BIOGRAPHICAL SKETCH

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NAME: Sui, Haixin

eRA COMMONS USER NAME (credential, e.g., agency login): WADS138

POSITION TITLE: Research Scientist V

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Dalian University of Technology, Dalian, China	B.S.	07/1989	Materials Sci. & Eng.
Dalian Univ. Tech. & Beijing Lab. of Electron Microscopy, Chinese Academy of Sciences	M.S.	07/1992	Material Physics & Chemistry
Same as above	Ph.D.	05/1996	Same as above
Lawrence Berkeley National Lab., Berkeley, CA	Postdoctoral Fellow & Postdoctoral Scientist	03/2003	Cryo-EM & x-ray crystallography of Membrane Proteins & Cytoskeleton

A. Personal Statement

I have extensive experience in several aspects of structural biology. The relevant experience and the unique expertise makes me an ideal PI to successfully carry out the structural portion of the proposed research. My post-graduate Master's and Doctoral works were in the areas of electron microscopy (EM) under Prof. K.H. Kuo who is internationally renowned in EM. This training provided me with a solid background in electron optics and high-resolution EM image processing. As a postdoctoral fellow in Bing K. Jap's group at Berkeley Lab, I purified and crystallized aquaporin-1 water channel and determined its structure at 2.2Å resolution by x-ray crystallography. The intensive training and hand-on experience in protein purification, biochemistry and structural model building for auaporin-1 enables me to directly supervise my lab member in biochemistry and building the atomic structural model of the complex. In Ken Downing's group at the Berkeley Lab, I successfully obtained a structural map of motile-cilium microtubule doublets using cryo-electron tomography and a self-developed algorithm of sub-tomogram averaging. I also developed a set of programs of sub-volume averaging and these programs were successfully used in sub-volume averaging of radial spoke complex as published in 2015. With this experience, we have already successfully obtained a high-quality structural map of AbmR 39S complex as the initial model for the proposed single particle structural determination. In 2010, I obtained structural maps at resolutions beyond 9Å for multiple types of microtubules, despite structural heterogeneity among the microtubules. This was achieved using self-developed sets of comprehensive image-processing programs which combined both single particle and helical reconstruction methods. This experience enhanced my capability in computational imaging processing using single particle approach and will benefit the proposed research.

In summary, with the extensive experience in protein biochemistry, x-ray crystallography, and strong background in cryo-EM method development, application and computational image processing, I am well-prepared to direct the structural study of the AbmR complex by cryo-EM.

1. Sun, S., Fisher, R.L., Bowser, S.S., Pentecost, B.T., Sui, H.* (2019) The three-dimensional architecture of epithelial primary cilia, Proc Natl Acad Sci U S A. 116(19):9370-9379. [PMID: 31004057]

2. Kishchenko, G.P., Danev, R., Fisher, R., He, J., Hsieh, C., Marko, M., **Sui, H*.** (2015). Effect of fringe-artifact correction on sub-tomogram averaging from Zernike phase-plate cryo-TEM. Journal of Structural Biology, 191(3), 299-305. [PMID: 26210582]

3. **Sui, H.***, and Downing, K.H. (2010). Structural basis of inter-protofilament interaction and lateral deformation of microtubules, Structure, 18, 1022-1031 [PMID: 20696402]
4. **Sui, H.** and Downing, K.H. (2006) Molecular architecture of axonemal microtubule doublets revealed by cryo-electron tomography. Nature *442*, 475-478. [PMID: 16738547]
5. **Sui, H.**, Han, B.G., Lee, J.K., Walian, P., and Jap, B.K. (2001). Structural basis of water-specific transport through the AQP1 water channel. Nature *414*, 872-878. [PMID: 11780053]

B. Positions and Honors

Positions and Employment

09/90 - 10/96	Research Assistant, Mentor: Professor Kehsin Kuo, Beijing Laboratory of Electron Microscopy, Chinese Academy of Sciences, Beijing, China
11/96 - 11/01	Postdoctoral Fellow/Scientist, Mentor: Dr. Bing K. Jap, Life Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA
11/01 - 03/03	Postdoctoral Scientist (term), Mentor: Dr. Kenneth H. Downing, Life Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA
03/03 - 08/08	Biochemist Scientist (career), Mentor: Dr. Kenneth H. Downing, Life Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA
08/08 -	Research Scientist IV-V, Laboratory of Molecular and Cell basis of Diseases, Division of Translational Medicine, Wadsworth Center, NYS Department of Health, Albany, NY
08/08 -	Assistant Professor, Department of Biomedical Sciences, School of Public Health, University at Albany, State University of New York, Albany, NY

Other Experience and Professional Memberships

06/94 - 09/94	Visiting Scientist, Arrhenius Lab, Structural Chemistry Div., Stockholm University, Sweden
1997 – present	Member, Biophysics Society
1997 – 2001	Member, Microscopy Society of America
2008 – present	Member, American Society for Cell Biology

Honors

06/1995	Takashi Mukaibo Award (1st place), Dalian University of Technology, by Dr. Takashi Mukaibo, the former President of Tokyo University, Japan.

C. Contributions to Science (* indicates corresponding author)

1. *Structure and function of microtubules and axonemal complexes in cilia/flagella*: We obtained the first 3D structural map of epithelial primary cilia by serial section electron tomography and characterize the 3D structures of microtubule doublet-single transitions. This work has provided rich new insights in primary cilia structure and function. We also found that motile ciliary tips are subject to structural development and modification during growth and demonstrated that the tip-complex does not directly mediate the fast turnover of intraflagellar transport (IFT). We have also obtained structural maps at resolutions beyond 9 Å for multiple types of microtubules, which provided functional understanding about interprotofilament interactions in microtubule bending and lateral deformation. This work has been included in the textbook "Cell and Molecular Biology: Concepts and Experiments, by Gerald Karp, Janet Iwasa, and Wallace Marshall." 8th Edition (2016). Using cryo-electron tomography and customized sub-volume averaging algorithm, we obtained the first 3D structural map of isolated microtubule doublets, which not only revealed the structural features, but also provided insights into locations and roles of particular proteins within the doublet. It also reported a new-type of microtubule associated proteins that bound to the intraluminal side of the microtubules (also see the comment by Linda Amos, Structure, 2010, 18, 894-895)
    a. Sun, S., Fisher, R.L., Bowser, S.S., Pentecost, B.T., **Sui, H.*** (2019) The three-dimensional architecture of epithelial primary cilia, Proc Natl Acad Sci U S A. 116(19):9370-9379. [PMID: 31004057]
    b. Bowler, M., Kong, D., Sun, S., Nanjundappa, R., Farmer, V., Mahjoub, M.R., and **Sui, H.,** and Loncarek, J. (2019) High-resolution characterization of centriole distal appendage morphology and dynamics by correlative STORM and electron microscopy, Nature Communication,*10(1)*, 993. [PMID:30824690]

c. Reynolds, M.J., Phetruen, T., Fisher, R.L., Chen, K., Pentecost, B.T., Gomez, G., Ounjai, P., and **Sui, H.*** (2018) Scientific Reports, *8(1)*:7977. [PMID: 29789632]
d. **Sui, H.***, and Downing, K.H. (2010). Structural basis of inter-protofilament interaction and lateral deformation of microtubules, Structure, 18, 1022-1031 [PMID: 20696402]
e. **Sui, H.**, and Downing, K.H. (2006). Molecular architecture of axonemal microtubule doublets revealed by cryo-electron tomography. Nature *442*, 475-478. [PMID: 16738547]

2. *Cryo-EM methodology for cellular structural imaging*: Driven by our project needs, some of our effort has been invested in developing and optimizing methods for studying vitreously frozen cells by cryo-electron tomography. We designed and re-engineered the Leica transferring block and successfully eliminated the lamella breakage problem. This enabled us to routinely obtain and study vitreously frozen cell specimens prepared using cryo-focused ion beam (cryo-FIB) milling technique. This cutting-edge technique will be used in this proposal for studying the influenza viruses in infected cells. In addition, we proved that the fringes of Zernike phase-plate imaging can lead to incorrect representation of a structure, and we developed a set of programs for image de-fringing, which can remove the artifacts. Phase-plate imaging is a cutting-edge imaging method to obtain high-contrast micrographs in cryo-EM. This technique is particularly useful for cellular structural imaging, and it will be used in the proposed research.
    a. He, J., Hsieh, C., Wu, Y., Schmelzer, T., Wang, P., Lin, Y., Marko, M., **Sui, H*.** (2017) Cryo-FIB specimen preparation for use in a cartridge-type cryo-TEM. Journal of Structural Biology. May 27. pii: S1047-8477(17)30091-6. doi: 10.1016/j.jsb.2017.05.011. [PubMed PMID: 28559166]
    b. Kishchenko, G.P., Danev, R., Fisher, R., He, J., Hsieh, C., Marko, M., **Sui, H.*** (2015). Effect of fringe-artifact correction on sub-tomogram averaging from Zernike phase-plate cryo-TEM. Journal of Structural Biology, 191(3):299-305. [PMID: 26210582]

3. *Structure and function of the kinetochore in mitosis*: We have been investigating kinetochores in mitosis. Recently, by correlative LM/EM, super-resolution LM, and 3D LM image analysis, we demonstrated that there is a high degree of variability in kinetochore architecture during mitosis. This work overturned the traditional structural understanding about the functional mechanism of kinetochore, and challenged the widely accepted concept of intrakinetochore tension and its role in the control of mitotic progression. Owing to the importance of the result, the *Journal of Cell Biology* published an “In Focus” editorial about our work.
    a. Magidson, V., He J., Ault, J.G., O’Connell, C.B., Yang, N.C., McEwen, B.F., **Sui, H.***, and Khodjakov, A*. (2016) Radial expansion and compaction of the outer kinetochore during mitosis: Changes in the kinetochore shape during mitosis, Journal of Cell Biology 212(3):307-19. [PMID: 26833787]
    b. Sikirzhytski, V, Magidson, V, Steinman, J.B., He, J, Le Berre, M., Tikhonenko, I., Ault, J.G., McEwen, B.F., Chen, J.K., **Sui, H.**, Piel, M., Kapoor, T.M., Khodjakov, A. (2014) Direct kinetochore-spindle pole connections are not required for chromosome segregation, The Journal of cell biology. 206(2):231-43. [PMID: 25023516]

4. *Functional mechanisms of membrane channel proteins*: Using electron and x-ray crystallography, we studied membrane channel proteins, including water cancel aquaporin 1, potassium channel KcsA and Kch. I determined the first high-resolution x-ray structure of water specific channel Aquaporin 1, which contributed to understanding how membrane channel proteins facilitate the specific transport of water molecules or ions across cell membranes. This work was acknowledged in the advanced information of the 2003 Nobel Prize in Chemistry, which was shared by Dr. Peter Agre for the discovery of water channels and Dr. Roderick MacKinnon for structural and mechanistic studies of ion channels. This work has been included in the popular college text book “Molecular Cell Biology by Lodish et al.” since 2003.
    a. **Sui, H.**, Han, B.G., Lee, J.K., Walian, P., and Jap, B.K. (2001). Structural basis of water-specific transport through the AQP1 water channel. Nature *414*, 872-878. [PMID: 11780053]
    b. Li, H.L., **Sui, H.X.**, Ghanshani, S., Lee, S., Walian, P.J., Wu, C.L., Chandy, K.G., and Jap, B.K. (1998). Two-dimensional crystallization and projection structure of KcsA potassium channel. Journal of Molecular Biology *282*, 211-216. [PMID: 9735281]

Complete List of Published Work in MyBibliography:
https://www.ncbi.nlm.nih.gov/sites/myncbi/haixin.sui.1/bibliography/43643469/public/?sort=date&direction=descending