

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

PRESIDENT'S ROOM

April 29, 2021

Engineering Research Centers Program
Division of Engineering Education and Centers
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

Dear ERC Program Directors:

I write with full support of the proposed NSF Engineering Research Center for Integrative Mechanobiology for Women's Health (IMWEL) led by Professor X. Edward Guo, Stanley Dicker Professor and Chair of the Department of Biomedical Engineering in The Fu Foundation School of Engineering and Applied Science, in partnership with the University of California, Irvine, the University of Pittsburgh, and East Carolina University.

IMWEL's vision of integrating engineering into women's health will converge the research of two fields that have not traditionally participated in discovery and development together. IMWEL's determination to create technology-driven innovations to (1) diagnose and prevent preterm birth, (2) prevent and treat pelvic floor disorders, and (3) bolster and support cardiovascular musculoskeletal health and aging, are profound examples of what I consider the Fourth Purpose of research universities. The Fourth Purpose endeavors to advance human welfare through the complex process of merging scholarly knowledge with external partnerships. University researchers and scholars must take responsibility for working with governments, organizations, businesses, and communities to tackle global challenges. IMWEL's embrace of this approach—in strong partnership with a multitude of stakeholders—holds the promise of significant societal impact.

Columbia also commits to instill IMWEL's broader impact goals and strategies in all aspects of IMWEL. Only by increasing the number of engineers, particularly female and under-represented minority engineers, interested in women's health, will this Center's efforts be sustained and flourish. Likewise, IMWEL must catalyze a robust innovation ecosystem to ensure its discoveries permanently change the trajectory of women's health. Finally, Columbia supports IMWEL's determination to make itself a subject of research by examining and measuring its ability to create an effective center of diversity and culture of inclusion. IMWEL seeks to develop substantiated best practices that other such centers might follow and incorporate.

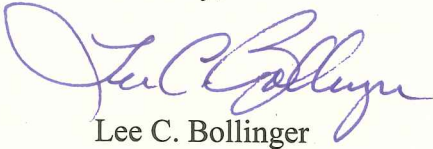
Through IMWEL, Professor Guo and his co-Principal Investigators, Professor Kristin M. Myers, Associate Professor of Mechanical Engineering, and Professor Lance C. Kam, Professor of Biomedical Engineering and Medicine, will intentionally locate its headquarters on the fourth and fifth floors of the Lasker Building on our Medical Center campus. Furthering the synergies, Alexandria LaunchLabs, a startup platform for early-stage life science companies, has just opened its newest space on the sixth floor of the Lasker Building, emphasizing IMWEL's determination to support effective translation of its work and partnership with other organizations.

April 29, 2021
Page 2

I am confident that the leadership of our academic partners embrace the effort to foster such translation. Our technology transfer offices have already been in touch, and are fully committed to establishing a cross-IMWEL intellectual property policy within 90 days, if an award is made.

Columbia University is committed to helping IMWEL achieve their ambitious goals.

Sincerely,



Lee C. Bollinger



April 15, 2021

Engineering Research Centers Program
Division of Engineering Education and Centers
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

Dear ERC Program Directors,

We write to commit the Fu Foundation of Engineering and Applied Science at Columbia University to the goals of the proposed *NSF Engineering Research Center for Integrative Mechanobiology for WomEn's HeaLth (IMWEL)*, which will leverage expertise across multiple disciplines to launch an initiative to advance women's health. Stanley Dicker Professor and Chair of our Department of Biomedical Engineering, X. Edward Guo as Director, together with Kristin Myers, Associate Professor of Mechanical Engineering and Lance Kam, Professor of Biomedical Engineering as co-Directors, will lead IMWEL in collaboration with academic partners East Carolina University, the University of California at Irvine, and the University of Pittsburgh. IMWEL will innovate across all aspects ranging from convergent research, engineering workforce development, and diversity and culture of inclusion. The proposed center intends to introduce engineering systems that will translate and transform the way society approaches women's health.

We believe the engineering profession has a responsibility to bring our talents and engineering innovations to health, wellness and medicine – in particular to bring these technological advancements to address the many under-served areas of women's health - 51% of our population. Unfortunately, the fundamental science and engineering underlying the role of gender in numerous reproductive health conditions remain elusive and understudied. This dearth underscores the need for a diversity of talent and perspective in engineering to these under-served challenges. The compelling issues surrounding women's health highlight the potential for engineering to impact human lives. IMWEL aspires to use this inspiration to attract and propel a diverse talent base, particularly women, to engineering. Indeed, a diversity in the professional talents also brings a diversity in perspectives to identify and pursue the critical challenges of today and tomorrow.

IMWEL identifies a timely opportunity to advance women's health through mechanobiological research innovations, and simultaneously influence the emerging mechanobiology discipline to embrace a truly inclusive culture. IMWEL will integrate critical disciplines cutting across engineering and biology, including mechanomics, multiscale computation and characterization, single-cell analysis, tissue engineering, materials science, and social psychology. IMWEL's team, comprising more than 30 faculty members are committed to fostering innovative research and training and to creating an environment of diversity, equity, and inclusion to develop engineering systems that specifically aim at serving women's health.

IMWEL envisions an “engineering for women's health” paradigm to attract substantial diverse talent to our nation's science and engineering workforce: IMWEL believes we must reconceptualize engineering *for* women in order to achieve a reality of engineering *with* women and to diversify the engineering workforce.

IMWEL's workforce development and diversity efforts will enable us to provide tangible experiences to inspire undergraduate and graduate students to embrace and change this discipline and profession. By broadening participation and dissolving barriers between engineers, practitioners, and patients, IMWEL will pioneer an approach that can be generalized and replicated across international engineering institutions.

As one of the leading research and education institutes and home to many government-supported research and education centers, Columbia Engineering will provide the intellectual and administrative environments necessary to ensure IMWEL's long-term success. IMWEL resonates with our school's strategic vision, *Engineering for Humanity*, setting a bold path for a sustainable, healthy, secure, connected, and creative humanity. Our Healthy Humanity Initiative leverages strengths in many fundamental engineering disciplines through internal collaborations and external partnerships with leading public, private, and not-for-profit organizations across New York City. We also note the natural synergy with four of the NSF Big Ideas, *Understanding the Rules of Life*, *Harnessing the Data Revolution*, *Future of Work* and *Growing Convergence Research*.

If the proposed center is awarded, we commit to housing IMWEL, as part of Columbia's *Engineering & Medicine Initiative*, within the Mary Woodard Lasker Biomedical Research Building on the Columbia University Irving Medical Center campus. Integrated in a 6-story research and translation building, the dedicated headquarters space will include at least 1,500 square feet lab spaces for shared facilities, 3 offices, 10 workstations, and additional shared spaces for collaborative activities of the Center. The building is already the research home for several faculty from Engineering and from the Vagelos College of Physicians & Surgeons. Several Co-PIs of this proposal, including Co-Director Dr. Kristin Myers, Associate Professor of Mechanical Engineering, already maintain their labs in this building. The same building also hosts Columbia's JP Sulzberger Genome Center, the Department of Systems Biology, and the recently opened Alexandria Launch Labs Life Science Incubator. This space is well suited for bridging the collaborating disciplines, community and industry outreach initiatives, and administrative infrastructures needed to fulfill the IMWEL vision.

I expressed my commitment to serving as chair of the Council of Deans in the preproposal. However, as previously communicated to the NSF, I will now assume the position of Provost on July 1, 2021. If the proposed Center is approved, the future Interim Dean, Richard Dicker Professor Telecommunications and current Senior Executive Vice Dean, Shih-Fu Chang, will also be honored to chair the Council of Deans and ensure that the new Center effectively implements its ambitious plans for achieving research innovation, workforce development, knowledge translation, and diversity and inclusion across all partner institutions. The schools have already conferred and committed to developing a cross-institutional IP policy within 90 days if an award is made. We stand fully behind this proposal as reflective of our school's convergent technology advancement and societal impact, and pledge to support ERC's long-term operations to the greatest degree possible. IMWEL creates an opportunity to revolutionize engineering research to address critical challenges facing the health and wellbeing of women.

Sincerely,



Mary Cunningham Boyce, PhD
Dean, The Fu Foundation School of Engineering & Applied Science
Provost Designate, Columbia University
Morris A. and Alma Schapiro Professor

A handwritten signature in black ink, appearing to read 'Shih-Fu Chang'. The signature is fluid and cursive, with the first name 'Shih' and last name 'Chang' clearly distinguishable.

Shih-Fu Chang

Interim Dean Designate, The Fu Foundation School of Engineering & Applied Science

Richard Dicker Professor



April 15, 2021

James R. Martin II
U.S. Steel Dean of Engineering
University of Pittsburgh
Swanson School of Engineering

Engineering Research Centers Program
Division of Engineering Education and Centers
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

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Dear ERC Program Directors,

I write to commit the University of Pittsburgh's Swanson School of Engineering (SSoE) to the goals of the proposed ***NSF Engineering Research Center for Integrative Mechanobiology for Women's Health (IMWEL)***. The SSoE fully supports IMWEL's approach to the four foundational elements: convergent research, engineering workforce development, innovation ecosystem, and diversity and culture of inclusion. Transforming the approach to women's health requires that society address all four elements.

Dr. Steven Abramowitch (SSoE) and his long-time collaborator Dr. Pamela Moalli (Magee Womens Research Institute) are international leaders in the study of pelvic floor disorders. They have assembled an esteemed team of senior and junior faculty from our Department of Bioengineering to support IMWEL including Dr. Spandan Maiti, Dr. Tamir Ibrahim, and Dr. Katrina Knight with nationally and internationally recognized expertise in multiscale and computation modeling, 7T MRI imaging, and animal model development and device design, respectively. Our school's mission is to develop engineering innovation that positively impacts the human condition. Women's health, especially women's pelvic and reproductive health, is an area of emphasis for our school and aligns strongly with our mission. Thus, we are fully supportive of IMWEL's approach and commitment to innovation in this space.

Sincerely,

James R. Martin, II
U.S. Steel Dean of Engineering



ERC Program
Division of Engineering Education and Centers
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

April 28, 2021

Subject: UCI Engineering Dean's letter of commitment; Columbia University proposal in response to NSF 20-553: Gen-4 Engineering Research Centers (ERC) – Convergent Research and Innovation through Inclusive Partnerships and Workforce Development

Dear ERC Program Directors,

If the proposal submitted by Dr. X. Edward Guo entitled "NSF Engineering Research Center for Integrated Mechanobiology for Women's Health (IMWEL)" is selected for funding by NSF, it is the intent of the UCI Samueli School of Engineering to commit resources as detailed in the Project Description or the Facilities, Equipment and Other Resources section of the proposal; commit to the goals of the ERC; and serve on the Council of the Deans.

IMWEL aims to enhance women's health by applying engineering approaches to understand and treat diseases of the female reproductive system. UCI brings an interdisciplinary team of researchers with expertise in mechanobiology/mechanomics, biomaterials, and clinical devices for reproductive health. The UCI team will contribute across multiple testbeds, technology and research thrusts with the goal of (1) measuring molecular, cellular, and tissue biomechanics; (2) modeling both normal and pathological condition; and (3) creating new devices for use in research and clinical treatment. The Samueli School of Engineering is committed to providing a strong engineering education to the next generation and to diversity, equity, and inclusion (DEI). To support IMWEL's success in these endeavors, the Stacey Nicholas Office of Access and Inclusion in the Samueli School of Engineering will be integral to these efforts. In summary, I can attest that the IMWEL team has the necessary resources to lead the proposed research and that the Samueli School of Engineering will continue to prioritize DEI strategies that create a robust diverse study body and a future innovative engineering workforce.

Sincerely,

A handwritten signature in cursive script that reads "Michael Green".

Michael Green
Stacey Nicholas Dean of Engineering (Interim)
Samueli School of Engineering

CC: Prof. Wendy Liu, Department of Biomedical Engineering, UCI IMWEL PI



Washington University in St. Louis

JAMES MCKELVEY SCHOOL OF ENGINEERING

Aaron F. Bobick

Dean and James M. McKelvey Professor

December 16, 2021

Engineering Research Centers Program
Division of Engineering Education and Centers
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

Dear ERC Program Directors,

It is with great enthusiasm that I write to commit the McKelvey School of Engineering at Washington University in St. Louis to the goals of the proposed ***NSF Engineering Research Center for Integrative Mechanobiology for Women's Health (IMWEL)***. McKelvey fully supports IMWEL's approach to the four foundational elements: convergent research, engineering workforce development, innovation ecosystem, and diversity and culture of inclusion. Transforming the approach to women's health requires that society address all four elements.

Our research team includes Prof. Michelle Oyen (PI, Department of Biomedical Engineering); Prof. Christine O'Brien (co-I, Department of Biomedical Engineering); Prof. Philip Bayly (co-I, Chair, Department of Mechanical Engineering and Materials Science) and his collaborator Dr. Jerry Lowder (Department of Obstetrics and Gynecology); Prof. Yong Wang (co-I, Departments of Electrical and Systems Engineering and Obstetrics and Gynecology); and Prof. Spencer Lake (co-I, Department of Mechanical Engineering and Materials Science).

Since 2019, the McKelvey School of Engineering has invested in advancing technologies to support women's reproductive health through a set of symposia and seed grant programs that partner engineers in multiple departments with experts in obstetrics and gynecology at Washington University. In continued pursuit of advancing both fundamental understanding and innovative interventions for women's reproductive health, I am delighted that Prof. Oyen will now join our School and will lead a new Center for Women's Reproductive Health Technologies. Our institution is strongly committed to the goals of the proposed IMWEL to generate innovative approaches needed to address the most critical needs in Preterm Birth, Pelvic Floor Disorders and Healthy Aging for women.

Sincerely,

Aaron Bobick

Dean and James M. McKelvey Professor