Biographical Sketch

Provide the following information for each individual included in the Research & Related Senior/Key Person Profile (Expanded) Form. (Five page limit)

NAME: **TAE SEOK MOON** | POSITION TITLE: **ASSOCIATE PROFESSOR**

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(S)	FIELD OF STUDY
Seoul National University	BS	1998	Chemical Technology
Seoul National University	MS	2000	Chemical Technology
MIT (Kristala Prather Lab)	PhD	2010	Chemical Engineering
UCSF (Christopher Voigt Lab)	Postdoctoral Scholar	2011	Pharmaceutical Chemistry
MIT (Christopher Voigt Lab)	Postdoctoral Associate	2012	Biological Engineering

Appointment

Council Member	Engineering Biology Research Consortium	2021-Present
Faculty Member	WU CSELS	2019-Present
Associate Professor	Washington University in St. Louis	2018-Present
Faculty Member	Engineering Biology Research Consortium	2016-Present
Senior Investigator	NSF CenSURF	2014-2015
Faculty Member	WU Division of Biol. & Biomed. Sci.	2013-Present
Assistant Professor	Washington University in St. Louis	2012-2018
Affiliated Principal Investigator	NSF SynBERC	2012-2016
Postdoctoral Associate	Massachusetts Institute of Technology	2011-2012
Postdoctoral Scholar	Univ. of California, San Francisco	2010-2011
Research Assistant	Massachusetts Institute of Technology	2005-2009
Manager & Research Scientist	LG Life Sciences, Ltd.	2002-2005
Assistant Manager & Scientist	LG Chem Investment, Ltd.	2001-2002
Researcher	LG Chemical, Ltd.	2000-2001
Research Assistant	Seoul National University	1997-1999

Selected Awards and Memberships

Editorial Board Member of ACS Synth. Biol. & OUP Synth. Biol.	Since 2021
Editorial Board Member of Biotechnology Notes & Metab. Eng. Commun.	Since 2021
iGEM Grant Committee Member	Since 2021
Advisory Board Member of Synbio Africa (Scientific Advisor)	Since 2021
Council Member of Engineering Biology Research Consortium (EBRC)	Since 2021
EPA Green Chemistry Challenge Award to Kalion, Inc (contributed as a patent holder)	2019
B&B Daniel I.C. Wang Award	2019
ONR Young Investigator Award	Jun. 2017 to May. 2021
Best of BIOT Award (American Chemical Society)	2016
NSF CAREER Award	Apr. 2014 to Mar. 2020
30th Annual Department Conference Poster Competition (MIT, 2nd Prize)	Oct. 2009
ILJU Foundation Fellow Award	Sep. 2005 to Aug. 2009
John C. Sluder (1941) Fellowship	Sep. 2005 to May. 2006
LG Chemical Fellowship	Mar. 1998 to Dec. 1999
The President Prize (No. 1 among 977 students)	Feb. 1998
SNU Honor Scholarship	Sep. 1994 to Feb. 1998

Grants (External funding only: total $7.3M to Moon; $15.9M to the entire teams)

1] Gates Foundation (Sole PI): Programmed Killing of Parasite Eggs by Probiotic Organisms

2] DOE (CoPI; Dantas, PI): Systems Biology of *Rhodococcus opacus* to Enable Production of Fuels and Chemicals from Lignocellulose

3] NSF (CoPI; Pakrasi, PI): Designing Nitrogen Fixing Ability in Oxygenic Photosynthetic Cells

4] NSF CAREER (Sole PI): Engineering Biological Robustness through Synthetic Control

5] ONR YIP (Sole PI): Engineering Probiotics to Manipulate Neurotransmitters

6] NSF (Sole PI): Establishing a generalizable model for predictable antisense RNA repression

7] DOE (CoPI; Gautam Dantas, PI): Systems Engineering of *Rhodococcus opacus* to Enable Production of Drop-in Fuels from Lignocellulose

8] NIH (One of Multiple PIs; with Gautam Dantas [contact PI]): Tunable therapeutic modulation of the gut microbiome by engineered probiotics

9] ONR (Sole PI): High-throughput automation for engineering novel biosensors, enzymes, and genetic circuits

10] NSF (Sole PI): Unifying synthetic small regulatory RNAs

11] USDA (Sole PI): Development of kill-switches for biocontainment of genetically engineered microbes

12] ONR (Sole PI): Engineering microbes to control heat production

13] EPA (PI): Developing microbial biocontainment strategies and their assessment methods

14] DOE (Sole PI): Developing a consolidated biological process to upcycle plastics

Selected Leadership and Service Activities

SynBYSS Founding Chair - Synthetic Biology Young Speaker Series, St. Louis, MO

A weekly, virtual, multi-year-long seminar series in which a global thought leader or a synthetic biology pioneer give an opening talk (5 min), followed by a 45 min talk and Q&A given by a rising untenured faculty or a faculty candidate; 8/26/2021-12/15/2022; the 2023 season schedule, TBD

Pioneer Committee (73) - I formed this committee by contacting and inviting selected global thought leaders and synthetic biology pioneers, including Frances Arnold, a Nobel Prize Laureate and a co-chair of President Joe Biden's Council of Advisors on Science and Technology.

Speakers (79) - I invited and received nominations for a full, 45-min talk from the synthetic biology community all over the world, and selected 79 speakers for this multi-year global event by gathering feedback from all participants.

Organizing Chair - I formed the Pioneer Committee, consisting of global thought leaders and synthetic biology pioneers as well as funding agencies (e.g., NSF, ONR, ARO, DARPA, NIH, DOE JGI, EPA, BWF, etc.) and top journal editors (e.g., Cell and Nature journals, ACS Synthetic Biology, etc.)

Participant Nations - US, Canada, European Countries, Australia, Korea, China, Taiwan, Singapore, etc.

Council Member - Engineering Biology Research Consortium (**EBRC**), Emeryville, CA

(a non-profit, public-private partnership funded by NSF, DOD, US DHS, and NIST): Fulfilling EBRC governance duties; Setting the organization's strategic vision to address national and global needs through synthetic biology; since 2021

EBRC Roadmapping Working Group Member - Monthly conference calls and several workshops a year to "create ambitious and visionary technical research roadmaps for the engineering biology community – academic, industrial, and government – that identifies priority areas for basic (pre-competitive) research over the next two decades"; since 2021

Selected Conference Organizing since 2012

Conference Organizing Committee Member – Metabolic Engineering 15, Singapore
Conference Organizing Committee Member – 2022 SEED, Washington, D.C.
Session Chair - International Conference on Biomol. Engineering, San Diego, CA
Technical Program Committee - ACM NanoCom Conference, New York City, NY
Poster Session Judge - ICBE, Fort Lauderdale, FL
Poster Judge - Global Health & Infectious Disease Conference, St. Louis, MO
Conference Session Chair - 11th Workshop on Cyanobacteria, St. Louis, MO
AIChE Session Chair (2 sessions) - Annual Meeting, San Francisco, CA
AIChE Session Chair (1 session) - Annual Meeting, Atlanta, GA
AIChE Session Chair (1 session) - Annual Meeting, Salt Lake City, UT
AIChE Session Chair (1 session) - Annual Meeting, San Francisco, CA
AIChE Session Chair (1 session) - Annual Meeting, Minneapolis, MN
ACS Session Chair (1 session) - National Meeting, San Diego, CA

Service for Journal

Editorial Advisory Board Member - ACS Synth. Biol. & OUP Synth. Biol.; since 2021
Editorial Board Member - Biotechnology Notes & Metab. Eng. Commun.; since 2021
Special Issue Editor - BioDesign Research (AAAS); 2021-22

Paper Reviewer (36 journals) since 2012 - Nature Biotechnol.; Nature Biomed. Eng.; Nature Chem. Biol.; Nature Commun.; Science Advances; PNAS; Cell Reports; Cell Systems; Nucleic Acids Res.; Curr. Opin. Biotechnol.; Curr. Opin. Chem. Biol.; Metab. Eng.; ACS Synth. Biol.; Biotechnol. Bioeng.; J. Mol. Biol.; Scientific Reports; Chem. Eng. Sci.; Front. Microbiol.; Front. Bioeng. Biotechnol.; PLoS One; Bioproc. Biosyst. Eng.; Biochem. Eng. J.; EMCBMM; KJCE; J. Biol. Eng.; PLoS Comput. Biol.; Biotechnol. J.; ACS Catalysis; Wiley Book Series; BMC Biotechnol.; Metab. Eng. Commun.; Synth. Syst. Biotechnol.; JIMB; ACS Sustain. Chem. Eng.; Biotechnol. Biofuels

Evaluation of Institutes and Students

Evaluator - Performance evaluation of School of Chemical and Biological Engineering, Seoul National University; 2020
MIT Educational Counselor - Conducting interviews and writing interview reports for MIT Undergrad Admissions; since 2021

Proposal Review

Proposal Panel - National Science Foundation (BIO, CBET, CAREER, etc.; multiple times); since 2012
Proposal and Project Reviewer - BBSRC, UK. ONR. EREF. USDA; since 2014
Reviewer - HHMI Summer Undergraduate Research Fellowship (SURF); 2013-14
Reviewer - I-CARES proposals; 2014-17
iGEM Grant Committee Member – Reviewing iGEM teams' proposals for grants; since 2021

Graduate Students & Other Researchers Supervised: 110
Moon lab: 26 permanent & 29 undergrad members; 33 rotation PhD in addition to 55 since 2012
7 postdoctoral researchers, 12 PhD students, 4 MS students, and 3 Technicians
Other labs: 22 graduate students as a thesis committee member

Publications (57 total; 46 from WashU as PI):

[+] Corresponding author; * These authors contributed equally to the work.

Selected publications during the past 3 years: Research Articles

AG Rottinghaus, C Xi, MB Amrofell, H Yi and **TS Moon**[+]. Engineering probiotics for specific sensing of aromatic amino acids or neurochemicals. ***Cell Systems.*** Accepted (2021)

DM DeLorenzo, J Diao, R Carr, Y Hu and **TS Moon**[+]. An improved CRISPR interference tool to engineer *Rhodococcus opacus*. ***ACS Synth. Biol.*** 10, 786–798 (2021)

K Zhang, J Hodge, A Chatterjee, **TS Moon** and KM Parker. Duplex structure of double-stranded RNA provides stability against hydrolysis relative to single stranded RNA. ***Environ. Sci. Technol.*** 55, 8045–8053 (2021)

K Zhang, J Wei, K Huff Hartz, M Lydy, **TS Moon**, M Sander and KM Parker. Analysis of RNA interference (RNAi) biopesticides: double-stranded RNA (dsRNA) extraction from agricultural soils and quantification by RT-qPCR. ***Environ. Sci. Technol.*** 54, 4893−4902 (2020)

C Frankfater, WR Henson, A Juenger-Leif, M Foston, **TS Moon**, J Turk, JLF Kao, A Haas and F Hsu. Structural determination of a new peptidolipid family from *Rhodococcus opacus* and the pathogen *Rhodococcus equi* by multiple stage mass spectrometry. ***J. Am. Soc. Mass Spectrom.*** 31, 611−623 (2020)

DM DeLorenzo and **TS Moon**[+]. Construction of genetic logic gates based on the T7 RNA polymerase expression system in *Rhodococcus opacus* PD630. ***ACS Synth. Biol.*** 8, 1921−1930 (2019)

GW Roell, R Carr, T Campbell, Z Shang, WR Henson, J Czajka, H Martin, F Zhang, M Foston, G Dantas, **TS Moon**[+] and YJ Tang[+]. A concerted systems biology analysis of phenol metabolism in *Rhodococcus opacus* PD630. ***Metab. Eng.*** 55, 120-130 (2019)

SJ Kim*, M Leong*, MB Amrofell, YJ Lee and **TS Moon**[+]. Modulating responses of toehold switches by an inhibitory hairpin. ***ACS Synth. Biol.*** 8, 601−605 (2019)

YJ Lee*, SJ Kim*, MB Amrofell* and **TS Moon**[+]. Establishing a multivariate model for predictable antisense RNA-mediated repression. ***ACS Synth. Biol.*** 8, 45–56 (2019)

Selected publications during the past 3 years: Review Articles

MB Amrofell*, AG Rottinghaus* and **TS Moon**[+]. Engineering microbial diagnostics and therapeutics with smart control. ***Curr. Opin. Biotechnol.*** 66, 11-17. **Invited Review** (2020)

K Davis and **TS Moon**[+]. Tailoring microbes to upgrade lignin. ***Curr. Opin. Chem. Biol.*** 59, 23-29. **Invited Review** (2020)

AG Rottinghaus*, MB Amrofell* and **TS Moon**[+]. Biosensing in smart engineered probiotics. ***Biotechnol. J.*** 15, 1900319. **Invited Review** (2020)

A Chatterjee*, DM DeLorenzo*, R Carr and **TS Moon**[+]. Bioconversion of renewable feedstocks by *Rhodococcus opacus*. ***Curr. Opin. Biotechnol.*** 64, 10-16. **Invited Review** (2020)

W Anthony, RR Carr, DM DeLorenzo, T Campbell, Z Shang, M Foston, **TS Moon**[+] and G Dantas[+]. Development of *Rhodococcus opacus* as a chassis for lignin valorization and bioproduction of high-value compounds. ***Biotechnol Biofuels***. 12:192. **Invited Review** (2019)

Selected representative earlier publications pertinent to this application

WR Henson, F Hsu, G Dantas, **TS Moon**[+] and M Foston[+]. Lipid metabolism of phenol tolerant *Rhodococcus opacus* strains for lignin bioconversion. ***Biotechnol Biofuels***. 11:339 (2018)

WR Henson*, T Campbell*, D DeLorenzo*, Y Gao, B Berla, SJ Kim, M Foston, **TS Moon**[+] and G Dantas[+]. Multi-omic elucidation of aromatic catabolism in adaptively evolved *Rhodococcus opacus*. ***Metab. Eng.*** 49, 69–83 (2018)

DM DeLorenzo, AG Rottinghaus, WR Henson and **TS Moon**[+]. Molecular toolkit for gene expression control and genome modification in *Rhodococcus opacus* PD630. ***ACS Synth. Biol.*** 7, 727–738 (2018)

DM DeLorenzo, WR Henson and **TS Moon**[+]. Development of Chemical and Metabolite Sensors for *Rhodococcus opacus* PD630. ***ACS Synth. Biol.*** 6, 1973–1978 (2017)

CM Immethun, DM DeLorenzo, CM Focht, D Gupta, CB Johnson and **TS Moon**[+]. Physical, Chemical, and Metabolic State Sensors Expand the Synthetic Biology Toolbox for *Synechocystis* sp. PCC 6803. ***Biotechnol. Bioeng.*** 114, 1561–1569 (2017)

A Hoynes-O'Connor, T Shopera, K Hinman, JP Creamer and **TS Moon**[+]. Enabling Complex Genetic Circuits to Respond to Extrinsic Environmental Signals. ***Biotechnol. Bioeng.*** 114, 1626–1631 (2017)

YJ Lee, A Hoynes-O'Connor, MC Leong and **TS Moon**[+]. Programmable control of bacterial gene expression with the combined CRISPR and antisense RNA system. ***Nucleic Acids Res.*** 44, 2462–2473 (2016). **One of NAR Top Articles** (most often accessed in July 2017)

A Yoneda*, WR Henson*, NK Goldner, KJ Park, KJ Forsberg, SJ Kim, MW Pesesky, M Foston, G Dantas[+] and **TS Moon**[+]. Comparative transcriptomics elucidates adaptive phenol tolerance and utilization in lipid-accumulating *Rhodococcus opacus* PD630. ***Nucleic Acids Res.*** 44, 2240–2254 (2016)

CM Immethun, KM Ng, DM DeLorenzo, B Waldron-Feinstein, YC Lee and **TS Moon**[+]. Oxygen-Responsive Genetic Circuits Constructed in *Synechocystis* sp. PCC 6803. ***Biotechnol. Bioeng.*** 113, 433-442 (2016)

WD Hollinshead*, WR Henson*, M Abernathy, **TS Moon**[+] and YJ Tang[+]. Rapid Metabolic Analysis of *Rhodococcus opacus* PD630 via parallel ^{13}C-Metabolite Fingerprinting, ***Biotechnol. Bioeng.*** 113, 91-100 (2016)

A Hoynes-O'Connor, K Hinman, L Kirchner and **TS Moon**[+]. *De novo* design of heat-repressible RNA thermosensors in *E. coli*. ***Nucleic Acids Res.*** 43, 6166–6179 (2015)

TS Moon, C Lou, A Tamsir, BC Stanton and CA Voigt. Genetic Programs Constructed from Layered Logic Gates in Single Cells. ***Nature*** 491, 249-253 (2012)

SM Lippow*, **TS Moon***, S Basu, S-H Yoon, X Li, B Chapman, K Robison, D Lipovšek and KJ Prather. Engineering Enzyme Specificity Using Computational Design of a Defined-Sequence Library. ***Chem. Biol.*** 17, 1306-1315 (2010). **Selected as a "Recommended" paper by faculty of 1000**

JE Dueber, GC Wu, GR Malmirchegini, **TS Moon**, CJ Petzold, AV Ullal, KJ Prather and JD Keasling. Synthetic Protein Scaffolds Provide Modular Control over Metabolic Flux. ***Nat. Biotechnol.*** 27, 753-759 (2009)

Patents (9 total; 2 Licensed to US companies; 4 Products launched)

61 Invited Conference Talks, Invited Seminars & Lectures

Other Conference Presentations (118 total; 65 Oral; 53 Poster)

Commercialization Effort at WashU

Moonshot Bio (start-up company) - Founder and Head of the Scientific Advisory Board (2021)
Focusing on sustainable and green production of chemicals and fuels from wastes
Developing engineered probiotics for medical applications

Discussion with potential investors - Khosla Ventures, BioGenerator, Via Lucent, Hike Ventures, LLC, Technext Inc., etc.

Project Plastic (start-up company) - Providing advice and collaborating with this company to solve global plastic pollution problems: https://projectplastic.site/