

# 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 (Chen Kok Hao Group) 2018 – 2019

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

Research Fellow (Nicolas D. Plachta Group) 2015 – 2018

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

Research Officer (Hanry Yu Group) 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 Nobel Prize in Physiology or Medicine*, Nobel Committee 2020

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

*NUS Presidential Young Professorship*, 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	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 the 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 the 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

Young Individual Research Grant, National Medical Research Council, Singapore	2019 – 2022
OFYIRG19nov-0019; Role: PI; Amount: S\$300,000.00	
NUS Presidential Young Professorship start-up funding, NUS	2019 – 2024
Role: PI; Amount: S\$1,250,000.00	

## 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 > 1000 as of Aug 2020, according to [Google Scholar](#))

Zhan, Q., Pu, R., Peng, X., Guo, X., Liang, L., **Zhao, Z. W.**, Liu, X. Surface-migration emission depletion 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; <sup>§</sup>: co-corresponding author)

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

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**).

(\*: equal contribution)

**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).

(\*: 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.\***, Roy, R.\*, Gebhardt, J. C. M.\*, Suter, D. M.\*, 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

<b>CM4236</b>   Spectroscopy and Imaging in Biophysical Chemistry Instructor	Semester 1, AY2020/2021
<b>CM3225</b>   Biomolecules Co-Instructor (with Chng Shu Sin); Student rating: 4.5/5.0	Semester 2, AY2019/2020

### Prior to NUS

<b>Chem 161</b>   Statistical Thermodynamics, Harvard University Teaching Fellow; Student rating: 4.8/5.0	Semester 2, AY2013/2014
<b>Chem 163</b>   Frontiers in Biophysics, Harvard University Teaching Fellow (taught three times); Student rating: 5.0/5.0 (twice)	Semester 1, AYs2010 – 2013
<b>Chem 24ab</b>   Introduction to Biophysical Chemistry, Caltech Teaching Assistant (taught twice)	Terms 2 & 3, AYs2006 – 2008
<b>Life Sciences 1a</b>   An Integrated Introduction to the Life Sciences	AYs2012 – 2013
<b>Physical Sciences 2</b>   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

### 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
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: <i>Single Cells: Technology to Biology</i> , 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 (CSH) Laboratory Meeting: <i>Nuclear Organization and Function</i> , Cold Spring Harbor, NY	2016
Institute of Molecular and Cell Biology Seminar, Singapore	2016
Harvard Medical School Epigenetics Symposium, Boston, MA	2014
CSH Asia Meeting: <i>New Advances in Optical Imaging of Live Cells and Organisms</i> , Suzhou, China	2013
Biophysical Society 57 <sup>th</sup> Annual Meeting, Philadelphia, PA	2013
EMBO   EMBL Symposium: <i>The Complex Life of mRNA</i> , Heidelberg, Germany	2012
4 <sup>th</sup> Combined Scientific Meeting of the Life Sciences, Singapore	2003

**JOURNAL REVIEWING/EDITING**

Invited Topic Editor, <i>Frontiers in Molecular Biosciences</i>	2020 – present
Reviewer for: <i>Nano Letters</i> , <i>Nanoscale</i>	

**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**

Judge, A*STAR Talent Search (ATS)	2020
Graduate Talk speaker, NUS-ACS Undergraduate Research Symposium (canceled due to COVID-19)	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	2018 – 2019
Single-cell genomic and transcriptomic mapping in tissues using multiplexed FISH-based approaches	

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<i>Plachta Group</i> , Institute of Molecular and Cell Biology, A*STAR	2015 – 2018
Development of photoactivatable fluorescence correlation spectroscopy (paFCS)	
Probing spatio-temporal dynamics of transcription factors in live mouse embryos and neurons	
<i>Xie Group</i> , Department of Chemistry & Chemical Biology, Harvard University	2009 – 2015
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	
<i>Yu Group</i> , Institute of Bioengineering and Nanotechnology, A*STAR	2008 – 2009
Engineering microfluidic human cell culture platform and scaffold-free 3D <i>in vitro</i> tumor model	
<i>Björkman Group</i> , Division of Biology, Caltech	2007 – 2008
Crystallographic studies of class I MHC homolog protein MULT1 and its down-regulator	
<i>Gray Group</i> , Division of Chemistry & Chemical Engineering, Caltech	2005 – 2006
Spectroscopic studies of stability and folding kinetics of cytochrome c'	
<i>Lai Group</i> , Department of Pediatrics, National University of Singapore	2002 – 2003
SNP analysis of <i>Rb1</i> gene in Southeast Asian populations for diagnosing retinoblastoma	

## PROFESSIONAL MEMBERSHIPS

American Chemical Society	2009 – present
Biophysical Society	2009 – present