Stanford

Wei Gu

Assistant Professor of Pathology

CLINICAL OFFICE (PRIMARY)

- **Stanford Blood Center**
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Bio

BIO

Wei Gu, MD, PhD, is a physician, engineer, and scientist who combines clinical expertise with engineering principles to pioneer next-generation diagnostic approaches that enhance precision medicine and advance cancer genomics. He has pioneered technologies in cell-free DNA 'liquid biopsy' testing, methylome profiling, CRISPR diagnostics, clinical metagenomic sequencing, non-invasive prenatal testing, and COVID diagnostics. A current focus of his laboratory is the minimally/non-invasive genetic and epigenetic profiling of clinical cohorts using new technologies such as FLEXseq. Dr. Gu has received awards from the Burroughs Wellcome Career Award and the National Cancer Institute. As a physician, he is board-certified in molecular and clinical pathology and maintains a clinical practice at Stanford Healthcare.

CLINICAL FOCUS

- Molecular Pathology
- Anatomic and Clinical Pathology

ACADEMIC APPOINTMENTS

- Assistant Professor - University Medical Line, Pathology
- Member, Bio-X

HONORS AND AWARDS

- Career Awards for Medical Scientists (CAMS), Burroughs Wellcome (2018)
- Career Development Award (K08), National Cancer Institute (2017)
- Laurence Marton Research Award, UCSF (2016)
- Julius R. Krevans Award for Clinical Excellence, UCSF (2015)
- Medical Scientist Training Program Scholarship, Stanford University (2005-2014)
- Terumo Scholarship, Terumo (2004-2005)
- Winner (Undergraduate), National Collegiate Inventors Competition, US Patent Office (2004)

- Clifton S. Goddin Scholarship, University of Michigan (2004)
- Regents Award & Engineering Scholarships, University of Michigan (2001, 2003-2005)

PROFESSIONAL EDUCATION

- Board Certification: Molecular Genetic Pathology, American Board of Pathology (2018)
- Fellowship: UCSF Pathology Fellowships (2018) CA
- Board Certification: Clinical Pathology, American Board of Pathology (2017)
- Residency: UCSF Pathology Residency (2017) CA
- Medical Education: Stanford University School of Medicine (2014) CA
- PhD, Stanford University Schools of Medicine and Engineering , Bioengineering (2014)
- BSE, University of Michigan , Chemical Engineering (2005)

LINKS

- Research Lab website: https://cfna.stanford.edu/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Overall Interests: Our lab is dedicated to innovating in molecular diagnostics. We develop cutting-edge tools designed to convert nucleic acids into actionable clinical insights. We have been at the forefront of several breakthrough technologies in cell-free DNA 'liquid biopsy' testing, CRISPR diagnostics, clinical metagenomic sequencing, non-invasive prenatal testing, and COVID diagnostics. We have extensively studied cell-free nucleic acids from minimally invasive biopsies that contain terabytes of epigenetic and genetic data. Our goal is to maximize the diagnostic potential from this rich data through less invasive sampling, providing earlier, actionable information for patients. These biomarkers have already proven to be useful in fetal, transplant, microbial, and cancer diagnostics. However, there is still much to learn about utilizing this unique dataset in the context of human disease.

Current Interests: Our research team recently invented a methylation sequencing profiler that enriches genomewide by up to 18-fold (97%+ of reads have unbiased CpG data), and we are leveraging it to focus on: tumor classification, early cancer detection, early cancer prognostication, enhancing minimally invasive biopsies classification and prognostication, and tools to advance the diagnostic resolution of hard-to-diagnose clinical cases. The profiler is scaled and allows us to generate methylation profiles from thousands of FFPE and cfDNA specimens, beyond what is usually available or affordable. We then use advanced computational techniques related to methylation classification, bulk deconvolution, markers of prognostication, and new approaches in these areas.

Teaching

STANFORD ADVISEES

Postdoctoral Faculty Sponsor

Tiepeng Liao

Publications

PUBLICATIONS

- **Liquid Biopsy Based on Cell-Free DNA and RNA.** *Annual review of biomedical engineering*
  Loy, C., Ahmann, L., De Vlaminck, I., Gu, W.
  2024

- **Detection of Neoplasms by Metagenomic Next-Generation Sequencing of Cerebrospinal Fluid.** *JAMA neurology*
  Gu, W., Rauschecker, A. M., Hsu, E., Zorn, K. C., Sucu, Y., Federman, S., Gopez, A., Arevalo, S., Sample, H. A., Talevich, E., Nguyen, E. D., Gottschall, M., Nourbakhsh, et al
  2021

- **Detection of cryptogenic malignancies from metagenomic whole genome sequencing of body fluids.** *Genome medicine*
  Gu, W., Talevich, E., Hsu, E., Qi, Z., Urisman, A., Federman, S., Gopez, A., Arevalo, S., Gottschall, M., Liao, L., Tung, J., Chen, L., Lim, et al
  2021; 13 (1): 98

- **Cell-Free DNA Tissues-of-Origin by Methylation Profiling Reveals Significant Cell, Tissue and Organ-Specific injury related to COVID-19 Severity.** *Med (New York, N.Y.)*
  Cheng, A. P., Cheng, M. P., Gu, W., Lenz, J. S., Hsu, E., Schurr, E., Bourque, G., Bourgey, M., Ritz, J., Marty, F. M., Chiu, C. Y., Vinh, D. C., De Vlaminck, et al
  2021

- **Rapid pathogen detection by metagenomic next-generation sequencing of infected body fluids.** *Nature medicine*
  Gu, W., Deng, X., Lee, M., Sucu, Y. D., Arevalo, S., Stryke, D., Federman, S., Gopez, A., Reyes, K., Zorn, K., Sample, H., Yu, G., Ishpuniani, et al
  2020

- **Genomic surveillance reveals multiple introductions of SARS-CoV-2 into Northern California.** *Science (New York, N.Y.)*
  Deng, X., Gu, W., Federman, S., du Plessis, L., Pybus, O. G., Faria, N. R., Wang, C., Yu, G., Bushnell, B., Pan, C. Y., Guevara, H., Sotomayor-Gonzalez, A., Zorn, et al
  2020; 369 (6503): 582-587

- **Clinical Metagenomic Next-Generation Sequencing for Pathogen Detection.** *Annual review of pathology*
  Gu, W., Miller, S., Chiu, C. Y.
  2019; 14: 319-338

- **Non-invasive prenatal measurement of the fetal genome** *NATURE*
  Fan, H. C., Gu, W., Wang, J., Blumenfeld, Y. J., El-Sayed, Y. Y., Quake, S. R.
  2012; 487 (7407): 320-?

- **Genome-Wide DNA Methylation Identifies Distinct Subgroups of Vulvovaginal Mesenchymal Neoplasia**
  Neil, A., Howitt, B., Yu, J., Bennett, J., Pinto, A., Quick, C., Neville, G., Nucci, M., Chapel, D., Heilbroner, L., Wang, A., Yao, Y., Ahmann, et al
  ELSEVIER SCIENCE INC.2023: S960-S961

- **CRISPR-Cas12-based detection of SARS-CoV-2.** *Nature biotechnology*
  Broughton, J. P., Deng, X., Yu, G., Fasching, C. L., Servellita, V., Singh, J., Miao, X., Streithorst, J. A., Granados, A., Sotomayor-Gonzalez, A., Zorn, K., Gopez, A., Hsu, et al
  2020; 38 (7): 870-874

- **Associations of Early COVID-19 Cases in San Francisco with Domestic and International Travel.** *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*
  Gu, W., Deng, X., Reyes, K., Hsu, E., Wang, C., Sotomayor-Gonzalez, A., Federman, S., Bushnell, B., Miller, S., Chiu, C.
  2020

- **Evaluation of SARS-CoV-2 serology assays reveals a range of test performance.** *Nature biotechnology*
  Whitman, J. D., Hiatt, J. n., Mowery, C. T., Shy, B. R., Yu, R. n., Yamamoto, T. N., Rathore, U. n., Goldgof, G. M., Whitty, C. n., Woo, J. M., Gallman, A. E., Miller, T. E., Levine, et al
  2020

- **Depletion of Abundant Sequences by Hybridization (DASH): using Cas9 to remove unwanted high-abundance species in sequencing libraries and molecular counting applications** *GENOME BIOLOGY*
  Gu, W., Crawford, E. D., O'Donovan, B. D., Wilson, M. R., Chow, E. D., Retallack, H., DeRisi, J. L.
  2016; 17: 41

- **Brain Tumor Mutations Detected in Cerebral Spinal Fluid** *CLINICAL CHEMISTRY*
  Pan, W., Gu, W., Nagpal, S., Gephart, M. H., Quake, S. R.
  2015; 61 (3): 514-522

- **Noninvasive prenatal diagnosis in a fetus at risk for methylmalonic acidemia.** *Genetics in medicine*

Gu, W., Koh, W., Blumenfeld, Y. J., El-Sayed, Y. Y., Hudgins, L., Hintz, S. R., Quake, S. R.
2014; 16 (7): 564-567

- **Noninvasive prenatal diagnosis in a fetus at risk for methylmalonic acidemia** *GENETICS IN MEDICINE*
  Gu, W., Koh, W., Blumenfeld, Y. J., El-Sayed, Y. Y., Hudgins, L., Hintz, S. R., Quake, S. R.
  2014; 16 (7): 564-567
- **Electromechanical properties of pressure-actuated poly(dimethylsiloxane) microfluidic push-down valves** *ANALYTICAL CHEMISTRY*
  Chen, H., Gu, W., Cellar, N., Kennedy, R., Takayama, S., Meiners, J.
  2008; 80 (15): 6110-6113
- **A Microfluidic System for Rapid Bacterial Pathogen Detection** *7th IEEE Conference on Nanotechnology*
  Mai, J. D., Gaster, R. S., Wu, A., Gu, W., Mach, K. E., Liao, J. C.
  IEEE.2007: 1341–1345
- **Microscale integrated sperm sorter.** *Methods in molecular biology (Clifton, N.J.)*
  Chung, Y., Zhu, X., Gu, W., Smith, G. D., Takayama, S.
  2006; 321: 227-244
- **Handheld recirculation system and customized media for microfluidic cell culture** *LAB ON A CHIP*
  Futai, N., Gu, W., Song, J. W., Takayama, S.
  2006; 6 (1): 149-154
- **Computer-controlled microcirculatory support system for endothelial cell culture and shearing** *ANALYTICAL CHEMISTRY*
  Song, J. W., Gu, W., Futai, N., Warner, K. A., Nor, J. E., Takayama, S.
  2005; 77 (13): 3993-3999
- **Microfluidics for flow cytometric analysis of cells and particles** *PHYSIOLOGICAL MEASUREMENT*
  Huh, D., Gu, W., Kamotani, Y., Grotberg, J. B., Takayama, S.
  2005; 26 (3): R73-R98
- **Computerized microfluidic cell culture using elastomeric channels and Braille displays** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Gu, W., Zhu, X. Y., Futai, N., Cho, B. S., Takayama, S.
  2004; 101 (45): 15861-15866