

# Ziqing (Winston) Zhao: Curriculum Vitae

Department of Chemistry | Centre for BioImaging Sciences | Mechanobiology Institute  
National University of Singapore

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<https://cbis.nus.edu.sg/zhao-ziqing-winston/>

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## RESEARCH AND TEACHING INTERESTS

Biophysical chemistry; single-molecule/single-cell imaging; super-resolution microscopy; chromatin organization and dynamics; gene expression regulation; cell nuclear architecture; biomolecular phase separation; cancer and aging-associated diseases

## PROFESSIONAL APPOINTMENTS

### National University of Singapore (NUS)

Assistant Professor (Presidential Young Professorship), Dept. of Chemistry	2019 – present
Principal Investigator, Centre for BioImaging Sciences (CBIS)	2019 – present
Co-Principal Investigator, Mechanobiology Institute (MBI)	2021 – present

### Agency for Science, Technology and Research (A\*STAR)

Postdoctoral Fellow, Genome Institute of Singapore (GIS)	2018 – 2019
Research Fellow, Institute of Molecular and Cell Biology (IMCB)	2015 – 2018
Research Officer, Institute of Bioengineering and Nanotechnology (IBN)	2008 – 2009

## EDUCATION

<b>Harvard University</b> , Cambridge, MA	2009 – 2015
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Ph.D. in Biophysics

Thesis: “Probing the Spatio-Temporal Organizations and Dynamics of Gene Expression and DNA Replication in the Mammalian Cell Nucleus”

Advisor: X. Sunney Xie, Mallinckrodt Professor of Chemistry and Chemical Biology

<b>California Institute of Technology (Caltech)</b> , Pasadena, CA	2004 – 2008
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B.S. (with honors), double major in Chemistry and Biology

GPA: 4.12/4.0

<b>Raffles Junior College</b> , Singapore	2002 – 2003
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University of Cambridge GCE Advanced Level Examination Certificate

## AWARDS AND HONORS

<i>Invited to nominate candidates for the Nobel Prize in Physiology or Medicine</i> , Nobel Committee	2020, 2021
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<i>Young Individual Research Grant award</i> , National Medical Research Council, Singapore	2019
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<i>NUS Presidential Young Professorship</i> , National University of Singapore	2019
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<i>GIS Super Team Award (Team Member)</i> , Genome Institute of Singapore	2018
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<i>Selected Delegate of 65<sup>th</sup> Lindau Nobel Laureate Meeting</i> , Lindau, Germany	2015
<i>Certificate of Distinction in Teaching</i> , Harvard University	2011, 2014
<i>Cold Spring Harbor Asia Poster Award, Second Prize</i> , Cold Spring Harbor Asia	2013
<i>Student Research Achievement Award</i> , The Biophysical Society	2013
One of the thirteen recipients selected internationally	
<i>Dudley R. Herschbach Teaching Award</i> , Harvard University	2012
Awarded to the best graduate student teaching fellow in Dept. of Chemistry & Chemical Biology	
<i>National Science Scholarship (Ph.D.)</i> , A*STAR	2009
<i>Richard P. Schuster Memorial Prize</i> , Caltech	2008
Awarded to the best graduating senior in Division of Chemistry & Chemical Engineering	
<i>Phi Tau Phi Scholastic Honor Society of America Scholarship</i>	2007
<i>Summer Undergraduate Research Fellowship (Arthur R. Adams Fellow)</i> , Caltech	2007
<i>Upper Class Merit Award (Carnation Scholarship)</i> , Caltech	2006, 2007
<i>University College London Scholars Program</i> , Caltech	2006
<i>Summer Undergraduate Research Fellowship (Samuel &amp; Frances Krown Fellow)</i> , Caltech	2006
<i>Chairman's Honors List</i> , A*STAR	2005 – 2007
<i>National Science Scholarship (B.S.)</i> , A*STAR	2004
<i>World 15<sup>th</sup> Place</i> , American Invitational Mathematics Examination	2003
<i>Gold Medal and Team Champion</i> , Singapore Chemistry Olympiad	2002
<i>Gold Medals and Team Champion</i> , Singapore Mathematical Olympiad	1999 – 2003

## GRANTS AND FUNDING

Academic Research Fund (AcRF) Tier 3 Grant, Ministry of Education, Singapore	2021 – 2026
MOET32020-0001; Role: Co-PI; Amount: S\$8,424,000.00 (My share: S\$787,356.00)	
Competitive Research Programme (CRP), National Research Foundation, Singapore	2021 – 2025
NRF-CRP25-2020-0001; Role: Co-PI; Amount: S\$5,164,900.00 (My share: S\$561,340.00)	
Academic Research Fund (AcRF) Tier 1 Grant, Ministry of Education, Singapore	2022 – 2024
Role: PI; Amount: S\$250,000.00	
Young Individual Research Grant, National Medical Research Council, Singapore	2019 – 2023
MOH-000227; Role: PI; Amount: S\$300,000.00	
NUS Presidential Young Professorship start-up funding, NUS	2019 – 2023
Role: PI; Amount: S\$1,250,000.00	

## PUBLICATIONS

### Book and book chapter

- Zhao, Z. W.**, Xie, X. S. *Problems and Solutions to Life at the Single-Molecule Level: A Physical Chemistry Perspective* (under contract with Oxford University Press).
- Ng, W. S., Sielaff, H., **Zhao, Z. W.** “Phase Separation in Chromatin-based Intranuclear Processes.” In *Droplets of Life: Membrane-less Organelles, Biomolecular Condensates, and Biological Liquid-Liquid Phase Separation*, ed. Vladimir Uversky, pp. XX–XX. Cambridge, Mass.: Academic Press, 2022. (in press)

Papers (total citations > 1400 as of Sep 2022, according to [Google Scholar](#))

\*: co-first authorship; §: corresponding/co-corresponding authorship

At NUS

Pu, R. \*, Zhan, Q. \*§, Peng, X., Liu, S., Guo, X., Liang, L., Qin, X., **Zhao, Z. W.**, Liu, X. § Super-resolution microscopy enabled by ultrahigh-efficiency surface-migration emission depletion. *Nature Commun.* (in press).

Ng, W. S., Sielaff, H., **Zhao, Z. W.** § Phase separation-mediated chromatin organization and dynamics: From imaging-based quantitative characterizations to functional implications. *Int. J. Mol. Sci.* **23**, 8039 (2022).

Sielaff, H. §, Basu, S. §, **Zhao, Z. W.** § Imaging approaches to unravel chromatin organization and nuclear dynamics. *Front. Mol. Biosci.* **9**, 929370 (2022) (editorial commentary).

Liu, H., Peck, X. Y., Chong, Y. K., Ng, W. S., Engl, W., Raghuvamsi, P. V., **Zhao, Z. W.**, Anand, G. S., Zhou, Y., Sivaraman, J., Xu, Q. §, Wong, S.-M. § Identification of putative binding interface of PI(3,5)P<sub>2</sub> lipid on rice black-streaked dwarf virus (RBSDV) P10 protein. *Virology* **570**, 81–95 (2022).

Goh, J. J. L. \*, Chou, N. \*, Seow, W. Y., Ha, N., Cheng, C. P. P., Chang, Y.-C., **Zhao, Z. W.**, Chen, K. H. § Highly specific multiplexed RNA imaging in tissues with split-FISH. *Nature Methods* **17**, 689–693 (2020).

Featured on [GenomeWeb](#).

Su, Q. P. \*§, **Zhao, Z. W.** \*§, Meng, L., Ding, M., Zhang, W., Li, Y., Liu, M., Li, R., Gao, Y.-Q., Xie, X. S. §, Sun, Y. § Superresolution imaging reveals spatiotemporal propagation of human replication foci mediated by CTCF-organized chromatin structures. *Proc. Natl. Acad. Sci. U.S.A.* **117**, 15036–15046 (2020).

Featured on [BioArt](#); [EurekAlert!/AAAS](#); [Nanowerk](#); [News Break](#); [NUS News–In Focus](#); [Peking University](#); [Phys.org](#); [Scienmag](#).

Prior to NUS

Manning, S. A., Dent, L. G., Kondo, S., **Zhao, Z. W.**, Plachta, N., Harvey, K. F. § Dynamic fluctuations in subcellular localization of the Hippo pathway effector Yorkie *in vivo*. *Curr. Biol.* **28**, 1651–1660 (2018).

White, M. D. \*, **Zhao, Z. W.** \*, Plachta, N. § *In vivo* imaging of single mammalian cells in development and disease. *Trends Mol. Med.* **24**, 278–293 (2018) (**cover article**).

**Zhao, Z. W.** \*, White, M. D. \*, Alvarez, Y. D. \*, Zenker, J. \*, Bissiere, S., Plachta, N. § Quantifying transcription factor–DNA binding in single cells *in vivo* with photoactivatable fluorescence correlation spectroscopy. *Nature Protoc.* **12**, 1458–1471 (2017).

**Zhao, Z. W.**, White, M. D., Bissiere, S., Levi, V., Plachta, N. § Quantitative imaging of mammalian transcriptional dynamics: From single cells to whole embryos. *BMC Biol.* **14**, 115 (2016).

White, M. D. \*, Angiolini, J. F. \*, Alvarez, Y. D. \*, Kaur, G. \*, **Zhao, Z. W.**, Mocskos, E., Bruno, L., Bissiere, S., Levi, V. §, Plachta, N. § Long-lived binding of Sox2 to DNA predicts cell fate in the four-cell mouse embryo. *Cell* **165**, 75–87 (2016) (**cover article**).

Featured on [Cell cover](#); [Medical Xpress](#); [Straits Times](#); [The Scientist](#).

- Zhao, Z. W.**, Xie, X. S.<sup>§</sup>, Ge, H.<sup>§</sup> Nonequilibrium relaxation of conformational dynamics facilitates catalytic reaction in an elastic network model of T7 DNA polymerase. *J. Phys. Chem. B* **120**, 2869–2877 (2016).
- Zhao, Z. W.\***, Roy, R.\*, Gebhardt, J. C. M.\*, Suter, D. M.\*, Chapman, A. R., Xie, X. S.<sup>§</sup> Spatial organization of RNA polymerase II inside a mammalian cell nucleus revealed by reflected light-sheet superresolution microscopy. *Proc. Natl. Acad. Sci. U.S.A.* **111**, 681–686 (2014).
- Zhao, Z. W.**, Gebhardt, J. C. M., Suter, D. M., Xie, X. S.<sup>§</sup> Reply to “Convergence of chromatin binding estimates in live cells”. *Nature Methods* **10**, 692 (2013).
- Gebhardt, J. C. M.\*, Suter, D. M.\*, Roy, R., **Zhao, Z. W.**, Chapman, A. R., Basu, S., Maniatis, T., Xie, X. S.<sup>§</sup> Single-molecule imaging of transcription factor binding to DNA in live mammalian cells. *Nature Methods* **10**, 421–426 (2013).
- Ong, S.-M., **Zhao, Z.**, Arooz, T., Zhao, D., Zhang, S., Du, T., Wasser, M., van Noort, D., Yu. H.<sup>§</sup> Engineering a scaffold-free 3D tumor model for *in vitro* drug penetration studies. *Biomaterials* **31**, 1180–1190 (2010).
- Zhang, C.\*, **Zhao, Z.\***, Rahim, N. A. A., van Noort, D.<sup>§</sup>, Yu. H.<sup>§</sup> Towards a human-on-chip: Culturing multiple cell types on a chip with compartmentalized microenvironments. *Lab Chip* **9**, 3185–3192 (2009) (**inside cover article**).
- Pletneva, E. V., **Zhao, Z.**, Kimura, T., Petrova, K., Gray, H. B.<sup>§</sup>, Winkler, J. R.<sup>§</sup> Probing the cytochrome *c*’ folding landscape. *J. Inorg. Biochem.* **101**, 1768–1775 (2007).

## PATENT

- Chen, K. H., Goh, J. J. L., Chou, S. N., Seow, W. Y., Ha, N., Goh, C, **Zhao, Z. W.** Nucleic acid probes. Filed 24 Jun, 2020 (International application number: PCT/SG2020/050353).

## TEACHING

### At NUS

- CM4236** | Spectroscopy and Imaging in Biophysical Chemistry      AY2020/2021 – present (yearly)  
Instructor; Student rating: 4.9/5.0 (twice)
- CM3225** | Biomolecules      AY2019/2020  
Instructor (with Chng Shu Sin); Student rating: 4.4/5.0

### Prior to NUS

- Chem 161** | Statistical Thermodynamics, Harvard University      AY2013/2014  
Teaching Fellow; Student rating: 4.8/5.0
- Chem 163** | Frontiers in Biophysics, Harvard University      AYs2010 – 2013  
Teaching Fellow (taught three times); Student rating: 5.0/5.0 (twice)
- Chem 24a & b** | Introduction to Biophysical Chemistry, Caltech      AYs2006 – 2008  
Teaching Assistant (taught twice)
- Life Sciences 1a** | An Integrated Introduction to the Life Sciences      AYs2012 – 2013
- Physical Sciences 2** | Mechanics, Elasticity, Fluids, and Diffusion  
Peer Tutor with Bureau of Study Counsel, Harvard University

## MENTORING

At NUSResearch Fellows

Goran Biukovic (Department of Chemistry)	2022 – present
Wilfried Engl (Department of Chemistry)	2020 – present
Aliz Kunstar (Department of Chemistry)	2020 – present
Hendrik Sielaff (Department of Chemistry)	2020 – present

Ph.D. students

Kuo Xuan (Mechanobiology Institute, co-supervised with Tony Kanchanawong)	2021 – present
Ng Woei Shyuan (Department of Chemistry)	2020 – present

M.Sc. students

Zhou Songsong (Department of Chemistry)	2022 – 2023
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Undergraduate students

Jasmine Kiley (NUS Amgen Scholars Program, Tulane University, U.S.A.)	2022
Nicole Sim Jiaxuan (FYP student, Department of Chemistry)	2021 – 2022
Serene Fong Siew Min (FYP student, Department of Chemistry)	2019 – 2020

Ph.D./M.Sc. thesis advisory/examination committees

Sui Mingyu (Ph.D. thesis advisory committee, Department of Chemistry)	2022 – present
Huang Zengxin (Ph.D. thesis advisory committee, Mechanobiology Institute)	2022 – present
Chen Jiaye (Ph.D. thesis advisory committee, Department of Chemistry)	2021 – present
Ng Bao Hui (Ph.D. thesis examination panel, Department of Chemistry)	2022
Chen Yushu (Ph.D. thesis examination panel, Department of Chemistry)	2022
Kavitha Rajasekhar (M.Sc. thesis examination panel, Department of Biological Sciences)	2022
Saradha Venkatachalapathy (Ph.D. thesis examination panel, Mechanobiology Institute)	2021
Zhou Yu (Ph.D. thesis examination panel, Department of Physics)	2021

Research Associates/Assistants/Apprentices

Chen Siyi (Research Associate, Department of Chemistry)	2020 – present
Kuo Xuan (Research Apprentice, Department of Chemistry)	2020 – 2021
Nurul Diyana Bte Rosli (Research Apprentice, Department of Chemistry)	2020 – 2021
Ng Woei Shyuan (Research Assistant, Department of Chemistry)	2019 – 2020

Prior to NUS

Chen Siyi (Research Officer, Genome Institute of Singapore)	2018
Xu Peihao (H3 Research Attachment student, Institute of Molecular and Cell Biology)	2017
Julie C. Chang (Undergraduate student, Harvard University)	2013 – 2014
Qian Peter Su (Visiting graduate student from Peking University, Harvard University)	2012

**CONFERENCE AND SEMINAR PRESENTATIONS**

9 <sup>th</sup> Annual Conference of AnalytiX-2023, Sapporo, Japan	Jan 2023
2022 East Asian Single-Molecule Biophysics Symposium (virtual)	Oct 2022

6 <sup>th</sup> International Anatomical Sciences and Cell Biology Conference Microscopy Workshop (virtual)	Feb 2022
“Medicine Meets Science” Workshop, National University of Singapore	Nov 2021
3 <sup>rd</sup> International Conference on Nanoscopy (ICON) (virtual)	Nov 2021
13 <sup>th</sup> European Biophysics Conference, Vienna, Austria + virtual	Jul 2021
Focus on Microscopy (FOM) 2021 (virtual)	Mar 2021
SPiE BiOS Conference: <i>Single Molecule Spectroscopy and Superresolution Imaging</i> (virtual)	Mar 2021
Biophysical Society 65 <sup>th</sup> Annual Meeting (virtual)	Feb 2021
3 <sup>rd</sup> Tritium Workshop, Singapore National Institute of Chemistry	Sep 2020
Focus on Microscopy (FOM) 2020, Osaka, Japan (canceled due to COVID-19)	Apr 2020
National Workshop on Fluorescence and Raman Spectroscopy, Hyderabad, India	Dec 2019
Mechanobiology Institute, National University of Singapore	Nov 2019
Cell Symposia: <i>Single Cells: Technology to Biology</i> , Singapore	Feb 2019
Centre for BioImaging Sciences, National University of Singapore	Oct 2018
Department of Chemistry, National University of Singapore	Jul 2018
18 <sup>th</sup> International Congress of Developmental Biology, Singapore	Jun 2017
Cold Spring Harbor Laboratory Meeting: <i>Nuclear Organization and Function</i> , Cold Spring Harbor, NY	May 2016
Harvard Medical School Epigenetics Symposium, Boston, MA	Dec 2014
Cold Spring Harbor Asia Meeting: <i>New Advances in Optical Imaging of Live Cells and Organisms</i> , Suzhou, China	Aug 2013
Biophysical Society 57 <sup>th</sup> Annual Meeting, Philadelphia, PA	Feb 2013
EMBO   EMBL Symposium: <i>The Complex Life of mRNA</i> , Heidelberg, Germany	Oct 2012
4 <sup>th</sup> Combined Scientific Meeting of the Life Sciences, Singapore	Jan 2003

## JOURNAL/GRANT REVIEWING/EDITING

Review Editor, <i>Frontiers in Chemical Biology</i>	2022 – present
Invited Topic Editor, <i>Frontiers in Molecular Biosciences</i>	2020 – 2022
<i>Ad hoc</i> reviewer for: <i>Analytical Chemistry</i> , <i>Biophysical Journal</i> , <i>Journal of Physical Chemistry</i> , <i>Micron</i> , <i>Nano Letters</i> , <i>Nanoscale</i>	
Invited grant reviewer for: <i>Austrian Science Fund (FWF)</i> (declined)	

## ADMINISTRATIVE SERVICES

Member, Committee on Graduate Education, Department of Chemistry	2021 – present
Member, Committee on Student Life, Department of Chemistry	2020 – present
Member, Committee on College of Humanities & Sciences, Department of Chemistry	2020 – 2021
Member, University Research Committee Expert Panel, NUS	2019

## PROFESSIONAL SERVICES/OUTREACH ACTIVITIES

Judge, 26<sup>th</sup> Chemistry • Communication Challenge: *Chemistry for Singapore 2030*

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<i>and Beyond</i> , NUS Chemistry	2021
Speaker, <i>Advancing the Frontiers of Science and Technology with Chemistry</i>	
E-outreach, NUS Chemistry	2021 (twice)
Judge, A*STAR Talent Search (ATS)	2020
Speaker, NUS-ACS Student Chapter Graduate Studies Talk	2020
Selection panelist for nominees to 70 <sup>th</sup> Lindau Nobel Laureate Meeting, National Research Foundation, Singapore	2019
Poster judge, Chemistry National Meeting Singapore (ChnmSG)	2019