Biophysics, S.J. Tans (2017-2022)

Biography

Sander Tans obtained his PhD degree from Delft University of Technology in 1998, working in the group of Cees Dekker. After a brief position at IBM, he continued as a post-doctoral fellow with Carlos Bustamante at the University of California at Berkeley. Since 2002 he is based at the AMOLF institute in Amsterdam, where he leads the biophysics research group. He is department head for the department Autonomous Matter. In 2009 he was appointed professor in molecular and cellular biophysics at Delft University of Technology, within the department of Bionanoscience and the Kavli institute of Nanoscience.

His research is currently focused on single molecule and single cell biophysics, and before that he worked in the area of nanotechnology and solid-state physics. He made seminal contributions to using carbon nanotubes in electronic devices, establishing the first carbon nanotube wire and the first carbon nanotube transistor. He pioneered the use of single-molecule biophysics approaches to study chaperone-guided protein folding, and reversing the protein aggregation that underlies numerous ageing related pathologies. This work is currently extended to visualize chaperone-ribosome interactions and ubiquitin mediated protein degradation. He advanced various approaches to reveal phenomena at the cellular level, demonstrating for the first time the stochasticity of metabolism and growth, and the role of cellular motility in evolutionary coexistence to spatial. Since a number of years his cellular research is increasingly focused on dynamics within organoid systems. His work has appeared over 15 times in Nature, Science, and Cell.

Group output

Peer reviewed Publications 2017-2022

2017

1. Mario J Avellaneda, Eline J Koers, Mohsin M Naqvi, and Sander J Tans. *The chaperone toolbox at the single-molecule level : From clamping to confining*. Protein Science, 26:1291-1302, (2017).
2. S. Lahiri, P. Nghe, S.J. Tans, M.L. Rosinberg and D. Lacoste, *Information-theoretic analysis of the directional influence between cellular processes*, PLoS One **12**, e0187431: 1-26 (2017).
3. V. Satarifard, M. Heidari, S. Mashaghi, S.J. Tans, M.R. Ejtehadi and A. Mashaghi, *Topology of polymer chains under nanoscale confinement*, Nanoscale **9**, 12170-12177 (2017).
4. M. Heidari, V. Satarifard, S.J. Tans, M.R. Ejtehadi, S. Mashaghi and A. Mashaghi, *Topology of internally constrained polymer chains*, Phys. Chem. Chem. Phys. **19**, 18389-18393 (2017)
5. M. Osella, S.J. Tans and M.C. Lagomarsino, *Step by Step, Cell by Cell : Quantification of the Bacterial Cell Cycle*, Trends Microbiol. **25**, 250–256 (2017).

2018

1. P. Nghe, B.M. Mulder and S. J. Tans, *A graph-based algorithm for the multi-objective optimization of gene regulatory networks*, EJOR 270, 2: 784-793 (2018). **Green OA**
2. P. Nghe, M. Kogenaru and S. J. Tans, *Sign epistasis caused by hierarchy within signalling cascades*, Nature Commun. 9, 1, 1451: 1-9 (2018). **Gold OA**
3. M. Wehrens, D. Ershov, R. Rozendaal, N. Walker, D. Schultz, R. Kishony, P. A. Levin and S. J. Tans, *Size Laws and Division Ring Dynamics in Filamentous Escherichia coli cells*, Current Biol. 28, 6, 972: 979-5 (2018). **Green OA**
4. M Wehrens, F Büke, P Nghe, SJ Tans, *Stochasticity in cellular metabolism and growth: approaches and consequences*, Current Opinion in Systems Biology **8**, 131-136 (2018)
5. F. Wruck, M. J. Avellaneda, E. J. Koers, D. P. Minde, M. P. Mayer, G. Kramer, A. Mashaghi and S. J. Tans, *Protein Folding Mediated by Trigger Factor and Hsp70 : New Insights from Single-Molecule Approaches*, J. Mol. Biol. 430, 4: 438-449 (2018). **Green OA**

2019

1. T. Evers, M. Hochane, S.J. Tans, R.M.A. Heeren, S. Semrau, P. Nemes and A. Mashaghi, *Deciphering metabolic heterogeneity by single-cell analysis*, Anal. Chem. **91** (21), 13314–13323, (2019). **Green OA**
2. L. Hartl, G. Huelsz-Prince, J.S. van Zon and S.J. Tans, *Apical constriction is necessary for crypt formation in small intestinal organoids*, Dev. Biol. **450** (2), 76-81, (2019) **Hybrid OA**
3. Anne-Bart Seinen and A.J.M. Driessen, *Single-Molecule Studies on the Protein Translocon*, Annu. Rev. Biophys 48, 185-207, (2019). **Green OA**
4. N. Sachs, A. Papaspyropoulos, D.D. Zomer-van Ommen, I. Heo, L. Böttinger, D. Klay, F. Weeber, G. Huelsz-Prince, N. Iakobachvili, G.D. Amatngalim, J. de Ligt, A. van Hoeck, N. Proost, M.C. Viveen, A. Lyubimova, L. Teeven, S. Derakhshan, J. Korving, H. Begthel, J.F. Dekkers, K. Kumawat, E. Ramos, M.F.M. van Oosterhout, G.J. Offerhaus, D.J. Wiener, E.P. Olimpio, K.K. Dijkstra, E.F. Smit, M. van der Linden, S. Jaksani, M. van de Ven, J. Jonkers, A.C. Rios, E.E. Voest, C.H.M. van Moorsel, C.K. van der Ent, E. Cuppen, A. Oudenaarden, F.E. Coenjaerts, L. Meyaard, L.J. Bont, P.J. Peters, S.J. Tans, J.S. van Zon, S.F. Boj, R.G. Vries, J.M. Beekman and H. Clevers, *Long-term expanding human airway organoids for disease modeling*, EMBO J. 38 (4) e100300:1-20, (2019). **Hybrid OA**

2020

1. S. Koch, A.B. Seinen, M. Kamel, D. Kuckla, C. Monzel, A. Kedrov and A.J.M. Driessen, "*Single-molecule analysis of dynamics and interactions of the SecYEG translocon"*, FEBS J., early view (2020), **Hybrid OA.**
2. R.N.U. Kok, L. Hebert, G. Huelsz-Prince, Y.J. Goos, X. Zheng, K. Bozek, G.J. Stephens, S.J. Tans and J.S. van Zon, *OrganoidTracker: "Efficient cell tracking using machine learning and manual error correction"*, PLoS One **15**, 10: e0240802: 1-18 (2020), **Gold OA**
3. M. Kogenaru, P. Nghe, F.J. Poelwijk and S.J. Tans, "*Predicting Evolutionary Constraints by Identifying Conflicting Demands in Regulatory Networks"*, Cell Systems **10**, (6), 526-534 (2020) **Green OA**
4. B. Artegiani, D. Hendriks, J. Beumer, R.N.U. Kok, X. Zheng, I. Joore, S. Chuva de Sousa Lopes, J.S. van Zon, S.J. Tans and H. Clevers, "*Fast and efficient generation of knock-in human organoids using homology-independent CRISPR–Cas9 precision genome editing"*, Nature Cell Biol. **22**, (3), 321-331 (2020), **Green OA.**
5. S. Gude, E. Pince, K.M. Taute, A.B. Seinen, T.S. Shimizu and S.J. Tans, "*Bacterial coexistence driven by motility and spatial competition"*, Nature **578**, 588-592 (2020).
6. M.J. Avellaneda, E.J. Koers, D.P. Minde, V. Sunderlikova and S.J. Tans, "*Simultaneous sensing and imaging of individual biomolecular complexes enabled by modular DNA–protein coupling"*, Commun. Chem **3**, (1), 20: 1-7 (2020), **Gold OA.**

7. Moayed, F., Bezrukavnikov, S., Naqvi, M. M., Groitl, B., Cremers, C. M., Kramer, G., Ghosh, K., Jakob, U. & Tans, S. J. *The Anti-Aggregation Holdase Hsp33 Promotes the Formation of Folded Protein Structures*. Biophysical journal **118**, 85-95 (2020). **Green OA**

2021

1. M.A. Betjes, X. Zheng, R.N.U. Kok, J.S. van Zon and S.J. Tans, *Cell Tracking for Organoids: Lessons From Developmental Biology*, Front. Cell Dev. Biol. **9**, 675013: 1-7 (2021) **Gold OA**
2. F. Wruck, P.F. Tian, R. Kudva, R.B. Best, G. Von Heijne, S.J. Tans and A. Katranidis, *The ribosome modulates folding inside the ribosomal exit tunnel*, Commun. Biol **4**, (1), 523: 1-8 (2021) Gold OA
3. S. Koch, A.B. Seinen, M. Kamel, D. Kuckla, C. Monzel, A. Kedrov and A.J.M. Driessen, *Single-molecule analysis of dynamics and interactions of the SecYEG translocon*, FEBS J. **288**, (7), 2203-2221 (2021) **Hybrid OA**
4. A.B. Seinen, D. Spakman, A.M. van Oijen and A.J.M. Driessen, *Cellular dynamics of the SecA ATPase at the single molecule level*, Sci. Rep. **11**, (1), 1433: 1-16 (2021) **Gold OA**
5. M. Bertolini, K. Fenzl, I. Kats, F. Wruck, F. Tippmann, J. Schmitt, J.J. Auburger, S.J. Tans, B. Bukau and G. Kramer, *Interactions between nascent proteins translated by adjacent ribosomes drive homomer assembly*, Science **371**, (6524), 57-64 (2021) **Green OA**

2022

1. G. Huelsz-Prince, R.N.U. Kok, Y.J. Goos, L. Bruens, X. Zheng, S. Ellenbroek, J. Van Rheenen, S.J. Tans and J.S. van Zon, *Mother cells control daughter cell proliferation in intestinal organoids to minimize proliferation fluctuations*, eLife **11**, e80682: 1-21 (2022) **Gold OA**
2. A. Mashaghi, F. Moayed, E.J. Koers, Y. Zheng, K. Till, G. Kramer, M.P. Mayer and S.J. Tans, *Direct observation of Hsp90-induced compaction in a protein chain*, Cell Reports **41**, (9), 111734: 1-15 (2022) **Gold OA**
3. Y. Mulla, M.J. Avellaneda, A. Roland, L. Baldauf, W. Jung, T. Kim, S.J. Tans and G.H. Koenderink, *Weak catch bonds make strong networks*, Nature Mater. **21**, (9), 1019-1023 (2022) **Hybrid OA**
4. G.-W. He, L. Lin, J. DeMartino, X. Zheng, N. Staliarova, T. Dayton, H. Begthel, W.J. van de Wetering, E. Bodewes, J.S. van Zon, S.J. Tans, C. Lopez-Iglesias, P.J. Peters, W. Wu, D. Kotlarz, C. Klein, T. Margaritis, F. Holstege and H. Clevers, *Optimized human intestinal organoid model reveals interleukin-22-dependency of paneth cell formation*, Cell Stem Cell **29**, (9), 1333-1345.e6 (2022) **Hybrid OA**
5. N.M.L.P. Bérenger-Currias, M. Mircea, E. Adegeest, P.R. van den Berg, M. Feliksik, M. Hochane, T. Idema, S.J. Tans and S. Semrau, *A gastruloid model of the interaction between embryonic and extra-embryonic cell types*, J. Tissue Eng. **13**, 20417314221103042: 1-18 (2022) **Gold OA**
6. R.E. McKenzie, E.M. Keizer, J.N.A. Vink, J. van Lopik, F. Büke, V. Kalkman, C. Fleck, S.J. Tans and S.J.J. Brouns, *Single cell variability of CRISPR-Cas interference and adaptation*, Mol. Syst. Biol. **18**, (4), e10680: 1-18 (2022) **Hybrid OA**
7. M.M. Naqvi, M.J. Avellaneda, A. Roth, E.J. Koers, A. Roland, V. Sunderlikova, G. Kramer, H.S. Rye and S.J. Tans, *Protein chain collapse modulation and folding stimulation by GroEL-ES*, Sci.Adv. **8**, (9), eabl6293: 1-10 (2022) **Gold OA**
8. F. Büke, J. Grilli, M. Cosentino Lagomarsino, G. Bokinsky and S.J. Tans, *ppGpp is a bacterial cell size regulator*, Current Biol. **32**, (4), 870-877.e5 (2022) **Green OA**
9. S.J. Tans, *Picturing protein disaggregation*, Nature Chem. Biol. **18**, 240-241 (2022) **Green OA**
10. M.T. Wortel, D. Agashe, S.F. Bailey, C. Bank, K. Bisschop, T. Blankers, J. Cairns, E.S. Colizzi, D. Cusseddu, M.M. Desai, B. van Dijk, M. Egas, J. Ellers, A.T. Groot, D.G. Heckel, M.L. Johnson, K. Kraaijeveld, J. Krug, L. Laan, M. Lässig, P.A. Lind, J. Meijer, L.M. Noble, S. Okasha, P.B. Rainey, D.E. Rozen, S. Shitut, S.J. Tans, O. Tenaillon, H. Teotónio, J.A.G.M. de Visser, M.E. Visser, R.M.A. Vroomans, G.D.A. Werner, B. Wertheim and P.S. Pennings, *Towards evolutionary predictions: Current promises and challenges*, Evol. Appl., 00:1-19 (2022) **Gold OA**

Contributions to scientific books (chapters or entire book) 2017-2022

N/A

PhD theses 2017-2022

2019

1. G. Huelsz-Prince, *Snooping on cells in worms and mini-organs*, Delft University of Technology, October 14, 2019. **OA**
2. M. Wehrens*, Dynamical regulation in single cells*, Delft University of Technology, March 4, 2019. **OA**
3. M.J. Avellaneda, *Chaperone-mediated protein rescue A single-molecule study*, Delft University of Technology, November 28, 2019. **OA**

2021

1. Rebecca Mckenzie, *Single Cells in the Spotlight: Probing the kinetics of CRISPR Interference and Adaptation,* TU Delft, 15/10/2021. **OA**

Masters and Bachelors theses 2017-2022

2020

1. Tinka Clement, master program of Biomolecular Sciences in VU Amsterdam, on "Wnt signal propagation in intestinal organoids".

Invited lectures at international conferences and meetings

2017

1. S.J. Tans, Single cell dynamics: from bacterial growth to organoid infection, 3rd International SystemsX Conference on Systems Biology, Zurich, September 5, 2017.
2. S. J. Tans, Probing chaperone action at the single-molecule level, EMBO conference on Protein Quality Control in Health and disease, San Feliu de Guixols, Spain, May 16, 2017.

2018

1. Sander J. Tans et al., Chaperone guided folding of single proteins, BPE2018 conference, September 30, 2018, Leuven, Belgium.
2. Sander J. Tans et al., Size laws and division ring dynamics in filamentous cells, An interdisciplinary approach to the bacterial cell cycle, June 26, 2018, Boston, USA.
3. Sander J. Tans et al., Chaperone guided folding of single proteins, GRC protein dynamics, January 8, 2018, Galveston, USA.
4. Sander J. Tans et al., Dynamics of cellular metabolism, size, and motility, March 14, 2018, DFG conference, Berlin, Germany.

2019

1. Sander J. Tans, Constraint & coexistence in bacterial model systems, International workshop Predicting Evolution, Leiden, the Netherlands, 09-10-2019.
2. Sander J. Tans, Motility in bacterial coexistence, 03-09-2019, BacNet19 conference, Sant Feliu de Guíxol, Spain.
3. Sander J. Tans, GroEL-mediated acceleration of protein folding by enhanced collapse, 29-05-2019, EMBO Conference, Protein quality control: From mechanisms to disease, Costa de la Calma, Mallorca, Spain

2021

1. Sander J. Tans, "*Polypeptide loop translocation by single ClpB disaggregases"*, European Biophysics Conference EBSA 2021, Vienna, Austria (online), 26/07/2021.
2. Sander J. Tans, "*Motility-driven bacterial coexistence"*, TSRC 2021, Telluride, USA (online), 15/07/2021.
3. Sander J. Tans, "*Cell size and ppGpp"*, EMBO Workshop on Cell Size and Growth Regulation, 2021, Weizmann, Israel online), 21/06/2021.
4. Sander J. Tans, "*Polypeptide loop extrusion by the disaggregase ClpB"*, Biophysical Society Meeting, BPS 2021, Boston, USA (online), 14/01/2021.

Academic Teaching 2017-2022

2017

1. Masters course 'Cellular Dynamics' for Applied Physics, Delft University of Technology

2018

1. Masters course 'Cellular Dynamics' for Applied Physics, Delft University of Technology

2019

1. Masters course 'Physics of Biological Systems' for Applied Physics, Delft University of Technology

2020

1. Tans S., Masters course 'Physics of Biological Systems' for Applied Physics, Delft University of Technology.
2. Tans S., Advanced Course Microbial Physiology and Fermentation, Delft University of Technology.

Selected awards & recognitions 2017-2022

2019

1. Mario Avellaneda Best poster award at Dutch Chaperone meeting 2019 (Groningen).

Valorization 2017-2022

1. Within an IPP program with Unilever called Hybrid soft materials, we developed molecular tension sensors that were incorporated into gel materials in order to characterize the spatial organization of tension. Hybrid soft materials are important to several food products and this program is aimed at a better understanding and possible new bio-inspired paradigms.
2. Within a program with HUB called Cell dynamics within lung and intestinal organoids, we have developed new A.I. based image analysis tools to study the dynamics at the cellular level, which can provide roles in future drug discovery pipelines.
3. We have engaged in a collaboration with the company Lumicks to co-develop flow-cells for the optical tweezers instrument they market, as well as temperature control principles.