**Approved by the Regents**
**May 16, 2024**

PROMOTION RECOMMENDATION
The University of Michigan
College of Literature, Science, and the Arts

Alison R.H. Narayan, associate professor of chemistry, with tenure, College of Literature, Science, and the Arts, is recommended for promotion to professor of chemistry, with tenure, College of Literature, Science, and the Arts [also being promoted to research professor, Life Sciences Institute].

Academic Degrees:

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| Ph.D. | 2011 | University of California, Berkley |
| B.S. | 2006 | University of Michigan, Ann Arbor |

Professional Record:

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| 2022–present | Director, Program in Chemical Biology (Ph.D. and M.S. program), University of Michigan |
| 2021–present | Mary Sue Coleman Collegiate Professor, Life Sciences Institute, University of Michigan |
| 2021–present | Associate Professor, Department of Chemistry, and Research Associate Professor, Life Sciences Institute, University of Michigan |
| 2016–2019 | William R. Roush Assistant Professor of Chemistry, University of Michigan |
| 2015–2021 | Assistant Professor, Department of Chemistry and Research Assistant Professor, Life Sciences Institute, University of Michigan |
| 2011–2015 | Post-doctoral Research Fellow, University of Michigan, Ann Arbor |

Summary of Evaluation:

Teaching: Since her last promotion, Professor Narayan added one new course to her teaching portfolio, Chem 420, intermediate organic chemistry (around fifty students per term) and continued to teach Chem 210 (~ 300 students). Professor Narayan uses interactive and peer-to-peer approaches for teaching including adding a "think-pair-share" problem for each class. She also offers students chances to correct mistakes to relieve pressure and more opportunities to demonstrate mastery. Students from these classes are found to be well prepared for higher level chemistry and her student evaluations are excellent. Professor Narayan also mentors a large cadre of graduate students, post-doctoral trainees, and undergraduates in her research group. Her attentive mentoring style and advocacy for her students has led to high success in publication, obtaining fellowships and internships, and placement. Overall, her teaching accomplishments are considered excellent.

Research: Professor Narayan merges chemical biology and organic chemistry by studying and harnessing enzymes in the context of organic synthesis. Enzymes are green, natural catalysts with high selectivity; however, the range of possible reactions catalyzed by a given enzyme is often not known and often enzymes must be engineered to catalyze reactions of interest for synthesis. Professor Narayan has taken a multifaceted approach towards tackling these issues with the overarching goal of making biocatalysts part of the armamentarium of synthetic chemists as well as developing a deeper understanding of enzyme function. She has identified novel oxidation and carbon-carbon bond formation reactions that can be facilitated by biocatalysts, and demonstrated their use for performing selective reactions that are challenging otherwise. She has used bioinformatics to elucidate enzyme function, including exploring how reaction selectivity evolved in ancestral proteins, leading to new insights into enzyme function and reactions. Finally, she has explored combinations of enzymes for total synthesis. These studies have placed her in a leading

position in this emerging field of chemistry. Realizing her vision to broadly use enzymes for synthesis will have broad impacts by enabling the generation of new medicines and reducing the environmental impact of industrial synthetic processes. The success and broad scope of her work so far, as well as the enormous untapped potential of enzymes, suggest continued future impact and productivity.

Recent and Significant Publications:

Chang-Hwa Chiang, C.-h., Wymore, T., Rodríguez Benítez, A., Hussain, A., Smith, J. L., Brooks, C. L III, Narayan, A. R. H. (2023). Deciphering the evolution of flavin-dependent monooxygenase stereoselectivity using ancestral sequence reconstruction. *Proceedings of the National Academy of Sciences*, *120*(15), e2218248120.

Zetzsche, L. E., Yazarians, J. A., Chakrabarty, S., Hinze, M. E., Murray, L. A., Lukowski, A. L., Joyce, L. A., and Narayan, A. R. H. (2022). Biocatalytic oxidative cross-coupling reactions for biaryl bond formation. *Nature*, *603*(7899), 79-85.

Lukowski, A. L., Liu, J., Bridwell-Rabb, J., and Narayan, A. R. H. (2020). Structural basis of divergent C–H hydroxylation selectivity in two Rieske oxygenas. *Nature Communications*, *11*(1), 2991.

Ackenhusen, S. E., Wang, Y., Chun, S. W., and Narayan, A. R. H. (2022). Understanding and circumventing the requirement for native thioester substrates for α-oxoamine synthase reactions. *ACS Chemical Biology*, *17*(9), 2389-2395.

Service: Professor Narayan has been an active leader within her units, the university, and the broader scientific community. Within the Department of Chemistry, she is viewed as a highly engaged member of the various committees she has served on, including the graduate and faculty search committees. Her university-level service and leadership were seen as outsized given that she was on the Presidential Search Committee and has become the director of the Program in Chemical Biology. She has tackled the latter role she with high energy and goals of providing an excellent student experience, including with respect to DEI. In her broader scientific community, she has played several prominent roles including organizing conferences and becoming associate editor of the high-profile journal *ACS Central Science*.

External Reviewers:

Reviewer (A): "It is the courageous scientists like Prof. Narayan who are bridging the long-standing gap between the biocatalysis and synthetic chemistry communities. With her deep understanding of enzymes and synthetic chemistry, good taste in choosing interesting problems, and tremendous work ethic, Prof. Narayan has emerged as a leader in this vibrant and growing field."

Reviewer (B): "[Professor Narayan] has developed a creative program in biocatalysis that takes advantage of her background in synthetic organic chemistry and biosynthesis. Using her insight as an organic chemist, she has been able to significant contributions in understanding longstanding questions in the biosynthesis of important voltage-gate blocking natural products like saxitoxin as well as to develop oxidative enzymes for new types of biocatalytic reactions."

Reviewer (C): "The quality, quantity, focus and scholarly impact of Professor Narayan's works keeps growing as years pass…. Her research plans are excellent and she is clearly meeting all the criteria required including those related to teaching and service to the community locally and internationally."

Reviewer (D): "…[Professor Narayan] masterfully wields tools from biology to solve challenges in organic chemistry, and her achievements have been inspiring in scope and innovation. Exciting ongoing work to harness bioinformatics and machine learning to speed enzyme discovery and optimization, robotics and miniaturization to increase the pace of chemical synthesis, and cell-based assays for rapid screening of the compounds generated suggests that she will continue to play a major role in shaping developments in biocatalysis for many years to come."

Reviewer (E): "[Professor Narayan's] most conspicuous achievement to date is almost certainly her development of enzyme-catalyzed oxidative coupling reactions to make carbon-carbon bonds, which achieved the distinction of publication as a cover article in *Nature* (2022). This is a landmark study that places her squarely at the head of the field of organic biocatalysis."

Reviewer (F): "…Dr. Narayan has established herself as a major player in this highly competitive field by identifying hard problems—such as oxidative coupling reactions—and developing new methods such as the bioinformatics methods described in the 2023 PNAS and 202[2] Nature papers to discover new enzymatic activities."

Summary of Recommendation:
Professor Narayan has excelled in all aspects of her position. She has developed a highly visible research program that promises to provide new routes to chemical processes, taught core courses and mentored students with great success, and contributed to the university by leading programs and serving on significant committees at all levels. The Executive Committee of the College of Literature, Science, and the Arts and I recommend that Associate professor Alison R.H. Narayan be promoted to the rank of professor of chemistry, with tenure, College of Literature, Science, and the.

Anne Curzan, Dean
Geneva Smitherman Collegiate Professor of
English Language and Literature, Linguistics,
and Education
Arthur F. Thurnau Professor
College of Literature, Science, and the Arts

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