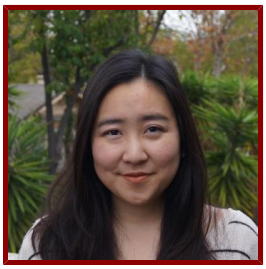
Stanford



Karina Nakayama

Instructor, Cardiothoracic Surgery

Bio

BIO

I am an Instructor in the Department of Cardiothoracic Surgery and the Cardiovascular Institute at Stanford University working with Dr. Ngan Huang using spatially patterned biomimetic niches to direct cell fate, angiogenesis, and tissue regeneration. Prior to Stanford, I attained a PhD from the University of California, Davis in Biomedical Engineering in the translational laboratory of Dr. Alice Tarantal working towards regenerative therapies for congenital kidney diseases using decellularized kidney matrices and directed differentiation of stem and progenitor cells towards renal lineages.

I am dedicated to understanding the biomechanical cell-substrate interactions that modulate cell phenotype and behavior towards enhancing tissue neurovascularization, regeneration, and function. The overarching goal of my research is the development of bioengineered therapeutics that can lead to future regenerative therapies, with relevance to cardiovascular and musculoskeletal injuries and diseases. My work to date, suggests that the composition, spatial organization, and mechanical properties of extracellular matrix microenvironments play a directive role in modulating cell phenotype and function. The scientific themes that frame my research program are the elucidation of novel biomechanical pathways that can be harnessed to enhance engineered vasculature, innervation, and function of cardiac and skeletal muscle, and complex multi-tissue composites using methods that range from nanopatterning of biomaterials and RNASeq, to modular immuno-physiologic culture systems and regenerative rehabilitation.

My research background spans the fields of biomedical engineering, developmental and stem cell biology, and cardiovascular medicine, making multi-disciplinary research at the interface of these disciplines natural and primed for innovation. I have enjoyed research funding through the California Institute of Regenerative Medicine (CIRM), the NIH/NHLBI (T32 and F32 fellowships), and the American Heart Association. I recently received K99/R00 funding through the NIH/NHLBI and look forward to using this award to jumpstart my independent research career.

I am eager to mentor undergraduates, graduate students, and postdocs from diverse backgrounds into critically thinking ambassadors of science, engineering, and medicine. I am excited to share my knowledge and passion for science and engineering with this next generation of talented young innovators and to be a positive force in promoting equity in education and diversity in STEM fields.

ACADEMIC APPOINTMENTS

- Instructor, Cardiothoracic Surgery

HONORS AND AWARDS

- Career Development Award: K99/R00 NIH Pathway to Independence Award, NIH/NHLBI (1/15/18-12/31/22)
- Pilot Training Grant: Alliance for Regenerative Rehabilitation Research, AR3T (7/1/17-6/30/19)
- Postdoctoral Fellowship: F32 Ruth L. Kirschstein National Research Service Award (NRSA), NIH/NHLBI (9/1/16-1/14/18)

- Postdoctoral Fellowship: AHA Western States Affiliates Postdoctoral Fellowship, AHA (7/1/15 – 8/31/16)
- Postdoctoral Fellowship: T32 Stanford Cardiovascular Institute Training Grant, NIH/NHLBI (7/1/14 – 6/30/15)
- Pre-doctoral Fellowship: California Institute of Regenerative Medicine Stem Cell Training Program, CIRM (9/1/08-8/31/11)
- Pre-doctoral Fellowship: T32 Pre-Doctoral Clinical Research Training Program, UC Davis, Clinical and Translational Science Center (4/1/08-8/31/08)

PROFESSIONAL EDUCATION

- Ph.D., University of California, Davis , Biomedical Engineering (2012)
- B.S., University of California, San Diego , Bioengineering (2007)

Publications

PUBLICATIONS

- **Engineering Biomimetic Materials for Skeletal Muscle Repair and Regeneration.** *Advanced healthcare materials*
  Nakayama, K. H., Shayan, M., Huang, N. F.
  2019: e1801168
- **Rehabilitative exercise and spatially patterned nanofibrillar scaffolds enhance vascularization and innervation following volumetric muscle loss** *NPJ REGENERATIVE MEDICINE*
  Nakayama, K. H., Alcazar, C., Yang, G., Quarta, M., Paine, P., Doan, L., Davies, A., Rando, T. A., Huang, N. F.
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- **Big bottlenecks in cardiovascular tissue engineering.** *Communications biology*
  Huang, N. F., Serpooshan, V., Morris, V. B., Sayed, N., Pardon, G., Abilez, O. J., Nakayama, K. H., Pruitt, B. L., Wu, S. M., Yoon, Y., Zhang, J., Wu, J. C.
  2018; 1: 199
- **Anisotropic microfibrous scaffolds enhance the organization and function of cardiomyocytes derived from induced pluripotent stem cells.** *Biomaterials science*
  Wanjare, M., Hou, L., Nakayama, K. H., Kim, J. J., Mezak, N. P., Abilez, O. J., Tzatzalos, E., Wu, J. C., Huang, N. F.
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- **Targeted delivery of human iPS-ECs overexpressing IL-8 receptors inhibits neointimal and inflammatory responses to vascular injury in the rat.** *American journal of physiology. Heart and circulatory physiology*
  Giordano, S., Zhao, X., Xing, D., Hage, F., Oparil, S., Cooke, J. P., Lee, J., Nakayama, K. H., Huang, N. F., Chen, Y.
  2016; 310 (6): H705-15
- **Nanoscale Patterning of Extracellular Matrix Alters Endothelial Function under Shear Stress** *NANO LETTERS*
  Nakayama, K. H., Surya, V. N., Gole, M., Walker, T. W., Yang, W., Lai, E. S., Ostrowski, M. A., Fuller, G. G., Dunn, A. R., Huang, N. F.
  2016; 16 (1): 410-419
- **Nanoscale Patterning of Extracellular Matrix Alters Endothelial Function under Shear Stress.** *Nano letters*
  Nakayama, K. H., Surya, V. N., Gole, M., Walker, T. W., Yang, W., Lai, E. S., Ostrowski, M. A., Fuller, G. G., Dunn, A. R., Huang, N. F.
  2016; 16 (1): 410–19
- **Aligned-Braided Nanofibrillar Scaffold with Endothelial Cells Enhances Arteriogenesis.** *ACS nano*
  Nakayama, K. H., Hong, G., Lee, J. C., Patel, J., Edwards, B., Zaitseva, T. S., Paukshto, M. V., Dai, H., Cooke, J. P., Woo, Y. J., Huang, N. F.
  2015; 9 (7): 6900-6908
- **Bilayered vascular graft derived from human induced pluripotent stem cells with biomimetic structure and function** *REGENERATIVE MEDICINE*
  Nakayama, K. H., Joshi, P. A., Lai, E. S., Gujar, P., Joubert, L., Chen, B., Huang, N. F.
  2015; 10 (6): 745-755
- **Role of extracellular matrix signaling cues in modulating cell fate commitment for cardiovascular tissue engineering.** *Advanced healthcare materials*
  Nakayama, K. H., Hou, L., Huang, N. F.
  2014; 3 (5): 628-641
- **Near-infrared II fluorescence for imaging hindlimb vessel regeneration with dynamic tissue perfusion measurement.** *Circulation. Cardiovascular imaging*
  Hong, G., Lee, J. C., Jha, A., Diao, S., Nakayama, K. H., Hou, L., Doyle, T. C., Robinson, J. T., Antaris, A. L., Dai, H., Cooke, J. P., Huang, N. F.

2014; 7 (3): 517-525

- **Multi-cellular interactions sustain long-term contractility of human pluripotent stem cell-derived cardiomyocytes.** *American journal of translational research*
  Burridge, P. W., Metzler, S. A., Nakayama, K. H., Abilez, O. J., Simmons, C. S., Bruce, M. A., Matsuura, Y., Kim, P., Wu, J. C., Butte, M., Huang, N. F., Yang, P. C.
  2014; 6 (6): 724-735

- **Tissue specificity of decellularized rhesus monkey kidney and lung scaffolds.** *PloS one*
  Nakayama, K. H., Lee, C. C., Batchelder, C. A., Tarantal, A. F.
  2013; 8 (5)

- **Renal Tissue Engineering with Decellularized Rhesus Monkey Kidneys: Age-Related Differences** *TISSUE ENGINEERING PART A*
  Nakayama, K. H., Batchelder, C. A., Lee, C. I., Tarantal, A. F.
  2011; 17 (23-24): 2891-2901

- **Use of large animal and nonhuman primate models for cell therapy and tissue engineering** *Tissue Engineering in Regenerative Medicine*
  Tarantal AF, Nakayama KH
  2011: 393-413

- **Decellularized Rhesus Monkey Kidney as a Three-Dimensional Scaffold for Renal Tissue Engineering** *TISSUE ENGINEERING PART A*
  Nakayama, K. H., Batchelder, C. A., Lee, C. I., Tarantal, A. F.
  2010; 16 (7): 2207-2216