Statement of Service, Motivation, and Vision

I have been an active and committed participant in the BMES-CMBE community since my graduate training, where I view service to this community as both a responsibility and a privilege. Over the years, I have contributed to BMES and CMBE Annual Meetings as an abstract reviewer, presenter, rising star awardee, and session chair/co-chair, supporting the dissemination of high-quality science and fostering constructive idea exchanges, which have given me the firsthand insights into the importance of strong leadership, inclusive programming, and sustained engagement across different career stages within the CMBE community and beyond.

My service as an abstract reviewer has allowed me to contribute to maintaining the rigor and relevance of CMBE programming, while my roles as an oral/poster presenter have strengthened my appreciation for thoughtful session design and effective moderation. Having participated in CMBE activities consistently from graduate school through my professional career, I have observed the evolution of the field and the growing impact of cellular and molecular bioengineering in addressing fundamental questions and unmet clinical needs. These experiences have motivated my desire to serve more formally on the CMBE SIG.

I seek to be a CMBE Council Member and continue to serve on the CMBE SIG because I am deeply invested in the mission of advancing cellular and molecular bioengineering research, education, and community-building. The CMBE SIG plays a key role in shaping the intellectual direction of the field, supporting early-career investigators/trainees, and creating platforms for collaboration across disciplines. I am particularly motivated to contribute to initiatives that enhance engagement among students, postdocs, and junior faculty, while also strengthening connections between established investigators, industry partners, clinicians, and the public. Serving on the CMBE Council would allow me to give back to the CBME/BMES community that has been instrumental in my own professional development and to help ensure its continued vitality.

My vision for CMBE SIG is the continued inclusive growth, scientific integration, and translational impact. I envision CMBE SIG as a hub that bridges fundamental cellular and molecular insights with engineering innovation, data science, and clinical translation. To achieve this, I believe the CMBE SIG can further promote multidisciplinary sessions, emerging-topic workshops, and mentorship-focused activities at the Annual Meeting and throughout the year. Expanding opportunities for trainee leadership, fostering cross-SIG collaborations, and strengthening engagement with underrepresented and international members will be critical to sustaining the field's momentum. In parallel, I see strong value in leveraging CMBE SIG to highlight emerging technologies, such as machine learning, immunoengineering, genome editing, biomanufacturing, organoid modeling, advanced imaging, and systems-level approaches, that are redefining how we study, understand, and engineer biological systems.

In summary, my sustained service to BMES and CMBE SIG, together with my commitment to community engagement and scientific excellence, motivates my desire to serve on the CMBE SIG. I would welcome the opportunity to contribute my experience, energy, and vision to advancing the BMES/CMBE community and to supporting its members across all career stages.

Curriculum Vitae

Xiaoping Bao

E-mail: bao61@purdue.edu
Phone: 765-496-3094

1158 Forney Hall, 480 Stadium Mall Drive
Purdue University, West Lafayette, IN 47907, USA

A. Education

Sept. 2011 – Jun. 2016	Ph.D. Chemical Engineering, University of Wisconsin, Madison, USA
Sept. 2007 – Jun. 2011	B.S. Chemical Engineering, Tsinghua University, Beijing, China

B. Professional Positions

July 2025 - Present	Youth Editorial Board Member, *Nano-Micro Letters*, Springer Nature
July 2024 - Present	William K. Luckow Associate Professor of Chemical Engineering at Purdue University, West Lafayette, IN, USA
Apr. 2023 – July 2024	William K. Luckow Assistant Professor of Chemical Engineering at Purdue University, West Lafayette, IN, USA
Jan. 2019 – Apr. 2023	Assistant Professor of Chemical Engineering at Purdue University, West Lafayette, IN, USA
Nov. 2022 - Present	Advisory Chief Scientific Officer (CSO) at Astheneia Bio, IN, USA
Oct. 2016 - Dec. 2018	American Heart Association (AHA) Postdoc Fellow at University of California-Berkeley, CA, USA

C. Honors & Awards

2025	World Association for Chinese Biomedical Engineers (WACBE)/CAB-BMES Young Investigator Award
2025	American Cancer Society (ACS) Research Scholar Award
2025	Purdue CoE Faculty Excellence Award for Early Career Research
2024	Purdue Institute for Cancer Research Early Career Research Achievement Award
2023	2023 Seed for Success Acorn Award, Purdue University
2023	49TH Northeast Bioengineering Conference New Innovator Award
2023	Junior Investigator Research Award, 2023 ABioM SIG BMES
2022	Young Investigator Award 2022 of *Cells Tissues Organs* Journal
2022	2023 BMES-CMBE Rising Star Junior Faculty Award
2022	NIH Stephen I. Katz Early Stage Investigator Research Project
2022	NSF Faculty Early Career Development Program (CAREER) Award
2022	DDMS Collaborative Idea Award, Purdue Institute for Cancer Research
2021	Robbers New Investigator Award, Purdue Institute for Cancer Research
2020	Young Investigator Award, Ralph W. and Grace M. Showalter Research Trust
2019	Global Innovation Award, LG Chem
2018	AHA Postdoctoral Fellowship, American Heart Association
2014	Stem Cell & Regenerative Medicine Doctoral Fellowship, University of Wisconsin Madison

D. Current Research Interests

- Engineer off-the-shelf chimeric antigen receptor (CAR)-T, natural killer (NK) cells, macrophages and neutrophils from human pluripotent stem cells (hPSCs) for immunotherapy
- Gene editing and forward programming of hPSCs for hematopoiesis and immunology studies

- *In vivo* hematopoietic and immune cell engineering with modified mRNA (modRNA) and lipid nanoparticles (LNPs) for targeted therapy
- Optogenetic-mediated cardiac tissue and immune cell engineering
- Machine learning-mediated scRNAseq analysis, synthetic biology and immunoengineering

E. Major Active Funding

- *In vivo* neutrophil programming to remodel tumor microenvironment and treat prostate cancer (PI), Research Scholar Grant, American Cancer Society (ACS), $946,000, 09/01/2025-08/31/2029.
- Collaborative Research: Chimeric Antigen Receptor Engineered Neutrophil Extracellular Vesicles Targeting Glioblastoma (PI), NSF CBET, $300,000, 09/01/2025-08/31/2028.
- CAR neutrophils produced *in vivo* to remodel tumor microenvironment and treat glioblastoma (lead PI), R01, NIH NCI, $3,209,680, 04/21/2025-03/31/2026.
- eMB: Explainable and physics-informed machine learning for cell typing via a modern optimization lens (co-PI; PI Li), Emerging Mathematics in Biology, NSF DMS, $376,162, 09/01/2024-08/31/2027.
- Engineer biomimetic microfluidic models to investigate and reprogram tumor associated neutrophils for cancer therapy (PI), R37 Merit Award, NIH NCI, $2,424,767, 07/15/2022-06/30/2029.
- CAREER: Engineering *ex vivo* human cardiogenesis with optogenetics (PI), CAREER Award, NSF CBET, $547,295, 03/01/2022-02/28/2027.
- Therapeutic efficacy of CAR-neutrophils and CAR-NK cells in animal models, Astheneia Bio, 07/01/2024-06/30/2027.
- Named Professorship Discretionary Funds, Purdue University, 04/01/2023-03/31/2028.

F. Selected Publications

- Chang Y, Shao K, Li H, Jin G, Bentley RT, McCain RR, Crain CJ, Syahirah R, Shen J, Tan Y, Liang P, Harper HA, Elzey BD, Vanhaezebrouck IF, Luo J, Lian XL[#], **Bao X[#]**. CAR-neutrophils produced *in vivo* to treat glioma. ***Nature Biomedical Engineering*** (2025). *Minor Revision*. [#]Corresponding author.
- Lu Y, Varghese A, Nahar R, Chen H, Shao K, **Bao X[#]**, Can Li[#]. scChat: A Large Language Model-Powered Co-Pilot for Contextualized Single-Cell RNA Sequencing Analysis. ***bioRxiv*** (2024). 10.1101/2024.10.01.616063. [#]Corresponding author.
- Haideri T, Lin J, **Bao X[#]**, Lian XL[#]. MAGIK: A rapid and efficient method to create lineage-specific reporters in human pluripotent stem cells. ***Stem Cell Reports***. 19(5): 744-757 (2024). doi: 10.1016/j.stemcr.2024.03.005.
- Chang Y, Deng Q, **Bao X[#]**. A Pluripotent Road to Immunoengineering. ***Nature Reviews Bioengineering*** (2023). doi: 10.1038/s44222-023-00056-2.
- Chang Y, Cai X, Syahirah R, Yao Y, Xu Y, Jin G, Bhute VJ, Torregrosa-Allen S, Elzey BD, Won Y, Deng Q, Lian X, Wang X[#], **Bao X[#]**. CAR-neutrophil mediated delivery of tumor-microenvironment responsive nanodrugs for glioblastoma chemo-immunotherapy. ***Nature Communications***. 14 (1): 2266 (2023). doi: 10.1038/s41467-023-37872-4.
- Chang Y, Jin G, Luo W, Luo Q, Jung J, Hummel SN, Torregrosa-Allen S, Elzey BD, Low PS[#], Lian X[#], **Bao X[#]**. Engineered Human Pluripotent Stem Cell-Derived Natural Killer Cells with PD-L1

Responsive Immunological Memory for Enhanced Immunotherapeutic Efficacy. ***Bioactive Materials***. 27: 168-180 (2023). doi: 10.1016/j.bioactmat.2023.03.018.

- Jin G, Chang Y, **Bao X**[#]. Generation of chimeric antigen receptor macrophages from human pluripotent stem cells to target glioblastoma. ***Immuno-Oncology and Technology***. 20: 100409 (2023). doi: 10.1016/j.iotech.2023.100409.
- Repina NA, Johnson HJ, **Bao X**, Zimmermann JA, Joy DA, Bi SZ, Kane RS, Schaffer DV. Optogenetic control of Wnt signaling models cell-intrinsic embryogenic patterning using 2D human pluripotent stem cell culture. ***Development***. 150 (14): dev201386 (2023).
- Harris DJ, Chang Y, Syahirah R, Lian XL, Deng Q, **Bao X**[#]. Engineered anti-protstate cancer CAR-neutrophils from human pluripotent stem cells. ***Journal of Immunology and Regenerative Medicine***. 20: 100074 (2023). doi: 10.1016/j.regen.2023.100074.
- Chang Y, Hummel SN, Jung J, Jin G, Deng Q, **Bao X**[#]. Engineered hematopoietic and immune cells from human pluripotent stem cells. ***Experimental Hematology***. 127: 14-27 (2023). doi: 10.1016/j.exphem.2023.08.006.
- Chang Y, Syahirah R, Wang X, Cooper SH, Torregrosa-Allen S, Elzey BD, Lian X, Deng Q[#], Broxmeyer HE, **Bao X**[#]. Engineering chimeric antigen receptor neutrophils from human pluripotent stem cells for targeted cancer immunotherapy. ***Cell Reports*** 40 (3):111128 (2022).
- Chang Y, Syahirah R, Oprescu SN, Wang X, Jung J, Cooper SH, Torregrosa-Allen S, Elzey BD, Hsu AY, Randolph LN, Sun Y, Kuang S, Broxmeyer HE, Deng Q, Lian X[#], **Bao X**[#]. Chemically-defined generation of human hemogenic endothelium and definitive hematopoietic progenitor cells. ***Biomaterials***. 285:121569 (2022).
- Jung J, Chang Y, Jin G, Lian X, **Bao X**[#]. Temporal Expression of Transcription Factor *ID2* Improves Natural Killer Cell Differentiation from Human Pluripotent Stem Cells. ***ACS Synthetic Biology***. 11(6): 2001-08 (2022). doi: 10.1021/acssynbio.2c00017.
- Liang P, Chang Y, Jin G, Lian X, **Bao X**[#]. Wnt signaling directs human pluripotent stem cells into vascularized cardiac organoids with chamber-like structures. ***Front Bioeng Biotechnol***. 10:1059243 (2022). doi: 10.3389/fbioe.2022.1059243.
- Haideri T, Howells A, Jiang Y, Yang J, **Bao X**[#], Lian XL[#]. Robust genome editing via modRNA-based Cas9 or base editor in human pluripotent stem cells. ***Cell Reports Methods***. 2 (9): 100290 (2022). doi: 10.1016/j.crmeth.2022.100290.
- Muckom R, **Bao X**, Tran E, Chen E, Murugappan A, Dordick JS, Clark DS, Schaffer DV. High-throughput 3D screening for differentiation of hPSC-derived cell therapy candidates. ***Science Advances***. 6 (32):eaaz1457 (2020). doi: 10.1126/sciadv.aaz1457.
- **Bao X**, Lian X, Hacker TA, *et al*. Long-term self-renewing human epicardial cells generated from pluripotent stem cells under xeno-free conditions. ***Nature Biomedical Engineering***. 1, 003 (2016). doi:10.1038/s41551-016-0003.
- Lian X*, **Bao X***, Zilberter M, *et al*. Chemically defined, albumin-free human cardiomyocyte generation. ***Nature Methods***. 12, 595-596 (2015). doi:10.1038/nmeth.3448. *Co-first authors.
- **Bao X**, Lian X, Dunn K, Palecek SP. Chemically defined albumin-free differentiation of human pluripotent stem cells to endothelial progenitor cells. *Stem Cell Res.* 15, 122-129 (2015). (**F1000Prime**).

G. Selected Presentations

- Bao X. Mending broken hearts with stem cells. Seminar talk, Department of Chemical Engineering, University of Michigan, Jan 2018.
- Bao X. Mending broken hearts with stem cells. Invited talk, Mayo Clinic Scottsdale, Nov 2019.
- Bao X. Off-the-shelf human chimeric antigen receptor NK cells and neutrophils for targeted cancer therapy. MidWest Drug Development Conference. Sept 2021.
- Bao X. Engineer human pluripotent stem cells for targeted cell and cancer therapies. Wisconsin Stem Cell Campus Seminar, University of Wisconsin-Madison, March 2022.
- Bao X. Engineer human pluripotent stem cells for targeted cell and cancer therapies. Seminar talk, Department of Chemical Engineering, Virginia Polytechnic Institute and State University (Virginia Tech), September 2022.
- Bao X. Engineer human pluripotent stem cells for targeted cell and cancer therapies. Seminar talk, Stem Cell and Regenerative Biology Program, The Pennsylvania State University, September 2022.
- Bao X. Engineer CAR-neutrophils from human pluripotent stem cells for targeted immunotherapy against glioblastoma. Invited talk, 8th International Conference on Stem Cell Engineering, Boston, MA, October 2022.
- Bao X. Engineer CAR-neutrophils from human pluripotent stem cells for targeted chemoimmunotherapy against glioblastoma. 2022 BMES Cellular and Molecular Bioengineering (CMBE) Conference, Indian Wells, CA, January 2023. Rising Star Junior Faculty Award, Plenary Talk.
- Bao X. Engineer CAR-neutrophils from human pluripotent stem cells for targeted chemoimmunotherapy against glioblastoma. Seminar talk, Department of Biological Sciences, University of Notre Dame, February 2023.
- Bao X. Chemically-defined, albumin-free hematopoietic stem and progenitor cell generation from human pluripotent stem cells for biomanufacturing. 2023 BMES Advanced Biomanufacturing (AbioM) Meeting, Hyattsville, MD, March 2023. Junior Investigator Research Award, Plenary Talk.
- Bao X. Engineer CAR-neutrophils from human pluripotent stem cells for targeted chemoimmunotherapy against glioblastoma. 2023 Rock Stars of Regenerative Engineering, San Diego, CA, April 2023. Shining Stars, Plenary Talk.
- Bao X. Engineer dual CAR-NK cells with PD-L1 responsive immunological memory for enhanced efficacy. Invited talk, 2024 AIChE Annual Meeting, San Diego, October 2024.
- Bao X. Engineer CAR-neutrophils for targeted cancer treatment. Invited talk, 2025 Biomaterials and Tissue Engineering GRC, Barcelona, Spain, July 2025.

H. Selected Patents

- Bao X, Wang X, Qin R, Xu Y, Rather A. Thermotropic liquid crystal-based sensors for naked-eye detection of SARS-CoV-2 with ultrahigh sensitivity and selectivity. US Patent, 18021248, 2023.
- Bao X, Chang Y, Deng Q. Blood-brain Barrier-penetrating CAR-neutrophil-mediated Drug Delivery for Treating Brain and other Diseases. US provisional patent application, 63351906, 2022. Licensed to *Astheneia Bio*.
- Bao X, Chang Y, Deng Q, Syahirah R. Human chimeric antigen receptor neutrophils, compositions, kits and methods of use. US Patent, US202063124125P, 2021. Licensed to *Astheneia Bio*.

- Sean P. Palecek, Lian X, Bao X. Chemically defined albumin-free conditions for cardiomyocyte differentiation of human pluripotent stem cells. US Patent, 9765299, 2018. Licensed to *AstraZeneca*.

I. Teaching

- Instructor, ChE-306 *Design of Staged Separation Processes*, Purdue University (Chemical Engineering UG core course), Spring 2019, Spring 2022.
- Instructor, ChE-435 *Chemical Engineering Lab*, Purdue University (Chemical Engineering UG core course), Fall 2022, Fall 2023, Spring 2024, Fall 2024, nominated by the School for the 2026 Purdue Murphy Teaching Award.
- Instructor, ChE-525 *Introduction to Biochemical Engineering*, Purdue University (Chemical Engineering UG/Grad elective course), Spring 2020, Spring 2021, Spring 2023.
- Instructor, ChE-597 *Stem Cell Engineering and Immunoengineering*, Purdue University (Chemical Engineering UG/Grad elective course), Fall 2020, Fall 2021, Spring 2025.

J. Academic Service

Jan. 2019 - Present Preliminary Exam/Defense Committee Member/Workshop Panelist

- Prelim/Defense Committee: Meng-Ling Shih, Ramizah Mohd Syahirah, Isaiah K. Mensah, Carly M Battistoni, Dhushyanth Viswanath, Tarun Singh, Melissa D. Marsing, Dingxuan Wang, Anukrishna Radhakrishnan (PULSe), Kunming Shao (PULSe), Christopher Schorr.
- Workshop Panelist/Poster Judge: Purdue EXPO Scholarship, Purdue Undergraduate Research Conference, Purdue Institute for Cancer Research Career Development Panelist, *etc*.
- Committee Member/Chairs: School Head Search Committee, Advanced Chemistry Cluster Hire Search, Graduate Recruiting Committee, ASGCT's Cancer Cell & Gene Therapy Committee, *etc*.

Feb. 2012 - Present Research Mentor for Undergraduate, Graduate Students and Postdocs

- Postdocs: Dr. Yun Chang, Dr. Gyuhyung Jin (**AHA Postdoc Fellowship**), Dr. Huiyang Li
- Graduate Students: Juhyung Jung (defensed in 2023), Katherine Hebert, Jackson Harris, Peter B. Hellwarth, Yibo Xu, Vijesh J. Bhute, Hao-Ning Huang, Kaitlin K. Dunn, Ting-Jung Sung, Kunming Shao, Frank Liang, Yen-Chun Lu, Arundhati Das, Jingqiao Shen
- Undergraduate Researchers: Nathan Petrucci, Monique N. Watson, Sydney Hummel (**2023 Astronaut Scholar, Churchill Scholar**), Yuxian Xing, Connor Dobbins, Aurelie Tran, Natalie Suhy, Tianxiao Han, Wentao Dong, Jialu Liu, *et al*.

Jan. 2015 - Present Journal/Grant Reviewer, Academic Editor, Conference Chair/Co-Chair

- Journal Reviewer: Nature Biomedical Engineering, Nature Communications, Science Advances, Advanced Materials, Advanced Science, Advanced Healthcare Materials, Cell Reports, Cell Reports Medicine, Cell Reports Methods, Stem Cell Reports, Stem Cells, Bioactive Materials, ACS Synthetic Biology, Journal of Cellular and Molecular Medicine, *etc*.
- Academic Editor: Frontiers in Bioengineering and Biotechnology, PlosOne, JoVE, *etc*.
- Grant Panelist: DoD CDMRP/NSF/NIH/Indiana CTSI Proposal Panel
- Conference Chair/Co-Chairs: The American Institute of Chemical Engineers (AIChE) Annual Meeting, Biomedical Engineering Society (BMES) Annual Meeting, 8th Midwest Tumor Microenvironment Conference Planning Committee, *etc*.