

## EDUCATION

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<b>University of Freiburg</b> (Freiburg im Breisgau, Germany) <i>Master of Science, Biology (major Neuroscience)</i> GPA: 1.7/1.0	<i>Oct. 2021 – expected Oct. 2023</i>
<b>Nankai University</b> (Tianjin, China) <i>Bachelor of Science, Chemical Biology</i> GPA: 89.4/100, Rank: 3/20	<i>Sep. 2016 – July 2020</i>

## PUBLICATIONS

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### JOURNAL ARTICLE

- [1] Wang, Baifan, Zhang, Zijuan, **Zhu, Hao**, Niu, Congwei, Wen, Xin, and Xi, Zhen. The hydrogen bonding network involved Arg59 in human protoporphyrinogen IX oxidase is essential for enzyme activity. *Biochemical and Biophysical Research Communications*, 557:20–25, June 2021.

### TOOLBOX

- [1] **Zhu, Hao**. Neugym: A python package for reinforcement learning environment of animal behavior modeling. <https://github.com/HaoZhu10015/neugym>, 2022.

## RESEARCH EXPERIENCE

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<b>Optophysiology Lab, IMBIT//BrainLinks-BrainTools</b> <b>University of Freiburg, Germany</b> <i>Research Assistant</i>	<i>Aug. 2022 – present</i>  <b>Supervisor: Prof. Dr. Ilka Diester</b>
<ul style="list-style-type: none"><li>- Designed the Parallel Q-Learning with Hidden Markov Model (PQL-HMM) framework for the mathematical modeling of animal evidence based decision-making behavior.</li><li>- Designed, implemented, and released a general reinforcement learning environment for rodent behavior simulation (Python module, available on GitHub).</li></ul>	
<b>Institute of Biology I &amp; Bernstein Center Freiburg</b> <b>University of Freiburg, Germany</b> <i>Research Assistant</i>	<i>July 2022 – Nov. 2022</i>  <b>Supervisor: Prof. Dr. Andrew D. Straw</b>
<ul style="list-style-type: none"><li>- Implemented a Tree of Parzen Estimators (TPE) method based parameter auto-tuning process of Kalman filter used for animal tracking.</li><li>- Designed and implemented an event-camera-based lock-on tracker prototype, which is able to steer a multiple camera system for bee tracking in the wild.</li></ul>	
<b>State Key Laboratory of Elemento-organic Chemistry</b> <b>Chemistry College, Nankai University, China</b> <i>Undergraduate Researcher / Research Assistant</i>	<i>Aug. 2017 – Jan. 2021</i>  <b>Supervisor: Prof. Dr. Xin Wen, Prof. Dr. Zhen Xi</b>
<ul style="list-style-type: none"><li>- Led National Training Program of Innovation and Entrepreneurship for Undergraduates: “Computational Simulation and Biological Verification for Different Species of Protoporphyrinogen IX Oxidase Amino Acid Interactions”.</li><li>- Completed bioinformatic analysis of multiple genera protoporphyrinogen oxidase (PPO) amino acid conservative property.</li></ul>	

- Constructed global dynamical amino acid interaction network for multiple genera PPO and mutants with data sampled from Molecular Dynamics (MD) simulation, with which further identified 67 potential key residues of *human*PPO using graph algorithms and network theory.
- Optimized our previous *human*PPO mutant enzyme activity prediction method Prenzyme, tenfold increase in efficiency.

**State Key Laboratory of Elemento-organic Chemistry**  
**Chemistry College, Nankai University, China**

*Oct. 2016 – Sep. 2017*

*Undergraduate Researcher*

***Supervisor: Prof. Dr. Xuncheng Su***

- Synthesized an 1,3,4-oxadiazole-Based trifluoromethyl protein tag.
- Conducted sampling and data analysis of  $^1\text{H}$ ,  $^{13}\text{C}$ -NMR spectrum.

## SKILLS

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### PROGRAMMING

<b>Language</b>	Python, C++, Rust, MATLAB, R, Shell
<b>Scientific Programming</b>	NumPy, SciPy, scikit-learn, JAX, PyMC, NetworkX, FilterPy, Hyperopt, NEURON
<b>Deep Learning</b>	PyTorch, TensorFlow, Keras
<b>Reinforcement Learning</b>	Gym
<b>Data Visualization</b>	Matplotlib, Seaborn, pandas
<b>Camera System</b>	Kalibr, Metavision-SDK
<b>Documentation</b>	LaTeX, Markdown, reStructuredText, Sphinx

### SOFTWARE

<b>Chemical Software</b>	Gaussian, GaussView, ChemDraw, Chem3D
<b>Biological Software</b>	Amber, AutoDock, Galaxy, PyMOL, ImageJ, WinEDR
<b>Data Visualization</b>	Origin, Graphpad Prism 9, Cytoscape, Gephi

## COURSE WORK

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**“Optogenetics & Behavior”** (Module SP1-05 Neurobiology, University of Freiburg, 2022)

- Designed behavioral experiment and confirmed the feasibility of generating an innate reward in the *Drosophila melanogaster* brain through artificial activation of neurons with gustatory receptors (Gr43a) using Channel-rhodopsin Chrimson, and further proved the existence of a weak activation effect of Chrimson under blue light ( $\sim 450\text{nm}$ ).

**“Neural Networks and Deep Learning”** (Coursera & DeepLearning.AI, 2019)

- Implemented a deep neural network for image classification of MNIST dataset with Python and Numpy module, including the image data loading, model optimizing and predicting.

**“Machine Learning”** (Coursera & Stanford University, 2019)

- Implemented basic supervised machine learning algorithms with MATLAB, including linear regression, logistic regression, shallow neural network, and support vector machine algorithm.
- Implemented basic unsupervised machine learning algorithms for clustering and dimension reduction with MATLAB, including k-means clustering and principal component analysis algorithm.

## AWARDS

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- Kaggle research code competition “Plant Pathology 2021 – FGVC8” (Fine-Grained Visual Categorization, CVPR 2021) (**Top 35%**) (*May 2021*)
- Innovative Scientific Research Award for College Students of Nankai University (**Excellence Award**) (*June 2020*)
- Mathematical Contest In Modeling (MCM/ICM) (**Successful Participant**) (*2019*)
- Asymchem Scholarship of Chemistry College, Nankai University (*2017 – 2018*)

- Asymchem Scholarship of Chemistry College, Nankai University (2016 – 2017)

## REFEREES

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