Stanford

Sheng Xu

Professor of Anesthesiology, Perioperative & Pain Medicine (Department Research) and, by courtesy, of Electrical Engineering and of Materials Science & Engineering

Anesthesiology, Perioperative and Pain Medicine

Bio

BIO

Dr. Sheng Xu is a tenured professor and the inaugural Director of Emerging Technologies in the Department of Anesthesiology, Perioperative and Pain Medicine at Stanford University, with courtesy appointments in Electrical Engineering and Materials Science and Engineering. He earned his B.S. degree in Chemistry from Peking University and his Ph.D. in Materials Science and Engineering from the Georgia Institute of Technology. Subsequently, he pursued postdoctoral studies at the Materials Research Laboratory at the University of Illinois at Urbana-Champaign. He then spent 10 years on the faculty at UC San Diego before joining Stanford in 2025. His research group is interested in developing new materials and fabrication methods for soft electronics. His research has been presented to the United States Congress as a testimony to the importance and impact of NIH funding.

ACADEMIC APPOINTMENTS

- Professor, Anesthesiology, Perioperative and Pain Medicine
- Professor (By courtesy), Electrical Engineering
- Professor (By courtesy), Materials Science and Engineering
- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- Biodesign Faculty Fellowship, Stanford (2026)
- Guggenheim Fellowship, John Simon Guggenheim Memorial Foundation (2026)
- Fellow, MRS (2025)
- Fellow, IEEE (2025)
- Distinguished Investigator Award, Academy for Radiology & Biomedical Imaging Research (2024)
- Fellow, AIMBE (2024)
- NIBIB RADx Tech Fetal Monitoring Challenge winner, NIH (2024)
- Rising Star Award, Chinese Association for Science and Technology (2024)
- Bau Family Award, International Symposium for Chinese Inorganic Chemists (2023)
- Blavatnik National Awards for Young Scientists Finalist, New York Academy of Sciences (2023)
- Healthy Longevity Catalyst Award, National Academy of Medicine (2023)

- Jacobs Faculty Scholar, UC San Diego (2023)
- Scialog Fellow in Advancing Bioimaging, Research Corporation for Science Advancement (2023)
- Science Breakthroughs of the Year, Falling Walls Foundation gGmbH (2023)
- 40 Under 40, Georgia Tech Alumni Association (2022)
- FLEXI R&D Award, SEMI (2022)
- Outstanding Youth Award, International Society of Bionic Engineering (2022)
- Technical Achievement Award, IEEE EMBS (2022)
- Technology Accelerator Challenge Prize, NIH (2022)
- Highly cited researcher, Clarivate (2021-present)
- Emerging Leader Forum Panelist, National Academy of Medicine (2021)
- Materials Research Prize for Young Investigators, ETH Zürich (2021)
- Outstanding Engineer of the Year, San Diego County Engineering Council (2021)
- Research Fellowship in Chemistry, The Alfred P. Sloan Foundation (2021)
- DCS Rising Researchers, SPIE (2020)
- Early Career Technical Achievement Award, IEEE Sensors Council (2020)
- George W. and Carol A. Lattimer Faculty Research Fellowship, UC San Diego (2020)
- NIGMS Maximizing Investigators' Research Award, NIH (2020)
- Bell Labs Prize, Nokia Bell Labs (2019)
- Catalyst Award, Biocom (2019)
- Innovator Award, Wellcome Trust (2019)
- Kavli Fellow, National Academy of Sciences (2019)
- NIBIB Trailblazer Award, NIH (2019)
- Outstanding Early Career Investigator Award, MRS (2019)
- U.S. Frontiers of Engineering, National Academy of Engineering (2019)
- 35 Innovators Under 35, MIT Technology Review (2018)
- NHLBI Technology Development Award, NIH-UC CAI (2018)
- Non-Tenured Faculty Award, 3M (2017)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Editorial Board, Soft Science (2025 - present)
- Associate Editor, Research (2024 - present)
- Editorial Board, npj Cardiovascular Health (2024 - present)
- Advisory Board, Nano Trends (2022 - present)
- Advisory Board, Matter (2022 - present)
- International Advisory Board, Small Methods (2022 - present)
- Technical Advisory Council, Nano-Bio Materials Consortium (2022 - present)
- Editorial Board, Current Applied Physics (2018 - present)

PROFESSIONAL EDUCATION

- Ph.D., Georgia Institute of Technology , Materials Science and Engineering (2011)

- B.S., Peking University , Inorganic Chemistry (2006)

LINKS

- Google Scholar: https://scholar.google.com/citations?hl=en&user=87EG-zcAAAAJ&view_op=list_works&sortby=pubdate

Teaching

STANFORD ADVISEES

Postdoctoral Faculty Sponsor

Xiangjun Chen, Tom Park

Publications

PUBLICATIONS

- **Structurally engineered ultrasoft PEDOT:PSS fiber microelectrodes with enhanced electrochemical performance for neural interfaces.** *Science advances*
  Won, C., Cho, Y. U., Kweon, S., Cho, S., Kwon, C., Kim, H. W., Lee, J. Y., Park, S. H., Han, S., Kim, Y. T., Jang, J., Jekal, J., Kim, et al
  2026; 12 (22): eaee2754

- **Fetal monitoring for high-risk pregnancies using a wearable ultrasound patch.** *Nature biotechnology*
  Park, G., Bian, Y., Huang, H., Zhou, S., Qin, S., Lin, M., Yang, X., Lee, A., Ramkumar, A., Tome, M., Lander, J., Chen, X., Wang, et al
  2026

- **Improving multimodal wearable sensing for healthcare with artificial intelligence.** *Nature biotechnology*
  Bian, Y., Ding, S., Jutzeler, C. R., Xu, S., Brasier, N., Wang, J.
  2026

- **Wearable blood pressure sensors for cardiovascular monitoring and machine learning algorithms for blood pressure estimation.** *Nature reviews. Cardiology*
  Min, S., An, J., Lee, J. H., Kim, J. H., Joe, D. J., Eom, S. H., Yoo, C. D., Ahn, H. S., Hwang, J. Y., Xu, S., Rogers, J. A., Lee, K. J.
  2025; 22 (9): 629-648

- **Wearable ultrasound technology** *NATURE REVIEWS BIOENGINEERING*
  Zhou, S., Park, G., Lin, M., Yang, X., Xu, S.
  2025; 3 (10): 835-854

- **Integration of chemical and physical inputs for monitoring metabolites and cardiac signals in diabetes.** *Nature biomedical engineering*
  Chang, A. Y., Lin, M., Yin, L., Reynoso, M., Ding, S., Liu, R., Dugas, Y., Casanova, A., Park, G., Li, Z., Luan, H., Askarinam, N., Zhang, et al
  2025

- **A stealthy neural recorder for the study of behaviour in primates.** *Nature biomedical engineering*
  Oh, S., Jekal, J., Won, J., Lim, K. S., Jeon, C. Y., Park, J., Yeo, H. G., Kim, Y. G., Lee, Y. H., Ha, L. J., Jung, H. H., Yea, J., Lee, et al
  2025; 9 (6): 882-895

- **Monitoring physical and mental activities with skin conductance: Wearables** *NATURE ELECTRONICS*
  Wang, S., Guo, G., Xu, S.
  2025; 8 (4): 294-295

- **A wearable echomyography system based on a single transducer.** *Nature electronics*
  Gao, X., Chen, X., Lin, M., Yue, W., Hu, H., Qin, S., Zhang, F., Lou, Z., Yin, L., Huang, H., Zhou, S., Bian, Y., Yang, et al
  2024; 7 (11): 1035-1046

- **A fingertip-wearable microgrid system for autonomous energy management and metabolic monitoring** *NATURE ELECTRONICS*
  Ding, S., Saha, T., Yin, L., Liu, R., Khan, M., Chang, A., Lee, H., Zhao, H., Liu, Y., Nazemi, A., Zhou, J., Chen, C., Li, et al
  2024; 7 (9)

- **Concepts and applications of digital twins in healthcare and medicine.** *Patterns (New York, N.Y.)*

Zhang, K., Zhou, H. Y., Baptista-Hon, D. T., Gao, Y., Liu, X., Oermann, E., Xu, S., Jin, S., Zhang, J., Sun, Z., Yin, Y., Razmi, R. M., Loupy, et al
2024; 5 (8): 101028

- **Wearable sensing of solid analytes.** *Nature materials*
  Qin, S., Xu, S.
  2024; 23 (8): 1019-1020
- **Clinical, Safety, and Engineering Perspectives on Wearable Ultrasound Technology: A Review.** *IEEE transactions on ultrasonics, ferroelectrics, and frequency control*
  Song, P., Andre, M., Chitnis, P., Xu, S., Croy, T., Wear, K., Sikdar, S.
  2024; 71 (7): 730-744
- **Emerging Wearable Ultrasound Technology.** *IEEE transactions on ultrasonics, ferroelectrics, and frequency control*
  Huang, H., Wu, R. S., Lin, M., Xu, S.
  2024; 71 (7): 713-729
- **Transcranial volumetric imaging using a conformal ultrasound patch.** *Nature*
  Zhou, S., Gao, X., Park, G., Yang, X., Qi, B., Lin, M., Huang, H., Bian, Y., Hu, H., Chen, X., Wu, R. S., Liu, B., Yue, et al
  2024; 629 (8013): 810-818
- **In-ear integrated sensor array for the continuous monitoring of brain activity and of lactate in sweat.** *Nature biomedical engineering*
  Xu, Y., De la Paz, E., Paul, A., Mahato, K., Sempionatto, J. R., Tostado, N., Lee, M., Hota, G., Lin, M., Uppal, A., Chen, W., Dua, S., Yin, et al
  2023; 7 (10): 1307-1320
- **Stretchable ultrasonic arrays for the three-dimensional mapping of the modulus of deep tissue.** *Nature biomedical engineering*
  Hu, H., Ma, Y., Gao, X., Song, D., Li, M., Huang, H., Qian, X., Wu, R., Shi, K., Ding, H., Lin, M., Chen, X., Zhao, et al
  2023; 7 (10): 1321-1334
- **Strategic heating for growing perovskite single crystals** *MATTER*
  Lu, C., Wang, R., Xu, S.
  2023; 6 (8): 2537-2539
- **A fully integrated wearable ultrasound system to monitor deep tissues in moving subjects.** *Nature biotechnology*
  Lin, M., Zhang, Z., Gao, X., Bian, Y., Wu, R. S., Park, G., Lou, Z., Zhang, Z., Xu, X., Chen, X., Kang, A., Yang, X., Yue, et al
  2023
- **Technology Roadmap for Flexible Sensors.** *ACS nano*
  Luo, Y., Abidian, M. R., Ahn, J. H., Akinwande, D., Andrews, A. M., Antonietti, M., Bao, Z., Berggren, M., Berkey, C. A., Bettinger, C. J., Chen, J., Chen, P., Cheng, et al
  2023
- **A wearable cardiac ultrasound imager.** *Nature*
  Hu, H., Huang, H., Li, M., Gao, X., Yin, L., Qi, R., Wu, R. S., Chen, X., Ma, Y., Shi, K., Li, C., Maus, T. M., Huang, et al
  2023; 613 (7945): 667-675
- **A photoacoustic patch for three-dimensional imaging of hemoglobin and core temperature.** *Nature communications*
  Gao, X., Chen, X., Hu, H., Wang, X., Yue, W., Mu, J., Lou, Z., Zhang, R., Shi, K., Chen, X., Lin, M., Qi, B., Zhou, et al
  2022; 13 (1): 7757
- **A stretchable epidermal sweat sensing platform with an integrated printed battery and electrochromic display** *NATURE ELECTRONICS*
  Yin, L., Cao, M., Kim, K., Lin, M., Moon, J., Sempionatto, J. R., Yu, J., Liu, R., Wicker, C., Trifonov, A., Zhang, F., Hu, H., Moreto, et al
  2022; 5 (10): 694-705
- **Perovskite superlattices with efficient carrier dynamics.** *Nature*
  Lei, Y., Li, Y., Lu, C., Yan, Q., Wu, Y., Babbe, F., Gong, H., Zhang, S., Zhou, J., Wang, R., Zhang, R., Chen, Y., Tsai, et al
  2022; 608 (7922): 317-323
- **Soft wearable devices for deep-tissue sensing** *NATURE REVIEWS MATERIALS*
  Lin, M., Hu, H., Zhou, S., Xu, S.
  2022; 7 (11): 850-869

- **Three-dimensional transistor arrays for intra- and inter-cellular recording** *NATURE NANOTECHNOLOGY*
  Gu, Y., Wang, C., Kim, N., Zhang, J., Wang, T., Stowe, J., Nasiri, R., Li, J., Zhang, D., Yang, A., Hsu, L., Dai, X., Mu, et al
  2022; 17 (3): 292-+
- **Demystifying phase transformations in metal halide perovskites** *MATTER*
  Lu, C., Wang, Y., Zhang, R., Xu, S.
  2021; 4 (8): 2627-2629
- **A passive perspiration biofuel cell: High energy return on investment** *JOULE*
  Yin, L., Moon, J., Sempionatto, J. R., Lin, M., Cao, M., Trifonov, A., Zhang, F., Lou, Z., Jeong, J., Lee, S., Xu, S., Wang, J.
  2021; 5 (7): 1888-1904
- **Review Single-crystal halide perovskites: Opportunities and challenges** *MATTER*
  Lei, Y., Chen, Y., Xu, S.
  2021; 4 (7): 2266-2308
- **Wearable Biosupercapacitor: Harvesting and Storing Energy from Sweat** *ADVANCED FUNCTIONAL MATERIALS*
  Lv, J., Yin, L., Chen, X., Jeerapan, I., Silva, C. A., Li, Y., Le, M., Lin, Z., Wang, L., Trifonov, A., Xu, S., Cosnier, S., Wang, et al
  2021; 31 (38)
- **Continuous monitoring of deep-tissue haemodynamics with stretchable ultrasonic phased arrays** *NATURE BIOMEDICAL ENGINEERING*
  Wang, C., Qi, B., Lin, M., Zhang, Z., Makihata, M., Liu, B., Zhou, S., Huang, Y., Hu, H., Gu, Y., Chen, Y., Lei, Y., Lee, et al
  2021; 5 (7): 749-+
- **An epidermal patch for the simultaneous monitoring of haemodynamic and metabolic biomarkers.** *Nature biomedical engineering*
  Sempionatto, J. R., Lin, M., Yin, L., De la Paz, E., Pei, K., Sonsa-Ard, T., de Loyola Silva, A. N., Khorshed, A. A., Zhang, F., Tostado, N., Xu, S., Wang, J.
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- **Instant, multiscale dry transfer printing by atomic diffusion control at heterogeneous interfaces.** *Science advances*
  Heo, S., Ha, J., Son, S. J., Choi, I. S., Lee, H., Oh, S., Jekal, J., Kang, M. H., Lee, G. J., Jung, H. H., Yea, J., Lee, T., Lee, et al
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- **Smart Contact Lenses for Biosensing Applications** *ADVANCED INTELLIGENT SYSTEMS*
  Ma, X., Ahadian, S., Liu, S., Zhang, J., Liu, S., Cao, T., Lin, W., Wu, D., de Barros, N., Zare, M., Diltemiz, S., Jucaud, V., Zhu, et al
  2021; 3 (5)
- **Fabric-substrated capacitive biopotential sensors enhanced by dielectric nanoparticles** *NANO RESEARCH*
  Chen, X., Gao, X., Nomoto, A., Shi, K., Lin, M., Hu, H., Gu, Y., Zhu, Y., Wu, Z., Chen, X., Wang, X., Qi, B., Zhou, et al
  2021; 14 (9): 3248-3252
- **Nanomaterial Biointerfacing via Mitochondrial Membrane Coating for Targeted Detoxification and Molecular Detection.** *Nano letters*
  Gong, H., Zhang, Q., Komarla, A., Wang, S., Duan, Y., Zhou, Z., Chen, F., Fang, R. H., Xu, S., Gao, W., Zhang, L.
  2021; 21 (6): 2603-2609
- **A self-sustainable wearable multi-modular E-textile bioenergy microgrid system.** *Nature communications*
  Yin, L., Kim, K. N., Lv, J., Tehrani, F., Lin, M., Lin, Z., Moon, J. M., Ma, J., Yu, J., Xu, S., Wang, J.
  2021; 12 (1): 1542
- **Role of the Metal-Semiconductor Interface in Halide Perovskite Devices for Radiation Photon Counting.** *ACS applied materials & interfaces*
  Shrestha, S., Tsai, H., Yoho, M., Ghosh, D., Liu, F., Lei, Y., Tisdale, J., Baldwin, J., Xu, S., Neukirch, A. J., Tretiak, S., Vo, D., Nie, et al
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- **Deciphering facial movements.** *Nature biomedical engineering*
  Gao, X., Chen, X., Xu, S.
  2020; 4 (10): 935-936
- **A fabrication process for flexible single-crystal perovskite devices.** *Nature*
  Lei, Y., Chen, Y., Zhang, R., Li, Y., Yan, Q., Lee, S., Yu, Y., Tsai, H., Choi, W., Wang, K., Luo, Y., Gu, Y., Zheng, et al
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- **Stretchable Nanolayered Thermoelectric Energy Harvester on Complex and Dynamic Surfaces.** *Nano letters*
  Yang, Y., Hu, H., Chen, Z., Wang, Z., Jiang, L., Lu, G., Li, X., Chen, R., Jin, J., Kang, H., Chen, H., Lin, S., Xiao, et al
  2020; 20 (6): 4445-4453
- **Frequency- and Power-Dependent Photoresponse of a Perovskite Photodetector Down to the Single-Photon Level.** *Nano letters*
  Xu, Z., Yu, Y., Arya, S., Niaz, I. A., Chen, Y., Lei, Y., Miah, M. A., Zhou, J., Zhang, A. C., Yan, L., Xu, S., Nomura, K., Lo, et al
  2020; 20 (3): 2144-2151
- **Strain engineering and epitaxial stabilization of halide perovskites.** *Nature*
  Chen, Y., Lei, Y., Li, Y., Yu, Y., Cai, J., Chiu, M. H., Rao, R., Gu, Y., Wang, C., Choi, W., Hu, H., Wang, C., Li, et al
  2020; 577 (7789): 209-215
- **Stretchable and Flexible Buckypaper-Based Lactate Biofuel Cell for Wearable Electronics** *ADVANCED FUNCTIONAL MATERIALS*
  Chen, X., Yin, L., Lv, J., Gross, A. J., Le, M., Gutierrez, N., Li, Y., Jeerapan, I., Giroud, F., Berezovska, A., O'Reilly, R. K., Xu, S., Cosnier, et al
  2019; 29 (46)
- **Soft sensors form a network** *NATURE ELECTRONICS*
  Lin, M., Gutierrez, N., Xu, S.
  2019; 2 (8): 327-328
- **A Biomimetic Soft Lens Controlled by Electrooculographic Signal** *ADVANCED FUNCTIONAL MATERIALS*
  Li, J., Wang, Y., Liu, L., Xu, S., Liu, Y., Leng, J., Cai, S.
  2019; 29 (36)
- **Wearable thermoelectrics for personalized thermoregulation.** *Science advances*
  Hong, S., Gu, Y., Seo, J. K., Wang, J., Liu, P., Meng, Y. S., Xu, S., Chen, R.
  2019; 5 (5): eaaw0536
- **Biomembrane-Modified Field Effect Transistors for Sensitive and Quantitative Detection of Biological Toxins and Pathogens.** *ACS nano*
  Gong, H., Chen, F., Huang, Z., Gu, Y., Zhang, Q., Chen, Y., Zhang, Y., Zhuang, J., Cho, Y. K., Fang, R. H., Gao, W., Xu, S., Zhang, et al
  2019; 13 (3): 3714-3722
- **Materials and Structures toward Soft Electronics.** *Advanced materials (Deerfield Beach, Fla.)*
  Wang, C., Wang, C., Huang, Z., Xu, S.
  2018; 30 (50): e1801368
- **Highly Stable Battery Pack via Insulated, Reinforced, Buckling-Enabled Interconnect Array** *SMALL*
  Yin, L., Seo, J., Kurniawan, J., Kumar, R., Lv, J., Xie, L., Liu, X., Xu, S., Meng, Y. S., Wang, J.
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- **Monitoring of the central blood pressure waveform via a conformal ultrasonic device.** *Nature biomedical engineering*
  Wang, C., Li, X., Hu, H., Zhang, L., Huang, Z., Lin, M., Zhang, Z., Yin, Z., Huang, B., Gong, H., Bhaskaran, S., Gu, Y., Makihata, et al
  2018; 2 (9): 687-695
- **Three-dimensional integrated stretchable electronics** *NATURE ELECTRONICS*
  Huang, Z., Hao, Y., Li, Y., Hu, H., Wang, C., Nomoto, A., Pan, T., Gu, Y., Chen, Y., Zhang, T., Li, W., Lei, Y., Kim, et al
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- **Controlled Homoepitaxial Growth of Hybrid Perovskites.** *Advanced materials (Deerfield Beach, Fla.)*
  Lei, Y., Chen, Y., Gu, Y., Wang, C., Huang, Z., Qian, H., Nie, J., Hollett, G., Choi, W., Yu, Y., Kim, N., Wang, C., Zhang, et al
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- **Stretchable ultrasonic transducer arrays for three-dimensional imaging on complex surfaces.** *Science advances*
  Hu, H., Zhu, X., Wang, C., Zhang, L., Li, X., Lee, S., Huang, Z., Chen, R., Chen, Z., Wang, C., Gu, Y., Chen, Y., Lei, et al
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- **Materials science. Assembly of micro/nanomaterials into complex, three-dimensional architectures by compressive buckling.** *Science (New York, N.Y.)*
  Xu, S., Yan, Z., Jang, K. I., Huang, W., Fu, H., Kim, J., Wei, Z., Flavin, M., McCracken, J., Wang, R., Badea, A., Liu, Y., Xiao, et al
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- **Soft microfluidic assemblies of sensors, circuits, and radios for the skin.** *Science (New York, N.Y.)*
  Xu, S., Zhang, Y., Jia, L., Mathewson, K. E., Jang, K. I., Kim, J., Fu, H., Huang, X., Chava, P., Wang, R., Bhole, S., Wang, L., Na, et al
  2014; 344 (6179): 70-4
- **Stretchable batteries with self-similar serpentine interconnects and integrated wireless recharging systems** *NATURE COMMUNICATIONS*
  Xu, S., Zhang, Y., Cho, J., Lee, J., Huang, X., Jia, L., Fan, J. A., Su, Y., Su, J., Zhang, H., Cheng, H., Lu, B., Yu, et al
  2013; 4
- **One-dimensional ZnO nanostructures: Solution growth and functional properties** *NANO RESEARCH*
  Xu, S., Wang, Z.
  2011; 4 (11): 1013-1098
- **Oxide nanowire arrays for light-emitting diodes and piezoelectric energy harvesters** *PURE AND APPLIED CHEMISTRY*
  Xu, S., Wang, Z.
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- **Piezoelectric-nanowire-enabled power source for driving wireless microelectronics.** *Nature communications*
  Xu, S., Hansen, B. J., Wang, Z. L.
  2010; 1: 93
- **Self-powered nanowire devices.** *Nature nanotechnology*
  Xu, S., Qin, Y., Xu, C., Wei, Y., Yang, R., Wang, Z. L.
  2010; 5 (5): 366-73