Approved by the Regents
May 16, 2019

PROMOTION RECOMMENDATION
THE UNIVERSITY OF MICHIGAN
MEDICAL SCHOOL
DEPARTMENT OF RADIATION ONCOLOGY

Issam El Naqa, Ph.D., associate professor of radiation oncology, with tenure, Department of Radiation Oncology, is recommended for promotion to professor of radiation oncology, with tenure, Department of Radiation Oncology, Medical School.

Academic Degrees

M.A.	2007	Washington University
Ph.D.	2002	Illinois Institute of Technology
M.S.	1995	University of Jordan
B.S.	1992	University of Jordan

Professional Record

2015-present	Associate Professor of Radiation Oncology, University of Michigan
2015-present	Adjunct Professor, McGill University, Montreal, Quebec Canada
2010-2015	Associate Professor of Oncology, McGill University
2007-2010	Assistant Professor, Washington University
2007-2010	Adjunct Instructor, Washington University
2005-2007	Instructor, Washington University

Summary of Evaluation:

Teaching: Dr. El Naqa has been involved in the teaching and training of students from diverse backgrounds and at different academic and professional levels including undergraduate engineering students, graduate engineering and medical physics students, medical students and post-doctoral fellows, and medical physics and radiation oncology residents. He has authored or co-authored manuscripts in more than 42 journals, and 145 proceedings and abstracts with 45 mentees. Many mentees have received prestigious academic honors and awards as a result. Dr. El Naqa has instructed and coordinated several classes, seminars, and teaching lectures locally and internationally. He gives annual lectures on imaging and outcome modeling to radiation oncology residents and participates in the Applied Physics Department activities including graduate students' supervision, seminars, and participation in qualifying and candidacy exams. He also supervised a BME 450 design project. Dr. El Naqa has an extensive international teaching reputation. He has participated in courses for The American Association of Physicists in Medicine, the European Society for Therapeutic Radiology and Oncology, the Jordanian Association of Physicists in Medicine, and the Association of Medical Physicists of India. He has further been engaged in invited teaching through the above mentioned professional societies as well as the International Scientific Exchange Program (ISEP), Japanese Society of Medical Physics (JSMP), and the Danish Society of Clinical Oncology (DSKO) on topics related to machine learning, radiomics, and radiogenomics.

Research: Dr. El Naqa's general research interests are in the areas of oncology bioinformatics, multimodality image analysis, and treatment outcome modeling. He operates at the interface of

physics, biology, and engineering. His primary motivation is to design and develop novel approaches to unravel cancer patients' tumor and normal tissue responses to treatment by synthesizing knowledge from physical, biological, and imaging information into advanced computational models using top-down (machine learning) and bottom-up (first principles) techniques and evaluate their performance in clinical and preclinical settings. These models could be then used to personalize cancer patients' treatment, help understand the underlying biological response to disease, and optimize clinical decision making. Such an approach represents a paradigm shift in radiobiology modeling and oncology outcomes research. This has been made possible by his interdisciplinary training (electrical engineering, medical physics, and molecular biology), collaborative team efforts, and institutional support. Dr. El Naqa has published 169 peer-reviewed manuscripts, and has had extramural grant support for most of his faculty career, progressing from a NIH k25 award as an assistant professor at Washington University through a series of grants while at McGill University. Operating initially under a startup fund and support on a P01 in Radiation Oncology at University of Michigan, Dr. El Naqa very quickly established a significant broad research infrastructure and was recently awarded an R01 which was further extended by the NIH to an R37 due to its merit. He is currently engaged in a broad spectrum of collaborative research investigations across the university and worldwide, and has several grant applications in various states of preparation and review.

Recent and Significant Publications:

Yi Luo, Daniel L. McShan, Martha M. Matuszak, Dipankar Ray, Theodore S. Lawrence, Shruti Jolly, Feng-Ming Kong, Randall K. Ten Haken, Issam El Naqa: A Multi-Objective Bayesian Networks Approach for Joint Prediction of Tumor Local Control and Radiation Pneumonitis in Non-Small-Cell Lung Cancer (NSCLC) with High Dimensional Data: Development of a Fully Cross-Validated Bayesian Network Approach for Local Control Prediction in Lung Cancer. *Medical Physics*: June 4 2018.

El Naqa I, Johansson A, Owen D, Cuneo K, Cao Y, Matuszak M, Bazzi L, Lawrence TS, Ten Haken RK: Modeling of Normal Tissue Complications Using Imaging and Biomarkers After Radiation Therapy for Hepatocellular Carcinoma. *Int J Radiat Oncol Biol Phys* 100(2):335-343, 2018.

Hickling S, Lei H, Hobson M, Léger P, Wang X, El Naqa I: Experimental evaluation of x-ray acoustic computed tomography for radiotherapy dosimetry applications Medical physics. *Medical Physics* 44(2):608-617, 2017.

Tseng HH, Luo Y, Cui S, Chien JT, Ten Haken RK, El Naqa I: Deep reinforcement learning for automated radiation adaptation in lung cancer. *Medical Physics* 44(12):6690-6705, 2017.

Vallières M, Kay-Rivest E, Perrin LJ, Liem X, Furstoss C, Aerts HJWL, Khaouam N, Nguyen-Tan PF, Wang CS, Sultanem K, Seuntjens J, El Naqa I: Radiomics strategies for risk assessment of tumour failure in head-and-neck cancer. *Nature Sci Rep* 7(1):10117, 2017.

Service: Dr. El Naqa is an active citizen within our institution and of the academic and professional societies of medical physics, radiation oncology, and data sciences, and the scientific community at large. His service activities involve active participation at national and international task and

work groups on protocols for imaging, treatment outcomes modeling, and research and training support in underdeveloped countries, which are instrumental in translating research efforts and new technology developments in medical physics into the clinical practice of radiation oncology. Dr. El Naqa has served as a member of the Quantitative Analysis of Normal Tissue Effects in the Clinic (QUANTEC) initiative, the products of which are currently used as a standard reference for radiation dose prescription in the field. He has also acted as a consultant to recently published International Commission on Radiation Units and Measurements- Report 100 for the radiobiology section of small field dosimetry. Since 2015, he has served on the American Association of Physicists in Medicine/American Society for Radiation Oncology efforts for the standardization of hypofractionations in radiotherapy (HyTec) and the Pediatric Normal Tissue Effects in the Clinic working groups. He also served on a task group for standardizing the use of PET imaging and benchmarking its performance for treatment planning in radiation oncology (TG-211). Driven by his passion to give back to society and the underprivileged, Dr El Naqa served on the AAPM subcommittee for middle-eastern affairs until 2018 to promote higher standards of professional training and practice of medical physics in this underdeveloped region of the world. He acts as a board member/associate and provides expert reviews to national/international journals and funding agencies in the United States, Canada, and Europe. His service has been recognized by his election to become an AAPM fellow and an Institute of Electrical and Electronic Engineers senior member. At the University of Michigan, Dr. El Naqa serves on the medical physics residency committee as a liaison between residents and the committee and is an associate member of MIDAS, a university-wide initiative to catalyze data science at the University of Michigan, where he participates in its workshops, seminars, and collaborates with other members of MIDAS on developing data-related grant proposals.

External Reviewers:

Reviewer A: "Dr. El Naqa is also well known within the field for his national and international committee effort…He is an important contributor in a number of American Association of Physicists in Medicine (AAPM) committees…Issam El Naqa is a dynamic and academically productive leader in the fields of Machine Learning and Radiomics, and has developed an outstanding career trajectory…He is a nationally known expert in a leading edge research field (Machine Learning), has become a critical member of the research team at UM RadOnc and is an excellent teacher and researcher."

Reviewer B: "We successfully acquired $4M of prestigious CPRIT Rising Star Recruitment grant for him and offered him a full professor position. Unfortunately (for us, fortunately for University of Michigan) due to some family reasons, he eventually decided to move to Ann Arbor…The offering of the full professor position to Dr. El Naqa by [my institution] in 2014 also indicates that this promotion has been long overdue."

Reviewer C: "Since 2014 A/Prof El Naqa's research has followed an impressive trajectory with 50 papers and 23 book chapters published and another 20 articles submitted for review. He is established as a leading researcher in the emerging fields of machine learning and big data analysis for radiation oncology…The high-quality research and mentoring in his group is shown by the number of PhD students receiving recognition at leading conferences."

Reviewer D: "He has very effectively utilized his background in electrical and software engineering to make significant contributions in the areas of bioinformatics, image processing, radiomics, biology, treatment response modeling, adaptive radiotherapy and more…Dr. El Naqa has an excellent record of peer-reviewed publications (142), book chapters and other publications in terms of both quality and quantity. His sustained record of obtaining extramural funding is outstanding by any measure…He has important roles as co-investigator and co-PI on several other grants."

Reviewer E: "He has been prolific in the two related ends of the research process, first in procuring funding for his research program and in publishing significant results. The numbers and importance of each have been impressive."

Reviewer F: "Dr. El Naqa has established himself as a thought-leader in radiation oncology research…Dr. El Naqa is currently a renowned expert in bioinformatics and outcome research. He has stayed at the forefront in the application of data mining and, more recently, championed the development of deep learning methods…He is clearly an impact scientist in the current era of personalized medicine. Dr. El Naqa has a stellar record of sponsored research activities as the principal investigator (PI)…Dr. El Naqa's expertise is recognized nationally and internationally. …Dr. El Naqa has an extraordinary publication record with over 140 peer-reviewed articles… This level of productivity is rarely seen for a medical physicist in (this) stage of his career…The breadth of subject matters and co-authors is highly commendable, demonstrating the collaboration nature of Dr. El Naqa's research approach."

Summary of Recommendation:
Dr. El Naqa is an extremely talented and effective leader in the field of radiation physics, bioinformatics and treatment outcome modeling. He has established a strong national and international reputation for clinical expertise, research, teaching and service, and is well respected in each area. He is a dynamic head of research in experimental medicine, radiation oncology physics and applied physics with an engaging, collegial and collaborative research style, as well as an effective mentor leading to a large number of awards given to his mentees for scientific presentations and talks. I am pleased, therefore, to recommend Issam El Naqa, Ph.D. for promotion to professor of radiation oncology, with tenure, Department of Radiation Oncology, Medical School.

Marschall S. Runge, M.D., Ph.D.
Executive Vice President for Medical Affairs
Dean, Medical School

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