Approved by the Regents
May 16, 2024

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Biomedical Engineering

Cynthia A. Chestek, associate professor of biomedical engineering, with tenure, Department of Biomedical Engineering, College of Engineering and Medical School, associate professor of robotics, without tenure, Department of Robotics, and associate professor of electrical engineering and computer science, without tenure, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to professor of biomedical engineering, with tenure, Department of Biomedical Engineering, College of Engineering and Medical School, professor of robotics, without tenure, Department of Robotics, and professor of electrical engineering and computer science, without tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees:

Ph.D.	2010	Stanford University, Neuroengineering, Stanford, CA
M.S.	2005	Case Western. Electrical Engineering, Cleveland, OH
B.S.E.	2003	Electrical Engineering, Case Western University, Cleveland, OH

Professional Record:

2023 – present	Associate Professor (without tenure), Department of Robotics, University of Michigan
2018 – present	Associate Professor (with tenure), Department of Biomedical Engineering, University of Michigan
2018 – present	Associate Professor (without tenure), Department of Electrical Engineering and Computer Science, University of Michigan
2013 – 2018	Assistant Professor, Department of Electrical Engineering and Computer Science, University of Michigan
2012 – 2018	Assistant Professor, Department of Biomedical Engineering, University of Michigan

Summary of Evaluation:

Teaching: Professor Chestek's contributions to teaching include classroom instruction and mentoring graduate and undergraduate students in research. During her time in rank, she has created a core technical graduate course (BME 517, Neural Engineering). She has also taught a required undergraduate course (BME 241, Statistics, Computation, and Data Analysis), and co-taught BME 419 (Quantitative Physiology). In addition to the classroom instruction, she has mentored a total of 18 Ph.D. students (nine current and eight graduated), one incoming Ph.D. student directly matched to her lab to start in Fall 2023, six M.S. students, and 20 undergraduate students in her research lab.

Research: Professor Chestek's research seeks to create novel technology to restore function for people with paralysis or limb loss. She has two main projects in her lab: cortical brain-machine interface (BMIs) and peripheral nerve interfaces (RPNI). BMIs have both a hardware and software component and Professor Chestek's lab is one of the few in the world that conducts

research in both. On the hardware side, she has created novel electrodes and electrical circuits that advance the state of the art. Her carbon fiber electrode arrays are a disruptive technology that show the benefit of reducing penetrating brain recording arrays to subcellular dimensions. As evidence of impact, her lab has distributed over 1,000 of these devices to research groups around the world. On the software side, her novel decoding strategies have improved independent finger control, as demonstrated in her papers in Neuron 2021 and Nature Communications 2023. Focusing on finger control is exemplary of her willingness to take on difficult problems that are essential to developing truly impactful medical devices. Professor Chestek's second main area of research involves decoding signals from a regenerative peripheral nerve interface (RPNI). While initially developed by plastic surgeons at Michigan to reduce phantom limb pain, the RPNI provides a robust signal from peripheral nerves in an upper limb amputee. Professor Chestek and her trainees made the effort to obtain FDA approval, via an investigational device exemption, to permanently implant neural electrodes into RPNI. Using these implants, she demonstrated that amputees can intuitively control prosthetic limbs to perform daily tasks such as opening jars and pouring water.

Professor Chestek is a highly productive researcher by every measure. She publishes regularly in high-quality journals. She has advised a large number of Ph.D. students in multiple departments. She has obtained a significant number of research grants, both as the PI and in collaboration with others (nine current co-I grants). External reviewers were uniformly positive of her research portfolio.

Recent and Significant Publications

M. J. Mender, S. R. Nason-Tomaszewski, H. Temmar, J. T. Costello, D. M. Wallace, M. S. Willsey, N. G. Kumar, T. A. Kung, P. G. Patil and C. A. Chestek, "The impact of task context on predicting finger movements in a brain-machine interface," *eLife*, 12, e82598, 2023.

M. S. Willsey, S. R. Nason-Tomaszewski, S. R. Ensel, H. Temmar, M. J. Mender, J. T. Costello, P. G. Patil and C. A. Chestek, "Real-time brain-machine interface in non-human primates achieves high-velocity prosthetic finger movements using a shallow feedforward neural network decoder," *Nature Communications*, 13, 1, 2022.

A.K. Vaskov, P. P. Vu, N. North, A. J. Davis, T. A. Kung, D. H. Gates, P. S. Cederna and C. A. Chestek, "Surgically implanted electrodes enable real-time finger and grasp pattern recognition for prosthetic hands," *IEEE Trans on Robotics*, 35, 2841, 2022.

E. J. Welle, P. R. Patel, J. E. Woods, A. Petrossians, E. della Valle, A. Vega-Medina, J. M. Richie, D. Cai, J. D. Weiland and C. A. Chestek, "Ultra-small carbon fiber electrode recording site optimization and improved in vivo chronic recording yield," *J Neural Engineering*, 17, 026037, 2020.

S. R. Nason, A. K. Vaskov, M. S. Willsey, E. J. Welle, H. An, P. P. Vu, A. J. Bullard, C. S. Nu, J. C. Kao, K. V. Shenoy, T. Jan, H. S. Kim, D. Blaauw, P. G. Patil and C. A. Chestek, "A low-power band of neuronal spiking activity dominated by local single units improves the performance of brain–machine interfaces," *Nature Biomedical Engineering*, 27, 1, 2020.

Service: Professor Chestek has selflessly served the University of Michigan and the entire field of biomedical engineering nationally. She has served on the Executive Committee for both the Department of Robotics as well as the Department of Biomedical Engineering. She has been a

curriculum advisor in BME for bioelectronics and has helped to ensure that the neural engineering students within this program are getting the proper depth and breadth of training in this field. She is currently the associate chair for research in BME, and in this capacity, she has been responsible for mentoring trainees at all levels and faculty members as they pursue funding through extramural sources. She has helped them with grant writing and manuscript preparation to ensure the highest potential for success in gaining funding. She has also been responsible for the general administration of the grants office to ensure efficient processes in the pre-award and post-award stages of grant funding. In the Department of Robotics, she has served on the DEI Committee and has helped to organize a large annual event focused on mental health and emotional well-being. At the university level, she served on the search committee for the new director of the Michigan Neurosciences Institute. She has also been actively involved in reviewing the applications for the Rackham Pre-doctoral Fellowships, the Presidential Post-doctoral Scholars, and the COVID Relief Grants within the Medical School. She has also been a member of the Neuroscience Scholars Committee.

Nationally, she has served in many different ways with both the National Institutes of Health (NIH) and the National Science Foundation (NSF). Multiple times every single year, she attends study section meetings and special emphasis panels to review proposals submitted to both the NIH and NSF. Due to her level of activity, she was asked to help organize the Neural Interface Conference because of her deep understanding and commitment to this field of research and innovation. She has also been the co-chair of the IEEE Neural Engineering Conference in 2019 and the co-chair of the IEEE Advanced Neurotechnologies Meeting in 2020, the premier meetings internationally in this field.

External Reviewers:
Reviewer A: "Dr. Chestek has had an impressive impact in her teaching, research and service.... Dr. Chestek has published extensively in the highest-impact journals.... It has been a true professional pleasure to watch the idea grow from a hypothetical possibility to real-world implementation in humans…Dr. Chestek deserves the major credit for the engineering components that provided the capability of using and decoding the electrophysiological recordings into dexterous control of multiple degrees of freedom."

Reviewer B: "The translation of neurotechnology to both non-human primates and ultimately human trials is rare, and even more so with innovate mixing of multiple domains (new materials + neural sensing + signal processing); Prof Chestek has accomplished this milestone in a relatively short amount of time and using a novel mix of collaborators."

Reviewer C: "…She is both a role model and emerging leader in the field. She has a particularly important position because she stands out as a role model for young women engineers interested in this field, one that is heavily dominated by men and in great need of more diversity."

Reviewer D: "…she is among the very best investigators in chronic implants, primate work, and computational closed loop systems for brain-computer interfaces…. The hard work that Dr. Chestek does in her lab, building these interfaces and applying them to challenging problems, is impactful, thoughtful, creative, and extremely useful. She is a wonderful

contributor to advancing our field and her work is appreciated nationwide and beyond..”

Reviewer E: “Prof. Chestek is an internationally recognized neural engineering research [sic] focusing on both the development of new technologies and the control of finger movements using implanted neural interfaces.”

Reviewer F: “…Dr. Chestek is a jewel in your crown. It seems unlikely that she would choose to leave what has clearly been a very good situation for her at the University of Michigan. However, the school would do well to avoid giving her any reason to consider doing so. Dr. Chestek is highly deserving of this promotion and it would be a real mistake not to do so.”

Summary of Recommendation: Professor Chestek is a highly regarded scholar who has excelled as a researcher and teacher and has contributed to the university in multiple ways. She surpasses all expectations for promotion. It is with the support of the College of Engineering Executive Committee that I recommend Cynthia A. Chestek for promotion to professor of biomedical engineering with tenure, Department of Biomedical Engineering, College of Engineering and Medical School, professor of robotics, without tenure, Department of Robotics, and professor of electrical engineering and computer science, without tenure, Department of Electrical Engineering, College of Engineering.

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