

I am an Assistant Professor in the Centre for Mechanochemical Cell Biology (CMCB) at Warwick Medical School (WMS). As an experimental biophysicist, I am interested in cell surface mechanics, with a focus on understanding the physical principles underlying the interactions between the plasma membrane and the actin cortex. After training as a physicist at the University of Leipzig (GER), I got interested in biophysics and cell surface mechanics during a master's project at the Institut Curie (FRA). This developed into a joint PhD project between the groups of Patricia Bassereau, Christophe Lamaze and Josef Käs which showed that caveolae, small plasma membrane invaginations, act as a mechanical buffer against cell rupture (Sinha *et al*, 2011). This work had wide impact on the biophysics, cell biology and medical communities, and opened new avenues in our understanding of cell membrane mechanics and caveolae as mechano-sensors. For my post-doc I joined the group of Satyajit Mayor at the National Centre for Biological Sciences (IND) where I also worked closely with theoretical physicist Madan Rao. Supported by an AXA research fund postdoc fellowship, I developed reconstituted membrane-bound actomyosin networks to study the organisation of active networks and their effect on the dynamics and clustering of membrane proteins (Köster *et al*, 2016). During this time, I visited for four summers the Marine Biology Laboratory at Woods Hole (USA) which helped to expand further my international network and led to new collaborations (Ditlev *et al*, 2019). Following a short postdoctoral position with Mohan Balasubramanian at Warwick establishing minimal systems to study molecular aspects of the cytokinetic ring machinery in yeast, I started my independent cross-disciplinary research group in October 2018 as a member of the Wellcome-Warwick Quantitative Biomedical Program. With this appointment, I had now the opportunity to define my own research program and to focus on the interconnection of cell membrane mechanics, cell cortex dynamics and signalling by combining reconstituted, biomimetic systems and the study of live cells in controlled mechanical environments. Within the CMCB I worked together with Marco Polin (Physics) to develop an automated tracking routine following myosin II filament dynamics within actin networks recorded using iSCAT microscopy at the Kukura lab (Oxford University). Together with the Balasubramanian lab we identified a protein motif that generates tightly bent actin filament rings within planar lipid membranes (Palani *et al*, 2021). The set of publications highlighted above were all recommended by Faculty Opinions for their quality and originality. I recently secured a New Investigator Award by EPSRC to study shape dynamics of giant liposomes connected to actomyosin networks and my ambition is to continue to produce high quality research by building and training a team of excellent scientists with strengths in different disciplines ranging from physics, biochemistry, and biology, who efficiently work together to tap the full potential of cross-disciplinary collaboration. Currently, 4 PhD students supported by UKRI and the university are working in the DK lab.

Ditlev JA, Vega AR, Köster DV, Su X, Tani T, Lakoduk AM, Vale RD, Mayor S, Jaqaman K & Rosen MK (2019) A composition-dependent molecular clutch between T cell signaling condensates and actin. *Elife* 8:e42695

Köster DV, Husain K, Iljazi E, Bhat A, Bieling P, Mullins RD, Rao M & Mayor S (2016) Actomyosin dynamics drive local membrane component organization in an in vitro active composite layer. *Proc Natl Acad Sci* 113: E1645–E1654

Palani S, Ghosh S, Ivorra-Molla E, Clarke S, Suchenko A, Balasubramanian MK & Köster DV (2021) Calponin-homology domain mediated bending of membrane-associated actin filaments. *Elife* 10

Sinha B, Köster D, Ruez R, Gonnord P, Bastiani M, Abankwa D, Stan R V., Butler-Browne G, Védie B, Johannes L, *et al* (2011) Cells respond to mechanical stress by rapid disassembly of caveolae. *Cell* 144: 402–13

Darius Vasco Köster

Address: Warwick University, Gibbet Hill, Coventry, CV4 7AL, U.K.

Tel: +44(0)2476575599

Email: D.Koester@warwick.ac.uk

orcid ID: 0000-0001-8530-5476

Google-scholar: <https://scholar.google.com/citations?user=N444rf4AAAAJ&hl=en>

Academic Experience

- 2018 **Assistant Professor** at Warwick Medical School, Biomedical Sciences, Biophysics of the cell cortex – plasma membrane interface. **Tenure track position**
- 2017–18 **Research Fellow** in the laboratory of Prof. M. Balasubramanian, Warwick Medical School, Biomedical Sciences
- 2011–17 **Research Fellow** in the laboratory of Prof. S. Mayor, National Centre for Biological Sciences (Bangalore, IN) supported by an AXA research fund fellowship and an NCBS fellowship
- 2007–10 **Ph.D. project** in the laboratories of Dr. P. Bassereau and Dr. C. Lamaze, Institut Curie (Paris, FR) supported by an Institut Curie International PhD fellowship
Thesis: Role of Caveole in Membrane Tension
-

Education

- Sep 2010 Dr. rer. nat., Physics (Leipzig University (GE) and University Pierre et Marie Curie, Paris (FR)). Advisors: P. Nassoy (Institut Curie), J. Käs (Leipzig University), Degree with 'summa cum laude'
- Dec 2006 Diplom (M.Sc.) in Physics from Leipzig University
- Oct 2002 enrolment at Leipzig University (GE)
- Jul 2001 *Abitur* (high school diploma) at the *Gymnasium zum Grauen Kloster* in Berlin (GE)
-

Research funding

- 2022-25 EPSRC-New Investigator Award (£597,117, EP/V043498/1)
- 2020-21 BBSRC-ALERT19 (Co-I, £516,907, BB/T018070/1)
- 2020 Warwick Global Research Project fund (£4,500)
- 2019 Warwick Research Development Fund (£24,803)
- Royal Society Research Grant (£18,948, RG S\R2\192442)
- 2018-23 Start-up grant from WMS (£130,000)

Post-doctoral fellowships: Reconstructing the cell surface in a test tube - **NCBS Campus fellow** (2013, £65000); Deciphering the role of active remodeling of cortical actin on the spatiotemporal organization of cell surface molecules using an in vitro assay - **AXA Fellowship** (2011, £105.000)

Conference grants: **EMBO** conference grant (2017, £26000, main organizer); **DFG** (German science foundation) conference grant (2015, £17000, co-organizer), **Wellcome Trust/ DBT** (Department of Biotechnology, Govt. of India) outreach grant (2015, £11000, main organizer), **ICTS** (International Centre for Theoretical Sciences) conference grant (2015, £20000, main organizer), **ICTS** conference grant (2013, £25000, main organizer)

Ph.D.: scholarship of the Institut Curie for foreign PhD candidates; **studies:** scholarship of the *Studienstiftung des deutschen Volkes* (stipend and expenses for books and workshops)

Awards

- Sep 2016 Zeeshan Memorial best paper Award
- Sep 2016 travel award of the Company of Biologists to visit the Kukura lab in Oxford
- Mar 2016 best poster award at OWLS (Optics within Life Sciences), Mumbai
- Dec 2014 IUBMB travel award to attend the ASCB meeting, Philadelphia
- Sep 2014 FEBS letters best poster award at EMBO/FEBS conference, Paris
- Sep 2014 FEBS travel award to attend the EMBO/FEBS conference, Paris
- Feb 2014 travel award by the Department of Science and Technology, Govt. of India
-

Other Activities

Reviewer for the journals *Nature*, *eLife*, *Proceedings of the National Academy of Sciences* (USA), *Nature Communications Biology*, and *Nanoscale* of the Royal Society of Chemistry and for grant proposals from *EPSRC*, and the *Israel Science Foundation*.

Invited talks

Jul 2021 Molecular and Nanoscale Physics Group Seminar, University of Leeds, UK
Jul 2021 Bangalore Microscopy Course, NCBS, Bangalore (virtual)
Mar 2020 Kennedy Institute of Rheumatology, University of Oxford, UK
Feb 2020 Annual Meeting of the Biophysical Society, San Diego, UK
Mar 2019 University of Dundee, School of Life Science, UK
Jan 2019 'Reconstitution of Cell Cytoskeleton in vitro' CoB Workshop, Wiston house, UK
Feb 2018 Kent University, School of Biosciences, Canterbury, UK
Dec 2016 Max Planck Institute- Intelligent Systems, Stuttgart, GE
Jun 2016 University Geneva, Biochemistry Department, CH
Jun 2016 Gordon Research Conference – Bio Interfaces, Les Diablerets, CH
Apr 2016 Centre for Mechanochemical Cell Biology, Warwick University, UK
Apr 2016 Francis Crick Institute, London, UK
Apr 2016 King's College London, Randall Division, UK
Feb 2016 Mini-Symposium *Mechanobiology*, Biophysical Society meeting, L.A., USA

Most Relevant Peer Reviewed Publications (**important, #equal contribution)

1. Al-Izzi SC, **Köster DV**[#], & Morris RG[#]. (2021). ATP Controls the Mode of Actomyosin Remodelling. 1–6. <https://doi.org/http://arxiv.org/abs/2108.00764>
 2. **Palani S, Balasubramanian MK, **Köster DV**. (2020) Calponin-Homology Domain mediated bending of membrane associated actin filaments. *eLife*, doi: 10.7554/eLife.61078
 3. **Köster DV**. (2020) Pulling of tethers from the cell plasma membrane using Optical Tweezers. In CM Blouin (Ed.), *Caveolae - Methods and Protocols* (Vol. 2169). Springer.
 4. **Mosby L[#], Hundt N[#], Young G, Fineberg A, Polin M, Mayor S, Kukura P, **Köster D**. (2020) Visualization of myosin II filament dynamics in remodeling acto-myosin networks using interferometric scattering microscopy, *Biophysical Journal*. doi:10.1016/j.bpj.2020.02.025
 5. Das A, Bhat A, Sknepnek R, **Köster D**, Mayor S, Rao M. (2020). Assemblies of F-actin and myosin-II minifilaments: steric hindrance and stratification at the membrane cortex. *Science Advances*, doi: 10.1126/sciadv.aay6093
 6. Palani S, **Köster D**, Hatano T, Kamnev A, Kanamaru T, Brooker HR, Hernandez-Fernaund JR, Jones AME, Millar JBA, Mulvihill DP, Balasubramanian MK. (2019) Phospho-regulation of tropomyosin is crucial for actin cable turnover and division site placement in fission yeast. *J. Cell Biol.* doi: 10.1083/jcb.201809089
 7. **Ditlev JA[#], Vega AR[#], **Köster DV**[#], Su X, Tani T, Lakoduk AM, Vale RD, Mayor S, Jaqaman K, Rosen MK. (2019) A Composition-Dependent Molecular Clutch Between T Cell Signaling Clusters and Actin. *eLife*. doi: 10.7554/eLife.42695
 8. Dewulf M, **Köster D**, Sinha B, Lesegno C V de, Chambon V, Bigot A, Tardif N, Johannes L, Nassoy P, Butler-Browne G, Lamaze C, Blouin C M. (2019) Dystrophy-associated caveolin-3 mutations reveal that caveolae couple IL6/STAT3 signaling with mechanosensing in human muscle cells. *Nat. Commun.* Doi: 10.1038/s41467-019-09405-5
 9. **Köster DV**, Mayor S. (2016) Cortical actin and the plasma membrane: inextricably intertwined. *Curr. Opin. Cell Biol.* doi: 10.1016/j.ceb.2016.02.021
 10. ****Köster DV**, Husain K, Iljazi E, Bhat A, Bieling P, Mullins RD, Rao M, Mayor S. (2016) Actomyosin dynamics drive local membrane component organization in an in vitro active composite layer. *Proc. Natl. Acad. Sci. USA.* doi:10.1073/pnas.1514030113.
 11. Campillo C, Sens P, **Köster D**, Pontani LL, Lévy D, Bassereau P, Nassoy P, Sykes C. (2013) Unexpected Membrane Dynamics Unveiled by Membrane Nanotube Extrusion. *Biophys. J.* doi: 10.1016/j.bpj.2013.01.051
 12. **Sinha B[#], **Köster D**[#], Ruez R, Gonnord P, Bastiani M, Abankwa D, Stan RV, Butler-Browne G, Védie B, Johannes L, Morone N, Parton RG, Raposo G, Sens P, Lamaze C, Nassoy P. (2011) Cells respond to mechanical stress by rapid disassembly of caveolae. *Cell.* doi: 10.1016/j.cell.2010.12.031
-