

# Ziqing (Winston) Zhao: Curriculum Vitae

Department of Chemistry and Centre for BioImaging Sciences  
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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 nanoscopy; chromatin organization and dynamics; gene expression regulation; cell nuclear architecture; biomolecular phase separation; cancer and aging-associated diseases

## PROFESSIONAL APPOINTMENTS

### Department of Chemistry, National University of Singapore (NUS)

Assistant Professor (NUS Presidential Young Professorship) 2019 – present

### Centre for BioImaging Sciences (CBIS), National University of Singapore

Principal Investigator 2019 – present

### Genome Institute of Singapore (GIS), A\*STAR

Postdoctoral Fellow 2018 – 2019

### Institute of Molecular and Cell Biology (IMCB), A\*STAR

Research Fellow 2015 – 2018

### Institute of Bioengineering and Nanotechnology (IBN), A\*STAR

Research Officer 2008 – 2009

## EDUCATION

**Harvard University**, Cambridge, MA 2009 – 2015

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

**California Institute of Technology (Caltech)**, Pasadena, CA 2004 – 2008

B.S. (with honors), double major in Chemistry and Biology

GPA: 4.12/4.0

**Raffles Junior College**, Singapore 2002 – 2003

University of Cambridge GCE Advanced Level Examination Certificate

## AWARDS AND HONORS

*Invited to nominate candidates for the Nobel Prize in Physiology or Medicine,*

Nobel Committee 2020, 2021

*Young Individual Research Grant award, National Medical Research Council, Singapore* 2019

<i>NUS Presidential Young Professorship</i> , National University of Singapore	2019
<i>GIS Super Team Award (Member)</i> , Genome Institute of Singapore	2018
<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 One of the thirteen recipients selected internationally	2013
<i>Dudley R. Herschbach Teaching Award</i> , Harvard University Awarded to the best graduate student teaching fellow in the Dept. of Chemistry & Chemical Biology.	2012
<i>National Science Scholarship (Ph.D.)</i> , A*STAR	2009
<i>Richard P. Schuster Memorial Prize</i> , Caltech Awarded to the best graduating senior in the Division of Chemistry & Chemical Engineering	2008
<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 MOET32020-0001; Role: Co-PI; Amount: S\$8,424,000.00 (My share: S\$682,000.00)	2021 – 2026
Young Individual Research Grant, National Medical Research Council, Singapore OFYIRG19nov-0019; Role: PI; Amount: S\$300,000.00	2019 – 2022
NUS Presidential Young Professorship start-up funding, NUS Role: PI; Amount: S\$1,250,000.00	2019 – 2024

## PUBLICATIONS

### Book

**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).

Papers (total citations > **1100** as of Jan 2021, according to [Google Scholar](#))

### Since 2019

Zhan, Q., Pu, R., Peng, X., Liu, S., Guo, X., Liang, L., Qin, X., **Zhao, Z. W.**, Liu, X. Surface-migration emission depletion (SMED) microscopy. In revision at *Nature*.

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.\*<sup>§</sup>, **Zhao, Z. W.\*<sup>§</sup>**, Meng, L., Ding, M., Zhang, W., Li, Y., Liu, M., Li, R., Gao, Y.-Q., Xie, X. S.<sup>§</sup>, Sun, Y.<sup>§</sup>. 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).

(\*: equal contribution; §: co-corresponding author)

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

### Prior to 2019

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

(\*: equal contribution)

**Zhao, Z. W.\*<sup>§</sup>**, White, M. D.\*<sup>§</sup>, Alvarez, Y. D.\*<sup>§</sup>, Zenker, J.\*<sup>§</sup>, 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).

(\*: equal contribution)

**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., Ge, H. 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.\*<sup>§</sup>**, Roy, R.\*<sup>§</sup>, Gebhardt, J. C. M.\*<sup>§</sup>, Suter, D. M.\*<sup>§</sup>, Chapman, A. R., Xie, X. S. 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).

(\*: equal contribution)

**Zhao, Z. W.**, Gebhardt, J. C. M., Suter, D. M., Xie, X. S. 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. 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. 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., Yu. H. Towards a human-on-chip: Culturing multiple cell types on a chip with compartmentalized microenvironments. *Lab Chip* **9**:3185–3192 (2009) (**inside cover article**).  
(\*: equal contribution)
- Pletneva, E. V., **Zhao, Z.**, Kimura, T., Petrova, K., Gray, H. B., Winkler. J. R. 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 Semester 1, AY2020/2021  
Instructor; Student rating: 4.9/5.0
- CM3225** | Biomolecules Semester 2, AY2019/2020  
Co-Instructor (with Chng Shu Sin); Student rating: 4.4/5.0

### Prior to NUS

- Chem 161** | Statistical Thermodynamics, Harvard University Semester 2, AY2013/2014  
Teaching Fellow; Student rating: 4.8/5.0
- Chem 163** | Frontiers in Biophysics, Harvard University Semester 1, AYs2010 – 2013  
Teaching Fellow (taught three times); Student rating: 5.0/5.0 (twice)
- Chem 24ab** | Introduction to Biophysical Chemistry, Caltech Terms 2 & 3, 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 NUS

- Wilfried Engl (Research Fellow, Department of Chemistry) 2020 – present
- Aliz Kunstar (Research Fellow, Department of Chemistry) 2020 – present
- Hendrik Sielaff (Research Fellow, Department of Chemistry) 2020 – present
- Ng Woei Shyuan (Ph.D. student, Department of Chemistry) 2020 – present
- Chen Siyi (Research Associate, Department of Chemistry) 2020 – present
- Kuo Xuan (Research Apprentice, Department of Chemistry) 2020 – present
- Nurul Diyana Bte Rosli (Research Apprentice, Department of Chemistry) 2020 – present
- Ng Woei Shyuan (Research Assistant, Department of Chemistry) 2019 – 2020

Serene Fong Siew Min (FYP student, Department of Chemistry) 2019 – 2020

*Ph.D./Master thesis committee/examiner*

Zhou Yu (Ph.D., Department of Physics) 2021

### 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

8<sup>th</sup> Annual Conference of AnalytiX-2021, Osaka, Japan 2021

Focus on Microscopy (FOM) 2021 (virtual) 2021

SPIE BiOS Conference: *Single Molecule Spectroscopy and Superresolution Imaging* (virtual) 2021

Biophysical Society 65<sup>th</sup> Annual Meeting (virtual) 2021

3<sup>rd</sup> Tritium Workshop, Singapore National Institute of Chemistry (virtual) 2020

Focus on Microscopy (FOM) 2020, Osaka, Japan (canceled due to COVID-19) 2020

National Workshop on Fluorescence and Raman Spectroscopy, Hyderabad, India 2019

Mechanobiology Institute, National University of Singapore 2019

Cell Symposia: *Single Cells: Technology to Biology*, Singapore 2019

Centre for BioImaging Sciences, National University of Singapore 2018

Department of Chemistry, National University of Singapore 2018

18<sup>th</sup> International Congress of Developmental Biology, Singapore 2017

Cold Spring Harbor Laboratory Meeting: *Nuclear Organization and Function*,  
Cold Spring Harbor, NY 2016

Institute of Molecular and Cell Biology Seminar, Singapore 2016

Harvard Medical School Epigenetics Symposium, Boston, MA 2014

Cold Spring Harbor Asia Meeting: *New Advances in Optical Imaging of Live Cells  
and Organisms*, Suzhou, China 2013

Biophysical Society 57<sup>th</sup> Annual Meeting, Philadelphia, PA 2013

EMBO | EMBL Symposium: *The Complex Life of mRNA*, Heidelberg, Germany 2012

4<sup>th</sup> Combined Scientific Meeting of the Life Sciences, Singapore 2003

## JOURNAL REVIEWING/EDITING

Invited Topic Editor, *Frontiers in Molecular Biosciences* 2020 – present

Reviewer for: *Analytical Chemistry, Nano Letters, Nanoscale*

## ADMINISTRATIVE SERVICES

Member, Committee on Student Life, Department of Chemistry 2020 – 2021

Member, Committee on College of Humanities & Sciences, Department of Chemistry 2020 – 2021

**PROFESSIONAL SERVICES/OUTREACH ACTIVITIES**

Speaker, <i>Advancing the Frontiers of Science and Technology with Chemistry</i> E-outreach, NUS Chemistry	2021
Judge, A*STAR Talent Search (ATS)	2020
Speaker, NUS-ACS Student Chapter Graduate Studies Talk	2020
Member, University Research Committee Expert Panel, NUS	2019
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

**RESEARCH TRAINING**

<i>Chen Group</i> , Genome Institute of Singapore, A*STAR Single-cell genomic and transcriptomic mapping in tissues using multiplexed FISH-based approaches	2018 – 2019
<i>Plachta Group</i> , Institute of Molecular and Cell Biology, A*STAR Development of photoactivatable fluorescence correlation spectroscopy (paFCS) Probing spatio-temporal dynamics of transcription factors in live mouse embryos and neurons	2015 – 2018
<i>Xie Group</i> , Department of Chemistry & Chemical Biology, Harvard University Single-molecule and super-resolution imaging of transcription and DNA replication in human cells Development of reflected light-sheet super-resolution microscopy Modeling of enzyme catalysis and conformational dynamics	2009 – 2015
<i>Yu Group</i> , Institute of Bioengineering and Nanotechnology, A*STAR Engineering microfluidic human cell culture platform and scaffold-free 3D <i>in vitro</i> tumor model	2008 – 2009
<i>Björkman Group</i> , Division of Biology, Caltech Crystallographic studies of class I MHC homolog protein MULT1 and its down-regulator	2007 – 2008
<i>Gray Group</i> , Division of Chemistry & Chemical Engineering, Caltech Spectroscopic studies of stability and folding kinetics of cytochrome c'	2005 – 2006
<i>Lai Group</i> , Department of Pediatrics, National University of Singapore SNP analysis of <i>Rb1</i> gene in Southeast Asian populations for diagnosing retinoblastoma	2002 – 2003

**PROFESSIONAL MEMBERSHIPS**

American Chemical Society	2009 – present
Biophysical Society	2009 – present