

Block, Stephan, Dr.

Leader of the Emmy Noether Junior Research Group „Bionanointerfaces“

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Date of birth: July 12, 1978 (in Brandenburg an der Havel)
married, 1 daughter (born 2011)

Educational Background

- 08/2005-12/2010 Doctorate (**Dr. rer. nat.**, Applied Physics, grade: *summa cum laude*) at the University of Greifswald (Germany) in the lab of Prof. Dr. C. A. Helm („Soft Matter and Biophysics“)
- 10/1999-07/2005 **Diploma** in Physics (Applied Physics, grade: *excellent*) at the University of Greifswald (Germany) in the lab of Prof. Dr. U. Lübbert („Sensors and Signal Processing“)

Work Experience and Research Projects

- since 03/2016 **Junior Group Leader** at the Department of Chemistry and Biochemistry, *Freie Universität Berlin, Berlin, Germany*; Funding supported by the Focus Area Nanoscale, the CRC 765, and the Emmy Noether Programme of the German Science Foundation
- Application of mobility analyses to quantify multivalent virus-receptor interactions and their modification by virus (binding) inhibitors
 - Development of a massively parallelized force spectroscopy platform using shear forces generated within microfluidic channels
- 08/2013-02/2016 **PostDoc** in the lab of Prof. Dr. F. Höök („Biological Physics“), Department of Physics, *Chalmers University of Technology, Göteborg, Sweden*
- Application of single particle tracking, nanoplasmonically enhanced fluorescence correlation spectroscopy, and microfluidics to quantify multivalent interactions
 - Pioneered the application of mobility analyses to quantify the valency of multivalent interactions or the hydrodynamic forces acting on bilayer-linked particles
 - Studied diffusion of single lipids and lipid-lipid complexes in bilayers with nm (spatial) and μ s (temporal) resolution by combining fluorescence correlation spectroscopy, nanoplasmonics, and autocorrelative burst analysis
- 09/2011-07/2013 **PostDoc** in the lab of Dr. M. Delcea („Nanostructure Group“), ZIK HIKE, *University Medicine Greifswald, Germany*
- Biophysical characterization of proteins, protein complexes, and cells to study molecular fundamentals of autoimmune diseases
 - Development of *in vitro* assays to predict the antigenic potential of polymers
- 07/2010-08/2011 **Independent project leader**, associated to the lab of Prof. Dr. C. A. Helm („Soft Matter and Biophysics“), Institute of Physics, *University of Greifswald, Germany*
- Development of a novel AFM approach that allows magnetic properties of single superparamagnetic nanoparticles to be quantified on the nm-scale
- 08/2005-06/2010 **Research Assistant** in the lab of Prof. Dr. C. A. Helm („Soft Matter and Biophysics“), Institute of Physics, *University of Greifswald, Germany*
- Development of AFM approaches to determine the conformation of physisorbed polyelectrolytes from the measurement of surface forces

Third-party Funding and Awards

since 2017	Emmy Noether Programme of the German Science Foundation (1.3 Mio €)
2011	Dissertation Award 2011 of the University of Greifswald
2010	1st price of the idea competition VentureCup-MV 2010, category “young scientist” (130,000 € project funding provided by the European Social Fund)
2009	3rd price of the idea competition of the University of Greifswald

Memberships and Professional Service

- Memberships
 - **Associated Member** of the CRC 765 (since 2016) and CRC 1078 (since 2017)
 - **Member** of the German Physical Society (DPG) since 1999
- **Referee** for peer-reviewed journals
ACS Applied Materials & Interfaces, Europhysics Letters, International Journal of Nanomedicine, International Journal of Molecular Sciences, Journal of Alloys and Compounds, Journal of Pharmaceutics and Biopharmaceutics, Journal of Physical Chemistry, Journal of Physics D, Langmuir, JoVE, Macromolecules, Nano Letters, Nature Medicine, Sensors, Surface Review and Letters, Ultramicroscopy

Student Supervision

- Supervisor for **doctoral** and **Bachelor** level students at the *Freie Universität Berlin*
Matthias Müller (doctoral student since 2017; organic chemistry), *Lisa Glinzig* (Bachelor student in 2018; biochemistry)
- Co-supervision of **doctoral** students at *Chalmers University of Technology*
Björn Johansson Fast (2014 – 2016; biophysics)
- Co-supervision of **doctoral** students at the *University of Greifswald*
Florian Berg (2010 – 2015; applied physics), *Frank Lawrenz* (2010 – 2016; applied physics), *Sven Brandt* (2011 – 2012; biophysics), *Michael Glaubitz* (2011 – 2012; biophysics)
- Co-supervision of **diploma** students at the *University of Greifswald*
Matthias Cornelsen (2009 – 2010; applied physics), *Peter Nestler* (2009 – 2010; applied physics)

Teaching

Winter 2017	Support of the lecture Biophysics for Bachelor at the <i>Freie Universität Berlin</i> (equivalent to 2 hours per week per semester)
Winter 2014 + Winter 2015	Support of the lecture Biophysics at <i>Chalmers University of Technology</i>
Winter 2005 – Summer 2009	Teaching Assistant for courses on experimental physics (mechanics, optics, electrodynamics, thermodynamics, structure of matter) at the <i>University of Greifswald</i> (8 semesters in total with 2 hours per week per semester)

List of Publications

Research Articles (* marks corresponding authors, # marks equal contribution)

1. Runde, S.; Ahrens, H.; Lawrenz, F.; Sebastian, A.; **Block, S.**; Helm, C.A.* Stable 2D conductive Ga/Ga(OxHy) multilayers with controlled nanoscale thickness prepared from gallium droplets with oxide skin. *accepted, Advanced Materials Interfaces* (2018).
2. Peerboom, N.#; Schmidt, E.#; Trybal, E.; **Block, S.**; Bergström, T.; Pace, H.; Bally, M.* A cell membrane derived platform to study virus binding kinetics with single particle sensitivity. *accepted, ACS Infectious Diseases* (2018).
3. Parveen, N.; Rimkute, I.; **Block, S.**; Rydell, G.; Midtvedt, D.; Larsson, G.; Hytönen, V.; Zhdanov, V.P.; Lundgren, A.; Höök, F.* Membrane deformation induces clustering of norovirus bound to glycosphingolipids in a supported cell-membrane mimic. *Journal of Physical Chemistry Letters, accepted, doi: 10.1021/acs.jpcllett.8b00433* (2018).
4. **Block, S.***; Acimovic, S.S.; Länk, N.O.; Käll, M.*; Höök, F.* Antenna-enhanced fluorescence correlation spectroscopy resolves calcium-mediated lipid-lipid-interactions. *ACS Nano* **12**, 3272-3279 (2018).
5. Lundgren, A.O.#; Johansson Fast, B.#; **Block, S.**; Agnarsson, B.; Reimhult, E.; Gunnarsson, A.; Höök, F.* Affinity purification of membrane proteins in native supported membranes. *Nano Letters* **18**, 381-385 (2018).
6. Jumeaux, C.; Wahlsten, O.; **Block, S.**; Kim, E.; Chandrawati, R.; Howes, P.D.; Höök, F.*; Stevens, M.M.* MicroRNA Detection by DNA-Mediated Liposome Fusion Using a 3D Single Vesicle Tracking FRET Assay. *ChemBioChem* **19**, 434-438 (2018).
7. Peerboom, N.; **Block, S.**; Altgärde, N.; Wahlsten, O.; Schnabelrauch, M.; Bergström, T.; Bally, M.* Binding kinetics and lateral mobility of herpes simplex virus type 1 on end-grafted sulfated glycosaminoglycans. *Biophysical Journal* **113**, 1223-1234 (2017).
8. Parveen, N.; **Block, S.**; Zhdanov, V.P.; Rydell, G.; Höök, F.* Release and Inhibition of Virus by Competitive Protein. *Langmuir* **33**, 4049-4056 (2017).
9. Friedrich, R.; **Block, S.**; Alizadehheidari, M.; Heider, S.; Fritzsche, J.; Esbjörner, E.; Westerlund, F.*; Bally, M.* A nano flow cytometer for single lipid vesicle analysis. *Lab on a Chip* **17**, 830-841 (2017).
10. Berg, J.#; **Block, S.#**; Höök, F.; Brzezinski, P. Single proteoliposomes with E. coli quinol oxidase: proton pumping without transmembrane leaks. *Israel Journal of Chemistry* **57**, 437-445 (2017).
11. Rupert, D.L.M.; Shelke, G.V.; Emilsson, G.; Claudio, V.; **Block, S.**; Lässer, C.; Dahlin, A.; Lötvall, J. O.; Bally, M.; Zhdanov, V.P.; Höök, F.* Dual-wavelength surface plasmon resonance for determining the size and concentration of sub-populations of extracellular vesicles. *Analytical Chemistry* **88**, 9980-9988 (2016).
12. Tabaei, S.R.; Gillissen, J.J.J.; **Block, S.**; Höök, F. & Cho, N.-J.* Hydrodynamic propulsion of liposomes electrostatically attracted to a lipid membrane reveals size-dependent conformational changes. *ACS Nano* **10**, 8812-8820 (2016).
13. **Block, S.***; Johansson Fast, B.; Lundgren, A.; Zhdanov, V.P.; Höök, F.* Two-dimensional flow nanometry of biological nanoparticles for accurate determination of their size and emission intensity. *Nature Communications* **7**, 12956 (2016).

14. **Block, S.***; Zhdanov, V. P.; Höök, F.* Quantification of multivalent interactions by tracking single biological nanoparticle mobility on a lipid membrane. *Nano Letters* **16**, 4382-4390 (2016).
15. Lawrenz, F.; Lange, P.; Severin, N.; Rabe, J.P.*; Helm, C. A.*; **Block, S.*** Morphology, mechanical stability and protective properties of ultrathin gallium oxide coatings. *Langmuir* **31**, 5836-5842 (2015).
16. Petkovic, S.; Badelt, S.; **Block, S.***; Flamm, C.; Delcea, M.; Hofacker, I.*; Müller, S.* Sequence-controlled RNA self-processing: computational design, biochemical analysis and visualization by AFM. *RNA* **21**, 1-12 (2015).
17. Berg, F.; Wilken, J.; Helm, C.A.*; **Block, S.*** Quantification of radical-induced DNA damage using AFM imaging. *J. Phys. Chem. B* **119**, 25-32 (2015).
18. Kreimann, M.; Brandt, S.; Krauel, K.; **Block, S.**; Helm, C.A.; Weitschies, W.; Greinacher, A.*; Delcea, M.* Binding of anti-platelet factor 4/heparin antibodies depends on the thermodynamics of conformational changes in platelet factor 4. *Blood* **124**, 2442-2449 (2014).
19. Glaubitz, M.; **Block, S.***; Witte, J.; Empen, K.; Gross, S.; Schlicht, R.; Weitmann, K.; Klingel, K.; Kandolf, R.; Hoffmann, W.; Gottschalk, K.E.; Busch, M.; Dörr, M.; Helm, C.A.; Felix, S.B.; Riad, A.* Stiffness of left ventricular cardiac fibroblasts contributes to ventricular dilation in patients with recent-onset non-ischemic and non-valvular cardiomyopathy. *Circulation Journal* **78**, 1693-1700 (2014).
20. Rupert, D.L.M.; Lässer, C.; Eldh, M.; **Block, S.**; Zhdanov, V.P.; Lotvall, J.; Bally, M.; Höök, F.* Determination of exosome concentration in solution using surface plasmon resonance spectroscopy. *Analytical Chemistry* **86**, 5929-5936 (2014).
21. Brandt, S.; Krauel, K.; Gottschalk, K.E.; Renné, T.; Helm, C.A.; Greinacher, A.*; **Block, S.*** Characterization of the conformational changes in platelet factor 4 induced by polyanions: towards *in-vitro* prediction of antigenicity. *Thrombosis and Haemostasis* **112**, 53-64 (2014).
22. **Block, S.***; Greinacher, A.; Helm, C.A.; Delcea, M.* Characterizing bonds formed between platelet factor 4 and negatively charged drugs using single molecule force spectroscopy. *Soft Matter* **10**, 2775-2784 (2014).
23. Jaax, M.E.; Krauel, K.; Marschall, T.; Brandt, S.; Gansler, J.; Fürll, B.; Appel, B.; Fischer, S.; **Block, S.**; Helm, C.A.; Müller, S.; Preissner, K.T.; Greinacher, A.* Complex formation with nucleic acids and aptamers alters antigenic properties of platelet factor 4. *Blood* **122**, 272-281 (2013).
24. Berg, F.; **Block, S.**; Drache, S.; Hippler, R.; Helm, C.A.* The effects of reactive oxygen species on single polycation layers". *J. Phys. Chem. B* **117**, 8475-8483 (2013).
25. Nestler, P.; **Block, S.***; Helm, C.A.* „Temperature-induced transition from odd-even to even-odd effect in polyelectrolyte multilayers due to interpolyelectrolyte interactions. *J. Phys. Chem. B* **116**, 1234-1243 (2012).
26. **Block, S.***; Glöckl, G.; Weitschies, W.; Helm, C.A. Direct visualization and identification of biofunctionalized nanoparticles using a magnetic atomic force microscope. *Nano Letters* **11**, 3587-3592 (2011).
27. **Block, S.***; Helm, C.A. Equilibrium and non-equilibrium features in the morphology and structure of physisorbed polyelectrolyte layers. *J. Phys. Chem. B* **205**, 7301-7313 (2011).

28. Straňák, V.*; **Block, S.**; Drache, S.; Hubička, Z.; Helm, C.A.; Jastrabík, L.; Tichý, M.; Hippler, R. Size-controlled formation of Cu nanoclusters in pulsed magnetron sputtering system. *Surface and Coatings Technology*, **205** 2755-2762 (2011).
29. Ortinau, S.; Schmich, J.; **Block, S.**; Liedmann, A.; Jonas, L.; Weiss, D.G.; Helm, C.A.; Rolfs, A.; Frech, M.J.* Effect of 3D-scaffold formation on differentiation and survival in human neural progenitor cells. *BioMedical Engineering OnLine* **9**, 70 (2010).
30. Cornelsen, M.; Helm, C.A.*; **Block, S.** Destabilization of polyelectrolyte multilayers formed at different temperatures and ion concentrations. *Macromolecules* **43**, 4300-4309 (2010).
31. **Block, S.**; Helm, C.A.* Single polyelectrolyte layers adsorbed at high salt concentrations: polyelectrolyte brush domains coexisting with flatly adsorbed chains. *Macromolecules* **42**, 6733-6740 (2009).
32. Straňák, V.*; Čada, M.; Quaas, M.; **Block, S.**; Bogdanowicz, R.; Kment, Š.; Wulff, H.; Hubička, Z.; Helm, C.A.; Tichý, M.; Hippler, R. Physical properties of homogeneous TiO₂ films prepared by high power impulse magnetron sputtering as a function of crystallographic phase and nanostructure. *J. Phys. D: Appl. Phys.* **42**, 105204 (2009).
33. Agmo Hernandez, V.; Niessen, J.; Harnisch, F.; **Block, S.**; Greinacher, A.; Kroemer, H.K.; Helm, C.A.; Scholz, F.* The adhesion and spreading of thrombocyte vesicles on electrode surfaces. *Bioelectrochemistry* **74**, 210-216 (2008).
34. **Block, S.**; Helm, C.A.* Conformation of poly(styrene sulfonate) layers physisorbed from high salt solution studied by force measurements on two different length scales. *J. Phys. Chem. B* **112**, 9318-9327 (2008). One image of this publication was reused in the book "Surface and Interfacial Forces" of Hans-Jürgen Butt and Michael Kappl.
35. **Block, S.**; Helm, C.A.* Measurement of long-ranged steric forces between polyelectrolyte layers physisorbed from 1 M NaCl. *Phys. Rev. E* **76**, 030801 (2007).
36. **Block, S.**; Gamet, E.; Pigeon, F.* Semiconductor laser with external resonant grating mirror. *IEEE Journal of Quantum Electronics* **41**, 1049-1053 (2005).

Books and Book Chapters

1. **Block, S.** "Imaging and characterization of magnetic micro- and nanostructures using force microscopy" in "Surface science tools for nanomaterials characterization" by C.S.S.R. Kumar (ed.), Springer-Verlag Berlin Heidelberg **2015**. (*book chapter*)
2. **Block, S.**; Soltwedel, O.; Nestler, P.; Helm, C.A. „Polyelectrolyte conformation in and structure of polyelectrolyte multilayers" in "Multilayer thin films: sequential assembly of nanocomposite materials" of Gero Decher and Joseph B. Schlenoff (eds.), Wiley Vch **2012**. (*book chapter*)
3. **Block, S.** "Physik: Formeln, Gesetze und Fachbegriffe" CompactVerlag München **2010**. (*book*)

Patents

1. **Block, S.**; Johansson Fast, B.; Lundgren, A & Höök, F. New method for sorting of nano-objects.
02.12.2016 WO002017093466A1 (**PCT**)
2. **Block, S.** and Helm, C.A. Verfahren zur Messung magnetischer Informationen, insbesondere der magnetischen AC-Suszeptibilität, von magnetischen Nanopartikeln (Markern). (Block 80%, Helm 20%):
29.10.2010 WO002011051449A1 (**PCT**)
30.10.2009 DE102009046267B4 (**Germany**)

Invited Talks

1. **Block, S.** „Motion at biointerfaces: from single-liposome- to single-lipid-assays”. *Annual Meeting of the GRK 1947*, Greifswald **2017**.
2. **Block, S.** „Mobility-based probing of virus-lipid and lipid-lipid interactions”. *TETHMEM: Tethered Membranes*, Vienna **2017**.
3. **Block, S.**; Höök, F. „Two dimensional flow nanometry for simultaneous determination of size and molecular content of biological nanoparticles”. *Nanobiosurfaces and Interfaces*, Leuven **2017**.
4. **Block, S.** „Quantification of proton pumping and weak, multivalent interactions using single-proteoliposome assays”. *Colloquium of the CRC 1078* (FU Berlin), Berlin **2017**.
5. **Block, S.** „Movement of Biological Nanoparticles Linked to Lipid Membranes”. *Colloquium of the Herminghaus lab* (MPI for Dynamics and Self-Organization), Göttingen **2016**.
6. Höök, F.; **Block, S.** „Surface-sensitive imaging of single vesicles and virus particles for diagnostic and drug-discovery applications”. *Colloquium of the Ewers lab* (FU Berlin), Berlin **2015**.
7. **Block, S.** „Different Scaling Behaviour in Mean Field and Scaling Theories Describing Salted Polyelectrolyte Brushes”. *Colloquium of the Fery lab* (University of Bayreuth), Bayreuth **2012**.
8. **Block, S.**; Helm, C. A. „ Conformation of poly(styrene sulfonate) layers physisorbed from different salt solutions: polyelectrolyte brush domains coexisting with flatly adsorbed chains”. *YES (Young European Scientists) Meeting*, Krakow **2010**.