

KEISUKE INOMURA

University of Rhode Island
Horn 216, 215 S Ferry Rd., Narragansett, RI, 02882, U.S.A.
Email: inomura@uri.edu Tel: 206-395-3568

EDUCATION

Massachusetts Institute of Technology (MIT)

Cambridge, MA, U.S.A.

Ph.D. in Climate Physics and Chemistry

Sep. 2011 – Jun. 2016

- Thesis: Development of a cell flux model and its application to nitrogen fixers
- Advisor, Professor Michael J. Follows
- Committee members: Dr. Stephanie Dutkiewicz, Professor Sallie W. Chisholm, Dr. Mak A. Saito

Kyushu University

Fukuoka, Japan

Master of Science in Agricultural Science

Apr. 2009 – Mar. 2011

Regional Environmental Science Division, Department of Bioproduction Environmental Science

- Thesis: Design and Analysis of Methods for the Application of Anaerobically Digested Slurry in Rice Paddy Fields
- Received the highest grade for the program's entrance examination

Bachelor of Science in Agricultural Science

Apr. 2005 – Mar. 2009

- Thesis: Numerical Analysis of Advection and Diffusion of Digestion Sludge from Methane Fermentation in Paddy Fields
- Won award for Most Outstanding Student in the School of Agriculture (March 2009)

University of Georgia

Athens, GA, U.S.A.

• Attended an Exchange Program

Aug. 2007 – May 2008

- Took various courses such as English Writing, Structural Engineering, Water Resources, Horticulture, Entomology and Computer Sciences.

University of Cambridge

Cambridge, U.K.

11th Kyushu University Summer School at Pembroke College, Cambridge

Aug. 2006

- Studied English and Art & Architecture as part of a one-month summer program
- Received the highest grade on both final exams

RESEARCH POSITIONS

Assistant Professor, University of Rhode Island

Dec. 2020 – present

Research Associate, University of Washington, Supervisor: Curtis Deutsch

Sep. 2017 – Dec. 2020

Postdoctoral Investigator, MIT, Supervisor: Michael J. Follows

Jun. 2016 – Aug. 2017

Research Assistant, MIT, Supervisor: Michael J. Follows

Sep. 2011 – Jun. 2016

RESEARCH INTERESTS

Quantitative microbiology, Quantitative model of ocean biogeochemistry and ecosystems, Computational microbiology, Microbial physiology, Microbial ecology, Biogeochemistry, Environmental microbiology, Elemental composition in microbial cells, phytoplankton, nitrogen fixers, mathematical modeling, computer simulation.

MENTORING

Gabrielle Armin (Ph.D. student)	<i>Aug. 2020 – present</i>
Meng Gao (Ph.D. student)	<i>May. 2021 – present</i>
Margaret Bernish (Ph.D student)	<i>May. 2023 – present</i>

RESEARCH GRANTS AND FELLOWSHIPS

Kyushu University Exchange Program Fellowship for studying at the University of Georgia ~\$8,200	<i>Aug. 2007 – May 2008</i>
Japan Student Service Organization (JASSO): Long term international study program ~ \$178,000	<i>Sep. 2011 – May 2016</i>
Simons Foundation: Life Sciences-Simons Postdoctoral Fellowships in Marine Microbial Ecology \$258,364	<i>Oct. 2017 – Sep. 2020</i>
The Interdisciplinary Collaborative Research Program: Quantifying the role of rhodopsins in diatoms ~\$5,500	<i>Apr. 2021– Mar. 2022</i>
NSF Subaward: Collaborative Research: Direct determination and model analysis of elemental stoichiometry of phytoplankton from the Oregon Coast (OCE-2048373, subaward SUB0000525 from Princeton University) \$305,207	<i>Aug. 2021 – Jul. 2024</i>
RI Science and Technology Advisory Council: Multi-scale modeling of bacterial plankton-mediated nutrient cycling in the Narragansett Bay (Co-PI: Ying Zhang) (AWD10732) \$79,995	<i>Jan. 2022 – Dec. 2022</i>
The Interdisciplinary Collaborative Research Program: Evaluating the effect of localized diatom rhodopsins on carbon fixation and microbial ecosystems ~\$5,500	<i>Apr. 2022– Mar. 2023</i>
Simons Foundation: Simons Early Career Investigator in Aquatic Microbial Ecology and Evolution Awards - LIFE-ECIAMEE – 2023 \$810,000	<i>Apr. 2023– Mar. 2026</i>
NSF (OCE): META-DDA: METabolic Activities of Diatom-Diazotroph Associations \$1,053,775 (as a co-PI with Tatiana Ryneerson as a PI)	<i>Jun. 2023– May. 2026</i>

FUNDED COLLABORATIVE PROJECTS (PROPOSALS CO-WRITTEN)

<p>GACR (Grant Agency of the Czech Republic) Project title: C and N metabolisms and their impact on ecological significance of unicellular diazotrophic cyanobacteria ~ \$361,000 to Ondřej Prášil and Takako Masuda</p>	<p>Jan. 2020 – Dec. 2022</p>
<p>GACR Junior Grant Project title: Single-cell orchestration of nitrogen fixation and photosynthesis in <i>Trichodesmium</i>. ~ \$295,000 to Meri Eichner</p>	<p>Jan. 2020 – Dec. 2022</p>

PUBLICATIONS

1. ¹Cornejo-Castillo FM, ²**Inomura K**, Zehr JP, Follows MJ (2024) Article metabolic trade-offs constrain the cell size ratio in a nitrogen. *Cell* 187:1–7.
2. Agarwal V, Chávez-Casillas J, **Inomura K**, Mouw CB (2024) Patterns in the temporal complexity of global chlorophyll concentration. *Nature Communications* 15:1522.
3. ¹Deutsch C, ²**Inomura K**, Luo YW, Wang YP (2024) Projecting global biological N₂ fixation under climate warming across land and ocean. *Trends in Microbiology* 1–8.
4. ¹Armin G, ²Kim J, **Inomura K** (2023) Saturating growth rate against phosphorus concentration explained by macromolecular allocation. *mSystems*. 8:00611–23.
5. ¹Masuda T, ²**Inomura K**, Mareš J, Kodama T, Shiozaki T, Matsui T, Suzuki K, Takeda S, Deutsch C, Prášil O, Furuya K (2023) Coexistence of dominant marine phytoplankton sustained by nutrient specialization. *Microbiology Spectrum* 11:e04000-22.
6. Yoshizawa S, Azuma T, Kojima K, **Inomura K**, Hasegawa M, Nishimura Y, Kikuchi M, Armin G, Tsukamoto Y, Miyashita H, Ifuku K, Yamano T, Marchetti A, Fukuzawa H, Sudo Y, Kamikawa R (2023) Light-driven proton pumps as a potential regulator for carbon fixation in marine diatoms. *Microbes and environments* 38:ME23015.
7. Darnajoux R, **Inomura K**, Zhang X (2023) A diazotrophy-ammoniotrophy dual growth model for the sulfate reducing bacterium *Desulfovibrio vulgaris* var. Hildenborough. *Computational and Structural Biotechnology Journal* 21:3136–3148.
8. Eichner M, **Inomura K**, Pierella Karlusich JJ, Shaked Y (2023) Better together? Lessons on sociality from *Trichodesmium*. *Trends in Microbiology* 31:1072–1084.
9. **Inomura K**, Pierella Karlusich JJ, Dutkiewicz S, Deutsch C, Harrison PJ, Bowler C (2023) High growth rate of diatoms explained by reduced carbon requirement and low energy costs of silica deposition. *Microbiology Spectrum* 11:e03311-22.
10. Masuda T, **Inomura K**, Gao M, Armin G, Kotabová E, Bernát G, Lawrenz-Kendrick E, Lukeš M, Bečková M, Steinbach G, Komenda J, Prášil O (2023) The balance between photosynthesis and respiration explains the niche differentiation between *Crocospaera* and *Cyanothece*. *Computational and Structural Biotechnology Journal* 21:58-65.
11. **Inomura K**, Deutsch C, Jahn O, Dutkiewicz S, Follows MJ (2022) Global patterns in marine organic

- matter stoichiometry driven by phytoplankton ecophysiology. *Nature Geoscience* 15: 1034-1040.
12. Agarwal V, **Inomura K**, Mouw CB (2022) Quantitative analysis of the trade-offs of colony formation for *Trichodesmium*. *Microbiology Spectrum* 10: e02025-22
 13. [†]Kim J, [†]Armin G, [#]**Inomura K** (2022) Saturating relationship between phytoplankton growth rate and nutrient concentration explained by macromolecular allocation. *Curr Res Microb Sci* 100167.
 14. Armin G, **Inomura K** (2022) Modeling the elemental stoichiometry and silica accumulation in diatoms. *Curr Res Microb Sci* 100164.
 15. Gao M, Armin G, **Inomura K** (2022) Low-ammonium environment increases the nutrient exchange between diatom-diazotroph association cells and facilitates photosynthesis and N₂ fixation—A mechanistic modeling analysis. *Cells* 11:2911.
 16. Benavides M, Bonnet S, Le Moigne FAC, Armin G, **Inomura K**, Hallstrøm S, Riemann L, Berman-Frank I, Poletti E, Garel M, Grosso O, Leblanc K, Guigue C, Tedetti M, Dupouy C (2022) Sinking *Trichodesmium* fixes nitrogen in the dark ocean. *ISME J* 16:2398–2405.
 17. Luo W, **Inomura K**, Zhang H, Luo Y-W (2022) N₂ fixation in *Trichodesmium* does not require spatial segregation from photosynthesis. *mSystems* 7:e00538-22.
 18. Deutsch C, Penn JL, Verberk WCEP, **Inomura K**, Endress M-G, Payne JL (2022) Impact of warming on aquatic body sizes explained by metabolic scaling from microbes to macrofauna. *PNAS* 119:e2201345119.
 19. [†]Masuda T, [†]**Inomura K**, Kodama T, Shiozaki T, Kitajima S, Armin G, Matsui T, Suzuki K, Takeda S, Prášil O, Furuya K (2022) Crocosphaera as a major consumer of fixed nitrogen. *Microbiol Spectrum* 10:e02177-21.
 20. Masuda T, **Inomura K**, Mareš J, Prášil O (2022) *Crocosphaera watsonii*. *Trends Microbiol* 30:805–806.
 21. Shiozaki T, **Inomura K**, Fujiwara A, Hirose Y, Hashihama F, Harada N (2022) Reply to: Questioning high nitrogen fixation rate measurements in the Southern Ocean. *Nature Geoscience* 15:31–33.
 22. **Inomura K**, Masuda T, Eichner M, Rabouille S, Zavřel T, Červený J, Vancová M, Bernát G, Armin G, Claquin P, Kotabová E, Stephan S, Suggett DJ, Deutsch C, Prášil O (2021) Quantifying *Cyanothece* growth under DIC limitation. *Computational and Structural Biotechnology Journal* 19:6456–6464.
 23. Armin G, **Inomura K** (2021) Modeled temperature dependencies of macromolecular allocation and elemental stoichiometry in phytoplankton. *Computational and Structural Biotechnology Journal* 19:5421–5427.
 24. Chakraborty S, Andersen KH, Visser AW, **Inomura K**, Follows MJ, Riemann L (2021) Quantifying nitrogen fixation by heterotrophic bacteria in sinking marine particles. *Nature Communications* 12:4085.
 25. Masuda T, Prášil O, Villafañe VE, Valiñas MS, **Inomura K**, Helbling EW (2021) Impact of increased nutrients and lowered pH on photosynthesis and growth of three marine phytoplankton communities from the coastal South West Atlantic (Patagonia, Argentina). *Front Mar Sci* 8:609962.
 26. **Inomura K**, Deutsch C, Masuda T, Prášil O, Follows MJ (2020) Quantitative models of nitrogen-fixing organisms. *Computational and Structural Biotechnology Journal* 18:3905–3924.
 27. Shiozaki T, Fujiwara A, **Inomura K**, Hirose Y, Hashihama F, Harada N (2020) Biological nitrogen fixation detected under Antarctic sea ice. *Nature Geosciences* 13:729–732.
 28. Masuda T, **Inomura K**, Takahata N, Shiozaki T, Sano Y, Deutsch C, Prášil O, Furuya K (2020) Heterogeneous rates of N₂ fixation in unicellular diazotroph populations confer an energetic advantage

and expanded ecological niche. *Communications Biology* 3: 172. *This paper exemplifies how modelers and experimentalists/observationalists may collaborate.

29. Omta AW, Talmy D, **Inomura K**, Irwin AJ, Finkel Z V, Sher D, Liefer JD, Follows MJ (2020) Quantifying nutrient throughput and DOM production by algae in continuous culture. *Journal of Theoretical Biology* 494: 110214
30. **Inomura K**, Omta A, Talmy D, Bragg J, Deutsch C, Follows MJ (2020). A mechanistic model of macromolecular allocation, elemental stoichiometry and growth rate in phytoplankton. *Frontiers in Microbiology* 11: 86.
31. **Inomura K**, Follett CL, Masuda T, Eichner M, Prášil O, Deutsch C (2020). Carbon transfer from the host diatom enables fast growth and high rate of N₂ fixation by symbiotic heterocystous cyanobacteria. *Plants* 9: 192. *Selected for the journal cover.
32. **Inomura K**, Deutsch C, Wilson ST, Masuda T, Lawrenz E, Bučinská L, Sobotka R, Gauglitz JM, Saito MA, Prášil O, Follows MJ (2019) Quantifying oxygen management and temperature-light dependencies of nitrogen fixation by *Crocospaera watsonii*. *mSphere* 4:e00531-19.
33. **Inomura K**, Masuda T, Gauglitz JM (2019) Active nitrogen fixation by *Crocospaera* expands their niche despite the presence of ammonium – A case study. *Scientific Reports*. 9:15064.
34. **Inomura K**, Wilson ST, Deutsch C (2019) Mechanistic model for the coexistence of nitrogen fixation and photosynthesis in marine *Trichodesmium*. *mSystems* 4:e00210-19.
35. **Inomura K**, Bragg J, Riemann L, Follows MJ (2018) A quantitative model of nitrogen fixation in the presence of ammonium. *PLoS ONE* 13:e0208282.
36. Follett CL, Dutkiewicz S, Karl DM, **Inomura K**, Follows MJ (2018) Seasonal resource conditions favor a summertime increase in North Pacific diatom–diazotroph associations. *ISME J* 12:1543-1557.
37. **Inomura K**, Bragg J, Follows MJ (2017) A quantitative analysis of the direct and indirect costs of nitrogen fixation: a model based on *Azotobacter vinelandii*. *ISME J* 11:166–175.
38. **Inomura K** (2016) Development of a cell flux model and its application to nitrogen fixers. Dissertation.
39. **Inomura K**, Yuge K, Anan M, Shinogi Y (2010) Numerical analysis of anaerobically digested slurry with irrigation water in rice paddy. *J Fac Agric Kyushu Univ* 55:357–363.

Group member authors are underscored.

° represents equal contributions.

P R E S E N T A T I O N S

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1. **Inomura K** (2024) Modeling phytoplankton physiology. *Ocean Sci Meet*.
 2. **Inomura K** (2023) Cell Flux Model and its application to carbon cycling. *BioGeoSCAPES Science Planning workshop*
 3. **Inomura K** (2023) Cell Flux Model and its application to carbon cycling. *OCB Summer Workshop*
 4. **Inomura K** (2022) Cell Flux Model as a complementary tool to modern microbial sciences. *ASM Microbe*
 5. **Inomura K**, Nishimura Y, Armin G, Yoshizawa S, Deutsch C. (2022) Quantifying ecological and geographical niche of heterotrophic bacteria with rhodopsin. *Ocean Sci Meet*.

6. **Inomura K**, Follett, C L, Masuda T, Eichner O, Prášil O, Deutsch C. (2021) Predicting C and N exchanges within diatom-diazotroph associations (DDAs). *14th European Nitrogen Fixation Conference*
7. **Inomura K**, Deutsch C, Wilson ST, Masuda T, Lawrenz E, Bučinská L, Sobotka R, Gauglitz J, Mak A Saito MA, Prášil O, Takahata N, Shiozaki T, Sano Y, Furuya K, Follows MJ. (2020) Predicting how O₂ characterizes the niche of marine unicellular diazotroph *Crocospaera*. *Ocean Sci Meet*.
8. **Inomura K**, Deutsch C, Masuda T, Wilson S, Omta AW, Gauglitz JM, Talmy D, Bragg J, Lawrenz E, Lenka B, Sobotka, R, Shiozaki T, Takahata N, Sano Y, Furuya K, Saito MA, Prášil O, Jahn O, Dutkiewicz S, Follows MJ. (2019). Cell Flux Model (CFM). *First Annu Meet Early Career Investig Mar Microb Ecol Evol Fellows Mar Microb Ecol*.
9. **Inomura K**, Deutsch C, Wilson ST, Masuda T, Lawrenz E, Lenka B, et al. (2019). Quantifying oxygen management and temperature-light dependencies of nitrogen fixation by *Crocospaera watsonii*. *Chem Lunch Semin*.
10. **Inomura K**, Deutsch C, Omta AW, Talmy D, Bragg J, Dutkiewicz S, et al. (2019). A macromolecular model of phytoplankton: from laboratory to global scale. *Bio Lunch Semin*.
11. **Inomura K**, Deutsch C, Omta AW, Talmy D, Bragg J, Dutkiewicz S, et al. (2018). A macromolecular model of phytoplankton: from laboratory to global scale. *Chem Lunch Semin*.
12. **Inomura K**, Deutsch C, Jahn O, Dutkiewicz S, Follows MJ. (2018). Latitudinal pattern of C:N and C:P controlled by different factors. *Ocean Sci Meet*.
13. **Inomura K**, Follows MJ. (2016). Development of a macromolecular model of phytoplankton under light and nutrient co-limitation (poster). *Int Conf Syst Biol*.
14. **Inomura K**, Follows MJ. (2016). Macro-molecular model indicates multiple oxygen management strategies by *Crocospaera watsonii*. *12th Eur Nitrogen Fixat Conf*.
15. **Inomura K**, Follows M. (2016). Quantifying metabolic trade-offs for diatoms: How do having silica frustules impact the growth of diatoms? *Ocean Sci Meet*.
16. **Inomura K**, Talmy D, Follows M. (2015). Modeling light-nutrient co-limitation of phytoplankton for ocean ecosystem simulations (poster). *Gordon Reseaerch Conf Photosynth*.
17. **Inomura K**, Follows MJ. (2014). Modeling the physiological cost of nitrogen fixation: Why do diazotrophs grow slowly? *Ocean Sci Meet*.
18. **Inomura K**, Follows MJ. (2013). How does nitrogen fixation slow down the growth of diazotrophs? - Numerical analysis of *Azotobacter vinelandii*-. *Microb Syst Semin MIT*.
19. **Inomura K**, Yuge K, Anan M, Shinogi Y. (2010). The Design and Analysis of Methods for the Application of Anaerobically Digested Slurry in Rice Paddy Fields. *Annu Conf Res Inst Resour Circ*.
20. **Inomura K**, Yuge K, Anan M. (2009). Numerical Analysis of Advection and Diffusion of Digestion Sludge from Methane Fermentation in Paddy Fields. *Annu Meet Japanese Soc Irrig Drain Rural Eng*.

TEACHING EXPERIENCES

Volunteered as a Japanese tutor, teaching conversational Japanese

Apr. 2006 – Jul. 2006
Oct. 2006 – Jul. 2007
May 2008 – Jun. 2008

Teaching assistant for Land Irrigation Laboratory	<i>Apr. 2009 – Jul. 2009</i>
Mentoring a graduate student: Deepa Lao	<i>Sep. 2014 – May 2016</i>
Teaching assistant for the class of Mechanisms and Models of the Global Carbon Cycle	<i>Feb. 2016 – May 2016</i>
Completed a course in “Teaching And Learning In Higher Education: From Campus To Career” at the University of Washington	<i>Jun. 2018 – Aug. 2018</i>
Guest-lecturing in ATM S 588, University of Washington: The Global Carbon Cycle and Climate. Taught Ocean Carbon Cycle and Phytoplankton Physiology.	<i>13th Feb. 2019</i>
Guest-lecturing in OCEAN 210, University of Washington: Integrative Oceanography. Taught Phytoplankton Biogeography and Function.	<i>15th Nov. 2019</i>
Guest-lecturing in OCG 594-0004: Special Studies in Microbial Interactions in the Ocean, University of Rhode Island: Quantitative models of microbial symbioses.	<i>1st Mar. 2021, 19th Apr. 2023</i>
Teaching a course OCG 593-0003: Modeling the Marine Carbon Cycles	<i>Fall 2021</i>
Co-teaching a course OCG 506: Numerical Models and Data Analysis in Ocean Sciences	<i>Spring 2022</i>
Teaching a course OCG 533: Graduate Writing in Marine and Environmental Sciences	<i>Fall 2022, Fall 2023</i>
Guest-lecturing in OCG 561: Biological Oceanography	<i>29th Nov 2022</i>
Teaching a course OCG/MBA 539: Hacking for Environment: Oceans	<i>Spring 2023</i>
Teaching a course OCG 577: Modeling the Marine Carbon Cycles	<i>Fall 2023</i>

ADDITIONAL INFORMATION

- **Volunteer experience:** Served as a tutor and cultural guide for three exchange students (from England, Singapore and Indonesia) at my university (*August 2008; Apr. 2009 – Jul. 2010*)
- **Member of Toastmasters International:** A club for improving public speaking (*Oct. 2015 – Sep. 2016, September 2019 – Current*)
- **Book publication:** Inomura, K., English study method for graduate schools abroad -toward MIT with TOEFL 105 and GRE 500- (in Japanese): a book for English studying for non-native speakers.
- **Group meeting organizer:** Organizing reserach meetings for the group of Prof. Curtis Deutsch at the Uiniveristy of Washington (*Sep. 2018 – Dec. 2018, Apr. – Jun. 2019*)