

List of Publications – Prof. Dr. Markus A. Seeger – June 2021

ORIGINAL RESEARCH PAPERS

1. 'Structural insights into the inhibition of glycine reuptake'
A. Shahsavari, P. Stohler, G. Bourenkov, I. Zimmermann, M. Siegrist, W. Guba, E. Pinard, S. Sinning, **M.A. Seeger**, T.R. Schneider, R.J.P. Dawson, and P. Nissen
Nature, 2021. 591(7851): p. 677-+.
2. 'An improved fluorescent tag and its nanobodies for membrane protein expression, stability assay, and purification'
H. Cai, H. Yao, T. Li, C.A.J. Hutter, Y. Li, Y. Tang, **M.A. Seeger**, and D. Li
Commun Biol, 2020. 3(1): p. 753.
3. 'Selection, biophysical and structural analysis of synthetic nanobodies that effectively neutralize SARS-CoV-2'
T.F. Custodio, H. Das, D.J. Sheward, L. Hanke, S. Pazicky, J. Pieprzyk, M. Sorgenfrei, M.A. Schroer, A.Y. Gruzinov, C.M. Jeffries, M.A. Graewert, D.I. Svergun, N. Dobrev, K. Remans, **M.A. Seeger**, G.M. McInerney, B. Murrell, B.M. Hallberg, and C. Low
Nat Commun, 2020. 11(1): p. 5588.
4. 'The ABC exporter IrtAB imports and reduces mycobacterial siderophores'
F.M. Arnold, M.S. Weber, I. Gonda, M.J. Gallenito, S. Adenau, P. Egloff, I. Zimmermann, C.A.J. Hutter, L.M. Hürlimann, E.E. Peters, J. Piel, G. Meloni, O. Medalia, and **M.A. Seeger***
Nature, 2020. 580(7803): p. 413-417
5. 'Generation of synthetic nanobodies against delicate proteins'
I. Zimmermann, P. Egloff, C.A.J. Hutter, B.T. Kuhn, P. Bräuer, S. Newstead, R.J.P. Dawson, E.R. Geertsma*, and **M.A. Seeger***
Nat Protoc, 2020. 15(5): p. 1707-1741
6. 'Biotinylation of Membrane Proteins for Binder Selections'
B.T. Kuhn, I. Zimmermann, P. Egloff, L.M. Hürlimann, C.A.J. Hutter, C. Miscenic, R.J.P. Dawson, **M.A. Seeger***, and E.R. Geertsma*
Methods Mol Biol, 2020. 2127: p. 151-165.
7. 'The structure of the Legionella response regulator LqsR reveals amino acids critical for phosphorylation and dimerization'
R. Hochstrasser, C.A.J. Hutter, F.M. Arnold, K. Barlocher, **M.A. Seeger**, and H. Hilbi
Mol Microbiol, 2020. p.
8. 'Spin-labeled nanobodies as protein conformational reporters for electron paramagnetic resonance in cellular membranes'
L. Galazzo, G. Meier, M.H. Timachi, C.A.J. Hutter, **M.A. Seeger***, and E. Bordignon*
Proc Natl Acad Sci U S A, 2020. 117(5): p. 2441-2448.
9. 'Mycobacterium marinum produces distinct mycobactin and carboxymycobactin siderophores to promote growth in broth and phagocytes'
P. Knobloch, H. Koliwer-Brandl, F.M. Arnold, N. Hanna, I. Gonda, S. Adenau, N.

- Personnic, C. Barisch, **M.A. Seeger**, T. Soldati, and H. Hilbi
Cell Microbiol, 2020. p. e13163.
10. 'The extracellular gate shapes the energy profile of an ABC exporter'
C.A.J. Hutter, M.H. Timachi, L.M. Hurlimann, I. Zimmermann, P. Egloff, H. Goddeke, S. Kucher, S. Stefanic, M. Karttunen, L.V. Schafer, E. Bordignon*, and **M.A. Seeger***
Nat Commun, 2019. 10(1): p. 2260-
 11. 'Identification of conformation-selective nanobodies against the membrane protein insertase BamA by an integrated structural biology approach'
H. Kaur, J.B. Hartmann, R.P. Jakob, M. Zahn, I. Zimmermann, T. Maier, **M.A. Seeger**, and S. Hiller
J Biomol NMR, 2019.
 12. 'Engineered peptide barcodes for in-depth analyses of binding protein libraries'
P. Egloff, I. Zimmermann, F.M. Arnold, C.A.J. Hutter, D. Morger, L. Opitz, L. Poveda, H.A. Keserue, C. Panse, B. Roschitzki, and **M.A. Seeger***
Nat Methods, 2019.
 13. 'Structural basis for pH-dependent retrieval of ER proteins from the Golgi by the KDEL receptor'
P. Bräuer, J.L. Parker, A. Gerondopoulos, I. Zimmermann, **M.A. Seeger**, F.A. Barr, and S. Newstead
Science, 2019. 363(6431): p. 1103-1107.
 14. 'Increased drug permeability of a stiffened mycobacterial outer membrane in cells lacking MFS transporter Rv1410 and lipoprotein LprG'
M. Hohl#, S. Remm#, H.A. Eskandarian, M. Dal Molin, F.M. Arnold, L.M. Hürlimann, A. Krügel, G.E. Fantner, P. Sander, and **M.A. Seeger***
Mol Microbiol, 2019.
 15. 'A Library-Based Screening Strategy for the Identification of DARPins as Ligands for Receptor-Targeted AAV and Lentiviral Vectors'
J. Hartmann, R.C. Munch, R.T. Freiling, I.C. Schneider, B. Dreier, W. Samukange, J. Koch, **M.A. Seeger**, A. Pluckthun, and C.J. Buchholz
Mol Ther Methods Clin Dev, 2018. 10: p. 128-143.
 16. 'A uniform cloning platform for mycobacterial genetics and protein production'
F.M. Arnold, M. Hohl, S. Remm, H. Koliwer-Brandl, S. Adenau, S. Chusri, P. Sander, H. Hilbi, and **M.A. Seeger***
Sci Rep, 2018. **8**.
 17. 'Synthetic single domain antibodies for the conformational trapping of membrane proteins'
I. Zimmermann#, P. Egloff#, C.A. Hutter, F.M. Arnold, P. Stohler, N. Bocquet, M.N. Hug, S. Huber, M. Siegrist, L. Hetemann, J. Gera, S. Gmur, P. Spies, D. Gyax, E.R. Geertsma*, R.J. Dawson*, and **M.A. Seeger***
Elife, 2018. **7**.

18. 'Atomistic Mechanism of Large-Scale Conformational Transition in a Heterodimeric ABC Exporter'
H. Göddeke, M.H. Timachi, C.A.J. Hutter, L. Galazzo, **M.A. Seeger**, M. Karttunen, E. Bordignon, and L.V. Schafer
J Am Chem Soc, 2018. 140(13): p. 4543-4551.
19. 'Structural insights into Legionella RidL-Vps29 retromer subunit interaction reveal displacement of the regulator TBC1D5'
K. Bärlocher, C.A.J. Hutter, A.L. Swart, B. Steiner, A. Welin, M. Hohl, F. Letourneur, **M.A. Seeger***, and H. Hilbi*
Nat Commun (2017) 8(1): p. 1543.
20. 'Non-invasive in vivo imaging of tumour-associated cathepsin B by a highly selective inhibitory DARPIn'
L. Kramer, M. Renko, J. Završnik, D. Turk, **M.A. Seeger**, O. Vasiljeva, M.G. Grutter, V. Turk, and B. Turk
Theranostics (2017) 7(11): p. 2806-2821.
21. 'Split tasks of asymmetric nucleotide-binding sites in the heterodimeric ABC exporter EfrCD'
L.M. Hürlimann, M. Hohl, and **M.A. Seeger***
FEBS J (2017) 284(11): p. 1672-1687.
22. 'Exploring conformational equilibria of a heterodimeric ABC transporter'
M.H. Timachi#, C.A. Hutter#, M. Hohl, T. Assafa, S. Böhm, A. Mittal, **M.A. Seeger***, and E. Bordignon*
Elife (2017) 6.
23. 'The heterodimeric ABC transporter EfrCD mediates multidrug efflux in *Enterococcus faecalis*'
L.M. Hürlimann, V. Corradi, M. Hohl, G.V. Bloemberg, D.P. Tieleman and **M.A. Seeger***
Antimicrobial Agents and Chemotherapy (2016), Aug 22;60(9):5400-11
24. 'A Transporter Motor Taken Apart: Flexibility in the Nucleotide Binding Domains of a Heterodimeric ABC Exporter'
M.A. Bukowska#, M. Hohl#, E.R. Geertsma, L.M. Hurlimann, M.G. Grutter*, and **M.A. Seeger***
Biochemistry (2015), 54(19): p. 3086–3099
25. 'Bicistronic mRNAs to Enhance Membrane Protein Overexpression'
J. Marino, M. Hohl, **M.A. Seeger**, O. Zerbe, and E.R. Geertsma
J Mol Biol (2015) 427(4): p. 943-954.
26. 'Coupling of remote alternating-access transport mechanisms for protons and substrates in the multidrug efflux pump AcrB'
T. Eicher#, **M.A. Seeger#**, C. Anselmi#, W. Zhou, L. Brandstätter, F. Verrey, K. Diederichs, J.D. Faraldo-Gomez, and K.M. Pos
Elife (2014), 3

27. 'Structural basis for allosteric cross-talk between the asymmetric nucleotide binding sites of a heterodimeric ABC exporter'
M. Hohl, L.M. Hürlimann, S. Böhm, J. Schöppe, M.G. Grütter, E. Bordignon, and **M.A. Seeger***
Proc Natl Acad Sci U S A (2014) 111(30): p.11025-30
28. 'Design, construction, and characterization of a second-generation DARPIn library with reduced hydrophobicity'
M.A. Seeger*, R. Zbinden#, A. Flütsch#, P.G. Gutte#, S. Engeler, H. Roschitzki-Voser, and M.G. Grütter
Protein Sci (2013) 22(9): p. 1239-57
29. 'Tuning the drug efflux activity of an ABC transporter *in vivo* by *in vitro* selected DARPIn binders'
M.A. Seeger*, A. Mittal, S. Velamakanni, M. Hohl, S. Schauer, I. Salaa, M.G. Grütter, and H.W. van Veen*
PLoS One (2012) 7 (6): p. e37845.
30. 'Asymmetry in the homodimeric ABC transporter MsbA recognized by a DARPIn'
A. Mittal, S. Böhm, M.G. Grütter, E. Bordignon*, and **M.A. Seeger***
J Biol Chem (2012) 287(24): p. 20395-406.
31. 'Crystal structure of a heterodimeric ABC transporter in its inward-facing conformation'
M. Hohl, C. Briand, M.G. Grütter*, and **M.A. Seeger***
Nat Struct Mol Biol (2012) 19(4): p. 395-402.
32. 'Transport of drugs by the multidrug transporter AcrB involves an access and a deep binding pocket that are separated by a switch-loop'
T. Eicher#, H.J. Cha#, **M.A. Seeger#**, L. Brandstätter, J. El-Delik, J.A. Bohnert, W.V. Kern, F. Verrey, M.G. Grütter, K. Diederichs, and K.M. Pos
Proc Natl Acad Sci U S A (2012) 109(15): p. 5687-92.
33. 'Analysis of AcrB and AcrB/DARPIn ligand complexes by LILBID MS'
L. Brandstätter, L. Sokolova, T. Eicher, **M.A. Seeger**, C. Briand, H.J. Cha, M. Cernescu, J. Bohnert, W.V. Kern, B. Brutschy, and K.M. Pos
Biochim Biophys Acta (2011) 1808(9): p. 2189-96.
34. 'Designed ankyrin repeat protein binders for the crystallization of AcrB: plasticity of the dominant interface'
N. Monroe, G. Sennhauser, **M.A. Seeger**, C. Briand, and M.G. Grütter
J Struct Biol (2011) 174(2): p. 269-81.
35. 'A multidrug ABC transporter with a taste for salt'
S. Velamakanni, C.H. Lau, D.A. Gutmann, H. Venter, N.P. Barrera, **M.A. Seeger**, B. Woebking, D. Matak-Vinkovic, L. Balakrishnan, Y. Yao, E.C. U, R.A. Shilling, C.V. Robinson, P. Thorn, and H.W. van Veen
PLoS One (2009) 4(7): p. e6137.

36. 'Crucial role of Asp408 in the proton translocation pathway of multidrug transporter AcrB: evidence from site-directed mutagenesis and carbodiimide labeling'
M.A. Seeger, C. von Ballmoos, F. Verrey, and K.M. Pos
Biochemistry (2009) 48(25): p. 5801-12.
37. 'Mass spectrometry of membrane transporters reveals subunit stoichiometry and interactions'
N.P. Barrera, S.C. Isaacson, M. Zhou, V.N. Bavro, A. Welch, T.A. Schaedler, **M.A. Seeger**, R.N. Miguel, V.M. Korkhov, H.W. van Veen, H. Venter, A.R. Walmsley, C.G. Tate, and C.V. Robinson
Nat Methods (2009) 6(8): p. 585-7.
38. 'Functional role of transmembrane helix 6 in drug binding and transport by the ABC transporter MsbA'
B. Woecking, S. Velamakanni, L. Federici, **M.A. Seeger**, S. Murakami, and H.W. van Veen
Biochemistry (2008) 47(41): p. 10904-14.
39. 'Engineered disulfide bonds support the functional rotation mechanism of multidrug efflux pump AcrB'
M.A. Seeger, C. von Ballmoos, T. Eicher, L. Brandstatter, F. Verrey, K. Diederichs, and K.M. Pos
Nat Struct Mol Biol (2008) 15(2): p. 199-205.
40. 'Site-directed mutagenesis reveals putative substrate binding residues in the Escherichia coli RND efflux pump AcrB'
J.A. Bohnert, S. Schuster, **M.A. Seeger**, E. Fahrnich, K.M. Pos, and W.V. Kern
J Bacteriol (2008) 190(24): p. 8225-9.
41. 'Structural asymmetry of AcrB trimer suggests a peristaltic pump mechanism'
M.A. Seeger, A. Schiefner, T. Eicher, F. Verrey, K. Diederichs, and K.M. Pos
Science (2006) 313(5791): p. 1295-8.
42. 'Crystallographic analysis of AcrB'
K.M. Pos, A. Schiefner, **M.A. Seeger**, and K. Diederichs
FEBS Lett (2004) 564(3): p. 333-9.
43. 'Cloning of Baeyer-Villiger monooxygenases from *Comamonas*, *Xanthobacter* and *Rhodococcus* using polymerase chain reaction with highly degenerate primers'
J.B. Van Beilen, F. Mourlane, **M.A. Seeger**, J. Kovac, Z. Li, T.H. Smits, U. Fritsche, and B. Witholt
Environ Microbiol (2003) 5(3): p. 174-82.
44. 'New alkane-responsive expression vectors for *Escherichia coli* and *Pseudomonas*'
T.H. Smits, **M.A. Seeger**, B. Witholt, and J.B. van Beilen
Plasmid (2001) 46(1): p. 16-24.

REVIEWS

1. 'From in vitro towards in situ: structure-based investigation of ABC exporters by electron paramagnetic resonance spectroscopy'
E. Bordignon*, **M.A. Seeger***, L. Galazzo, and G. Meier
FEBS Lett, 2020. p.
2. 'Structures of ABC transporters: handle with care'
O. Lewinson*, C. Orelle*, and **M.A. Seeger***
FEBS Lett, 2020. p.
3. 'Membrane transporter research in times of countless structures'
M.A. Seeger*
Biochim Biophys Acta (2017).
4. 'Molecular basis of multidrug transport by ABC transporters'
M.A. Seeger and H.W. van Veen
Biochim Biophys Acta (2009) 1794(5): p. 725-37.
5. 'The AcrB efflux pump: conformational cycling and peristalsis lead to multidrug resistance'
M.A. Seeger, K. Diederichs, T. Eicher, L. Brandstatter, A. Schiefner, F. Verrey, and K.M. Pos
Curr Drug Targets (2008) 9(9): p. 729-49.

BOOK CHAPTERS

1. 'ABC Exporters from a Structural Perspective'
M.A. Seeger*, E. Bordignon, M. Hohl
Chapter ABC Transporters - 40 Years on (2015), pp. 65-84

* Denotes corresponding authorship

Denotes equal contribution