Masato TSUTSUMI, Ph.D.

Assistant Professor

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I study life phenomena as a hierarchical system of morphology, psychology, and behavior, and quantify them as information. My work combines deep generative models for morphological quantification, mathematical models of psychological states (e.g., social stress), and quantitative analysis of inter-individual behavior, aiming to uncover universal principles that describe biological state and dynamics.

APPOINTMENTS

2025/12 – present **Assistant Professor**, Life Science Center for Survival Dynamics (TARA), University of Tsukuba
Mathematical Life Dynamics Project (Assoc. Prof. Nen Saito)

2025/12 – present **Visiting Researcher**, Graduate School of Medicine, Nagoya University
Data-Driven Biology Laboratory (Prof. Naoki Honda)

2024/10 – 2025/11 **Designated Assistant Professor**, Graduate School of Medicine, Nagoya University

2023/10 – 2024/09 **Designated Researcher**, Graduate School of Integrated Sciences for Life, Hiroshima University

2020/04 – 2023/03 **Graduate Student Research Associate**, RIKEN

EDUCATION

2020/04 – 2023/09 **Ph.D. in Science**, Graduate School of Science, The University of Tokyo (Supervisor: Prof. Chikara Furusawa)

2018/04 – 2020/03 **M.S. in Science**, Graduate School of Science, The University of Tokyo (Supervisor: Prof. Chikara Furusawa)

2014/04 – 2018/03 **B.S. in Science**, Department of Physics, Faculty of Science, The University of Tokyo

TEACHING

2025/06 – 2025/07 **Medical Data Science I**, Nagoya University School of Medicine

2024/10 – 2025/03 **Basic Medical Seminar**, Nagoya University School of Medicine

2019/04 – 2019/08 **Computational Experiments I** (Teaching Assistant), Department of Physics, The University of Tokyo

GRANTS & AWARDS

2025 **Takeda Science Foundation Medical Research Grant** (Basic Research)

PUBLICATIONS

1. Sakaguchi, S.#, **Tsutsumi, M.**#(co-first), Nishi, K., Honda, N. Disentanglement of batch effects and biological signals across conditions in the single-cell transcriptome. ***Patterns*** (in press; expected October 2026). doi:10.1016/j.patter.202
2. Yamaguchi, M., **Tsutsumi, M.**, Kuroda, Y., Soeda, Y., Yamaguchi, T. *Artificial-Intelligence-Based Cephalometric Landmark Detection in Lateral Cephalograms*. ***Journal of Clinical Medicine*** (2026). doi:10.3390/jcm15155943
3. Uchida, Y., **Tsutsumi, M.**, Ichii, S., Irie, N., Furusawa, C. *Deciphering the origin of developmental stability: The role of intracellular expression variability in evolutionary conservation*. ***Evolution & Development*** (2024). doi:10.1111/ede.12473
4. **Tsutsumi, M.**, Saito, N., Koyabu, D., Furusawa, C. *A deep learning approach for morphological feature extraction based on variational auto-encoder: an application to mandible shape*. ***npj Systems Biology and Applications*** (2023). doi:10.1038/s41540-023-00293-6

PREPRINTS

1. **Tsutsumi, M.**, Kubo, T., Kato, T.A., Honda, N. Mind the gap: quantifying population–individual gap in depressive symptom dynamics through energy landscapes. *bioRxiv* (2026; v2).
2. Matsuda-Watanabe, N., **Tsutsumi, M.**, Okumura, M., Chihara, T. Chemosensory input suppresses cannibalism by stabilizing social feeding boundaries in Drosophila larvae. In submission (2026).
3. **Tsutsumi, M.**, Saito, N., Yamaguchi, T., Sasaki, T., Furusawa, C. Decoding Anadara shell morphology with deep learning. *bioRxiv* (2026).

INVITED TALKS

1. AI for measuring morphological differences among living organisms

   FY2026 University of Tsukuba Open Lecture: Frontiers of Interdisciplinary Life Science Research 2026 **2026/07/30**

2. Towards quantification of form using information science

   Workshop on Quantification of Form 2026 **2026/07/27**

3. Development of methods for quantifying biological morphology with an information-science approach

   78th Annual Meeting of the Japan Society for Cell Biology **2026/07/15**

4. Variational energy landscape analysis reveals population trends and individual heterogeneity during and after COVID-19 emergency declarations

40th Annual Conference of the Japanese Society for Artificial Intelligence (JSAI 2026) **2026/06/09**

5. Towards quantification of diverse life phenomena: morphology, behavior, and psychology as information

SSTB2026 - Spring School for Theoretical Biology 2026 **2026/03/05**

6. Development of quantitative analysis methods for biological morphology using deep learning

Japan Society for Industrial and Applied Mathematics Annual Meeting 2024 **2024/09/16**

7. Development of quantitative analysis methods for biological morphology using deep learning

Online Seminar Series "Future of Evolutionary Biology with AI" **2024/03/09**

8. Development of quantitative analysis methods for biological morphology using deep learning

8th Theoretical Immunology Workshop **2024/02/14**

9. Quantification of various biological morphologies using machine learning

Hiroshima University Mathematical Life Sciences Program Seminar **2022/11/10**

10. Quantification and application of biological morphology using machine learning: Focusing on primate mandibles

National Institute for Basic Biology Departmental Seminar **2021/10/20**

CONFERENCE PRESENTATIONS

1. Mind the gap: quantifying population–individual differences in depressive symptom dynamics using energy landscapes

2nd Systems Behavioral Science Workshop **2026/07/12**

2. Morphological character selection using machine learning for phylogenetic analysis: revisiting the phylogenetic position of lepidosaurs

Annual Meeting of the Palaeontological Society of Japan 2026 **2026/06/27**

3. Quantitative Analysis of Biological Morphology and Behavior Based on Deep Learning: Development of Morpho-VAE and DOLO

Frontiers of coevolutionary phenotypic emergence research: tracing how research unfolds from its roots **2026/02/20**

4. Analysis of morphology and behavior using deep learning methods

Principles for Creating Life Functions through Evolutionary Information Assembly **2026/01/13**

5. Development of a markerless multi-individual tracking system for controlling cannibalistic behavior in crickets

47th Annual Meeting of the Japanese Society for Comparative Physiology and Biochemistry **2025/12/05**

6. Morphological quantification using deep learning: Morpho-VAE

99th Symposium on Science of Form "Shape that brings motion" **2025/11/30**

7. Visualization of morphological variation using 3D Variational Autoencoder

34th Annual Meeting of the Japanese Society for Bioimaging **2025/09/26**

8. Behavioral analysis of double mutant Drosophila larvae using DOLO (Drosophila tracking with YOLO)

1st Systems Behavioral Science Workshop **2025/05/30**

9. Estimation of psychological state transitions during/after emergency declarations using energy landscape analysis

SSTB2025 - Spring School for Theoretical Biology 2025 **2025/02/20**

10. Proposal of morphological quantitative analysis methods using deep learning

Annual Meeting of the Japanese Society for Mathematical Biology 2024 **2024/09/12**

11. Quantification of mouse behavior under social defeat stress using mathematical models

CPSY TOKYO 2024 **2024/03/28**

12. Mathematical model of rumination in the brain using Bayesian inference

Spring School for Theoretical Biology 2024 **2024/02/20**

13. Mathematical model of rumination in the brain using free energy principle

11th Annual Meeting of the Quantitative Biology Society **2024/01/06**

14. Unveiling the enigmatic Middle Devonian vertebrate, Palaeospondylus

The 3rd Asia Evo Conference Symposium **2023/12/16**

15. Development of a quantitative analysis method for biological morphology using deep learning

Statphys28 Satellite meeting: Statistical Physics and Information-Processing in Living Systems **2023/08/08**

16. Morphological feature extraction of primate mandibles using variational autoencoders

10th Annual Meeting of the Quantitative Biology Society **2022/12/15**

17. A method for morphological feature extraction based on variational auto-encoder

60th Annual Meeting of the Biophysical Society of Japan **2022/09/30**

18. A deep learning approach for the shape analysis of the primates mandible

Euro Evo Devo 2022 **2022/06/01**

19. Quantifying mandibular morphology using machine learning

61st Summer School of the Young Biophysicists' Association **2021/09/07**

20. Quantification and application of biological morphology using machine learning

20th Life Science Symposium **2020/10**

21. Quantification and application of biological morphology using machine learning

58th Annual Meeting of the Biophysical Society of Japan **2020/09**

22. Quantification and application of biological morphology using machine learning

3rd ExCELLS Symposium **2020**

23. Verification of classification methods for 2D OCT images using two-stage networks

2nd Japanese Society for Medical AI Academic Conference **2020/01/31**

24. Quantification of biological morphology using machine learning

Workshop on theoretical analysis and experimental verification for understanding stability and plasticity of biological systems **2019/09/05**

25. Quantitation of cell shape by machine learning

57th Annual Meeting of the Biophysical Society of Japan **2019/09**

26. Machine learning of animal morphology using bones

59th Life Science Summer School **2019/08**

27. Analysis of single-cell deformation dynamics

9th Annual Meeting of the Quantitative Biology Society **2019/01**

28. Analysis of kinesin motility under temperature and pH conditions

57th Summer School of the Young Biophysicists' Association **2017/09**

29. Motion analysis of Brownian particles

Kyoto University ELCAS Research Presentation Meeting **2014/09**

RESEARCH PROJECTS

1. **Morpho-VAE**: Landmark-free morphological feature extraction with variational autoencoders.
2. **mindGAP**: Population–individual gap in depressive symptom dynamics via energy landscape analysis.
3. **KANADE**: Disentanglement of batch effects and biological signals in scRNA-seq.
4. **DOLO**: Multi-individual Drosophila larva tracking with YOLO.

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