flament, N.**, Gurnis, M., Bower, D. J. & Müller, R. D., 2015. Provenance of plumes in global convection models, *Geochemistry, Geophysics, Geosystems* 16, [doi:10.1002/2015GC005751](https://doi.org/10.1002/2015GC005751).
7. Williams, S., **Flament, N.**, Müller, R. D. & Butterworth, N., 2015. Absolute plate motions since 130 Ma constrained by subduction zone kinematics, *Earth and Planetary Science Letters* 418, 66-77; [doi:10.1016/j.epsl.2015.02.026](https://doi.org/10.1016/j.epsl.2015.02.026).
8. Seton, M., **Flament, N.**, Whittaker, J., Müller, R. D., Gurnis, M. & Bower, D. J., 2015. Ridge subduction sparked reorganization of the Pacific plate-mantle system 60-50 Myr ago, *Geophysical Research Letters* 42; [doi:10.1002/2015GL063057](https://doi.org/10.1002/2015GL063057).
9. Zahirovic, S., Seton, M., Müller, R. D. & **Flament, N.**, 2015. Tectonic speed limits from plate kinematic reconstructions, *Earth and Planetary Science Letters* 418, 40-52; [doi:10.1016/j.epsl.2015.02.037](https://doi.org/10.1016/j.epsl.2015.02.037).
10. Bower, D. J., Gurnis, M. & **Flament, N.**, 2015. Assimilating lithosphere and slab history in 4-D dynamic Earth models, *Physics of the Earth and Planetary Interiors* 238, 8-22; [doi:10.1016/j.pepi.2014.10.013](https://doi.org/10.1016/j.pepi.2014.10.013).
11. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Skogseid, J., Heine, C. & Müller, R. D., 2014. Topographic asymmetry of the South Atlantic from global models of mantle flow and lithospheric stretching, *Earth and Planetary Science Letters*, 387, 107-119; [doi:10.1016/j.epsl.2013.11.017](https://doi.org/10.1016/j.epsl.2013.11.017).
12. Rey, P. F., Coltice, N. & **Flament, N.**, 2014. Spreading continents kick-started plate tectonics, *Nature* 513, 405-408; [doi:10.1038/nature13728](https://doi.org/10.1038/nature13728).
13. Shephard, G., **Flament, N.**, Williams, S., Seton, M., Gurnis, M. & Müller, R. D., 2014. Circum-Arctic mantle structure and dynamic surface topography since the Jurassic, *Journal of Geophysical Research: Solid Earth* 119; [doi:10.1002/2014JB011078](https://doi.org/10.1002/2014JB011078).
14. Barnett-Moore, N., **Flament, N.**, Heine, C., Butterworth, N. & Müller, R. D., 2014. Cenozoic uplift of south Western Australia as constrained by river profiles, *Tectonophysics* 622, 186-197; [doi:10.1016/j.tecto.2014.03.010](https://doi.org/10.1016/j.tecto.2014.03.010).
15. **Flament, N.**, Gurnis, M. & Müller, R. D., 2013. A review of observations and models of dynamic topography. *Lithosphere* 5, 189-210; [doi:10.1130/L245.1](https://doi.org/10.1130/L245.1).
16. **Flament, N.**, Coltice, N. & Rey, P. F., 2013. The evolution of oceanic  $^{87}\text{Sr}/^{86}\text{Sr}$  does not constrain continental growth, *Precambrian Research* 229, 177-188; [doi:10.1016/j.precamres.2011.10.009](https://doi.org/10.1016/j.precamres.2011.10.009).
17. Zahirovic, S., Müller, R. D., Seton, M., **Flament, N.**, Gurnis, M. & Whittaker, J., 2012. Insights on the kinematics of the India-Eurasia collision from global geodynamic models, *Geochemistry, Geophysics, Geosystems* 13; [doi:10.1029/2011GC003883](https://doi.org/10.1029/2011GC003883).

18. Olivier, N., Dromart, G., Coltice, N., **Flament, N.**, Rey, P. F & Sauvestre, R., 2012. A deep subaqueous fan depositional model for the Paleoproterozoic (3.46 Ga) Marble Bar Cherts, Warrawoona Group, Western Australia, *Geological Magazine* 149, 743-749; [doi:10.1017/S0016756812000131](https://doi.org/10.1017/S0016756812000131).
19. **Flament, N.**, Rey, P. F., Coltice, N., Dromart, G. & Olivier, N., 2011. Lower crustal flow kept Archean continental flood basalts at sea level, *Geology* 39, 1159-1162; [doi:10.1130/G32231.1](https://doi.org/10.1130/G32231.1).
20. **Flament, N.**, Coltice, N. & Rey, P. F., 2008. A case for late-Archean continental emergence from thermal evolution models and hypsometry, *Earth and Planetary Science Letters* 275, 326-336; [doi:10.1016/j.epsl.2008.08.029](https://doi.org/10.1016/j.epsl.2008.08.029).

## Other articles

21. **Flament, N.**, 2014. Linking plate tectonics and mantle flow to Earth's topography, *Geology* 42, 927-928; [doi:10.1130/focus102014.1](https://doi.org/10.1130/focus102014.1).

## Articles under review/in preparation

22. **Flament, N.**, Williams, S., Müller, R. D., Gurnis, M. & Bower, D. J. B. Origin and evolution of the deep thermochemical structure beneath Eurasia, *to be submitted (journal to be confirmed)*.
23. **Zahirovic, S.**, Matthews, K. J., **Flament, N.**, Müller, R. D., Hill, L., Seton, M. & Gurnis, M. Tectonic evolution and deep mantle structure of the eastern Tethys since the Jurassic, *invited review submitted to Earth Science Reviews*.
24. **Zahirovic, S.**, **Flament, N.**, Müller, R. D., Seton, M. & Gurnis, M. Large fluctuations of shallow seas in low-lying Southeast Asia driven by mantle flow, *to be submitted to Geochemistry, Geophysics, Geosystems*.

## Peer-reviewed extended conference abstracts

25. Seton, M., **Flament, N.** & Müller, R. D., 2012. Subduction history of the Melanesian borderlands, *Eastern Australian Basins Symposium IV: Exploration - Driving Future Energy Solutions, Petroleum Exploration Society of Australia, Special Publication* 1-12.
26. **Matthews, K.**, Seton, M., **Flament, N.** & Müller, R. D., 2012. Late Cretaceous to present-day opening of the southwest Pacific constrained by numerical models and seismic tomography, *Eastern Australian Basins Symposium IV: Exploration - Driving Future Energy Solutions, Petroleum Exploration Society of Australia, Special Publication* 1-15, doi: 10.13140/2.1.2793.1843.

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## Conferences and seminars

### Session convening

- Co-convenor of the session *Models for Continental Growth Four Decades On*, Goldschmidt Conference, 2015
- Lead convenor of the session *Linking plate tectonics and mantle convection to Wilson cycles: constraints from the geological record and surface processes*, AGU Fall Meeting, 2014
- Convenor of the symposium *Linking deep Earth to plate tectonic and surface processes*, 34<sup>th</sup> International Geological Congress, Brisbane, 2012
- Co-convenor of the session *Tectonic reconstructions with deforming plates*, EGU General Assembly, 2012
- Co-convenor of the session *Linking Plate Tectonic and Surface Processes to the Deep Earth*, AGU Fall Meeting, 2011
- Co-convenor of the session *Early Earth: from deep dynamics to surface life*, EGU General Assembly, 2011

### Oral presentations

1. **Flament, N.**, Rey, P. F & Coltice, N. The rise of continents on a cooling Earth, *Goldschmidt Conference, 2015*
2. **Flament, N.**, Gurnis, M., Williams, S., Bower, D. J., Seton, M. & Müller, R. D. Evolution of the long-wavelength, subduction-driven topography of South America since 150 Ma, *AGU Fall Meeting, 2014*
3. Müller, R. D., **Flament, N.**, Shephard, G. E., Gurnis, M., Bower, D. J., Seton, M., Williams, S., Zahirovic, S. & Matthews, K. Reconstructing ancient ocean basins and evolving plate boundary configurations - a key to understanding solid Earth evolution, *Australian Earth Science Convention, 2014*
4. **Flament, N.**, Gurnis, M., Williams, S., Bower, D. J., Seton, M. & Müller, R. D. Evolution of the long-wavelength topography of South America since 150 Ma in response to eastern Pacific subduction, *Australian Earth Science Convention, 2014*

5. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Skogseid, J., Heine, C. & Müller, R. D. Topographic asymmetry of the South Atlantic from global models of mantle flow and lithospheric stretching, *EGU General Assembly, 2014*
6. **Flament, N.**, Coltice, N. & Rey, P. F. Continental emergence in the Late Archean reconciles early and late continental growth models, *EGU General Assembly, 2014*
7. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., & Müller, R. D. Evolution of the subduction-driven, long-wavelength topography of South America since the Jurassic, *AGU Meeting of the Americas, Cancun, 2013 - solicited*
8. **Flament, N.**, Gurnis, M. & Müller, R. D. Evolution of the subduction-driven, long-wavelength topography of Africa since the Jurassic, *TopoAfrica 2013 final workshop, Nelson Mandela Metropolitan University, George Campus, 20-25 January 2013 - invited keynote*
9. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Müller, R. D., Skogseid, J. & Heine, C. Asymmetry of the margins of the Atlantic Ocean from geodynamic models of mantle convection with lithospheric deformation, *46<sup>th</sup> Congresso Brasileiro de Geologia, Santos, 2012*
10. **Flament, N.**, Williams, S., Gurnis, M., Heine, C., & Müller, R. D., Testing alternative reconstructions of the South Atlantic by comparing predicted to observed total tectonic subsidence, *34<sup>th</sup> International Geological Congress, Brisbane, 2012*
11. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Müller, R. D. & Skogseid, J., A deep mantle origin for the asymmetry of the South Atlantic margins, *EGU General Assembly, 2012*
12. Williams, S., **Flament, N.**, Heine, C., Hosseinpour Vazifehshenas, M., Seton, M., Gurnis, M. & Müller, R. D., Geodynamic modeling of passive margin systems from tectonic reconstructions with deforming plate boundaries, *EGU General Assembly, 2012*
13. Gurnis, M., **Flament, N.**, Spasojevic, S., Williams, S., Seton, M. & Müller, R. D., Global geodynamic models constrained by tectonic reconstructions including plate deformation, *AGU Fall Meeting, 2011*
14. **Flament, N.**, Gurnis, M., Williams, S., Heine, C., Seton, M. & Müller, R. D., Effect of mantle convection on the total tectonic subsidence of South Atlantic margins, *Fragile Earth, Munich, Germany, September 2011*
15. **Flament, N.**, Coltice, N., Rey, P. F., Dromart, G. & Olivier, N., Subaqueous Archean continental flood basalts were emplaced on hot continental crust, *EGU General Assembly, 2011*
16. **Flament, N.**, Coltice, N., Rey, P. F., Dromart, G. & Olivier, N., On the rise of the continents, *Macquarie University, 17 September 2010 - invited*
17. **Flament, N.**, Coltice, N. & Rey, P. F., Secular cooling of the solid Earth, Archaean emerged land surface, and crustal growth, *5<sup>th</sup> International Archean Symposium, Perth, 2010*
18. **Flament, N.**, Coltice, N., Rey, P. F., Dromart, G. & Olivier, N., The role of lower crustal flow in the formation of subaqueous Archaean continental flood basalts, *Australian Earth Science Convention, 2010*
19. **Flament, N.**, Coltice, N. & Rey, P. F., Crustal growth, thermal evolution of the Earth, and Archaean emerged land surface, *EGU General Assembly, 2010 - solicited*
20. **Flament, N.**, Coltice, N. and Rey, P. F., Consequences of the late-Archaean emergence of continents, *Géosciences Rennes, 5 February 2009 and IUEM "Domaines Océaniques", Brest, 6 February 2009 - invited*
21. **Flament, N.**, Coltice, N. & Rey, P. F., Late-Archaean continental emergence: consequences for the rise of atmospheric oxygen, *AGU Fall Meeting, 2008 - Webcast (from 63 min) ㉟*
22. **Flament, N.**, Coltice, N. and Rey, P. F., Surface area of emerged land and depth of mid-oceanic ridges in the Archean, *Australian Earth Science Convention, 2008*

## Poster presentations

23. **Flament, N.**, Salles, T., Müller, R. D. & Gurnis, M., Influence of subduction history and surface processes on continental-scale topography, *XIV International workshop on modelling of mantle and lithosphere dynamics, Oléron, France, 31 Aug. - 5 Sep. 2015*
24. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Skogseid, J., Heine, C. & Müller, R. D. Tectonic subsidence of the passive margin of South America from global models of mantle flow and lithospheric stretching, *William Smith Meeting 2014: The Future of Sequence Stratigraphy: Evolution or Revolution?*
25. **Flament, N.**, Coltice, N. & Rey, P. F. Continental emergence in the Late Archean reconciles early and late continental growth models, *Australian Earth Science Convention, 2014*
26. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Müller, R. D. & Skogseid, J. Global models of mantle flow and lithospheric stretching since the Jurassic, *XIII International workshop on modelling of mantle and lithosphere dynamics, Honefoss, Norway, 31 Aug. - 5 Sep. 2013*
27. **Flament, N.**, Gurnis, M., Williams, S., Seton, M., Müller, R. D. & Skogseid, J. Asymmetry of the margins of the South Atlantic from geodynamic models of lithospheric deformation and mantle convection, *34<sup>th</sup> International Geological Congress, Brisbane, 2012*

28. **Flament, N.**, Gurnis, M., Williams, S., Heine, C., Seton, M. & Müller, R. D., Topography of the margins of South America since the Cretaceous from geodynamic models of lithospheric deformation and mantle convection, *AGU Fall Meeting, 2011*
  29. **Flament, N.**, Coltice, N., & Rey, P. F., The evolution of  $^{87}\text{Sr}/^{86}\text{Sr}$  does not rule out early continental growth, *AGU Fall Meeting, 2010*
  30. **Flament, N.**, Coltice, N., Rey, P. F., Dromart, G. & Olivier, N., Lower crustal flow and subaqueous Archean continents, *AGU Fall Meeting, 2009*
  31. **Flament, N.**, Rey, P. F. & Coltice, N., Modeling the thermal and mechanical response of 3.4-2.2 Ga continental crust to the emplacement of sills, *EGU General Assembly, 2008*
  32. **Flament, N.**, Coltice, N. & Rey, P. F., Emerged land surface in the Archean: constraints on continental growth and mantle thermal history, *EGU General Assembly, 2007*
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## Student supervision

### PhD

- **Completed projects**

- Matthews, Kara, **2010 - 2014** (auxiliary supervisor; with R.D. Müller & M. Seton), *Geologic and kinematic consequences of major plate boundary reorganisations*
- Zahirovic, Sabin, **2011 - 2015** (auxiliary supervisor; with R.D. Müller & M. Seton), *Post-Pangea global plate kinematics and geodynamic implications for Southeast Asia*

- **Ongoing projects**

- Hassan, Rakib, **2013 -** (auxiliary supervisor; with R.D. Müller & S. Williams), *The effect of plumes on paleotopography: Connecting global plate-mantle models with observations*
- Barnett-Moore, Nicholas, **2013 -** (auxiliary supervisor; with R.D. Müller & S. Williams), *Quantifying paleotopography along rifted margins from the geological record and solid Earth models*
- Tetley, Michael, **2014 -** (auxiliary supervisor; with R.D. Müller & S. Williams), *The co-evolution of plate tectonics and the deep Earth: Understanding lower mantle structures and their relationship with continental configuration over the past 1 billion years*
- Cao, Wenchao, **2015 -** (auxiliary supervisor; with R.D. Müller & S. Zahirovic), *The paleogeographic evolution of Australia and Asia in the Paleozoic and Mesozoic periods in a global context*
- Ding, Xuesong, **2015 -** (primary supervisor; with T. Salles & P. Rey), *Stratigraphy 2.0: Influence of dynamic topography on long-term sea level change*
- Arnould, Maëlis, **2015 -** (primary supervisor in Sydney; with N. Coltice & R.D. Müller), *Evolution of true polar wander and large-scale topography since the Jurassic*
- Xianzhi Cao, **2016 -** (auxiliary supervisor; with R.D. Müller & S. Li), *Dynamic ups and downs of the North China Craton*

### Honours (primary supervisor)

- **Completed projects**

- Healy, Jack, **2011 - 2012**, *Changes in heat flux at the core-mantle boundary and possible causes of geomagnetic superchrons - Second class Honours (1)*
  - Young, Alexander, **2011**, *Tectonic reconstruction of Patagonia during the break-up of western Gondwana - First class Honours*
  - Leonard, Jonathon, **2015**, *Influence of mantle convection on the topographic evolution of Tethyan orogens - First class Honours.*
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## Academic service

- IT Liaison for the School of Geosciences, **2015-**
  - Coordinator of paper discussions for the EarthByte Research Group [www](#) (~20-30 people) **2013 - 2015**
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## Media experience

- Comment on a scientific article in *Early life built Earth's continents*, *New Scientist*, 20 November 2013 [www](#)
- Comment on a scientific article in *The secret lives of passive margins include more than sea-level change*, *Earth Magazine*, September 2013.
- *Ancient Earth was a barren waterworld*, article about Flament et al. (2008) in the *New Scientist*, 30 December 2008 [www](#)

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## Miscellaneous

### Experience as peer-reviewer - publications

- *Nature Communications*
- *Nature Geoscience*
- *Gondwana Research*
- *Earth and Planetary Science Letters*
- *Geology*
- *Geochemistry, Geophysics, Geosystems*
- *Lithosphere*
- *Physics of the Earth and Planetary Interiors*
- *Geophysical Journal International*
- *Solid Earth*
- *Journal of Geodynamics*
- *Australian Journal of Earth Sciences*
- *Journal of Asian Earth Sciences*

### Experience as peer-reviewer - research proposals

- *National Science Foundation (Cooperative Studies Of The Earth's Deep Interior)*
- *European Research Council (Advanced Grants)*
- *Centre National de la Recherche Scientifique (Institut National des Sciences de l'Univers)*

### Professional Affiliations

- American Geophysical Union
- European Geosciences Union
- Geological Society of Australia
- Geochemical Society

### Computer skills

- Finite elements modeling: Ellipsis3D, CitcomS
- Programming: bash, Python, Fortran
- Mapping/GIS: GMT
- Other: L<sup>A</sup>T<sub>E</sub>X

### Language skills

- French - native
- English - fluent

### Hobbies

- Sports: basketball (competitive), swimming, squash, cycling

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## Referees

Prof. Dietmar Müller  
Postdoctoral mentor **2010 -**  
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