

# Jian Wei Tay, PhD

BioFrontiers Institute  
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## EDUCATION

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### **Ph.D. in Physics** 2011

University of Otago, New Zealand

Thesis: Optical Motion Detection

Thesis committee: Jevon J. Longdell, Warwick P. Bowen, Igor Meglinski

### **BSc. (Honors First class) in Physics** 2006

University of Otago, New Zealand

Dissertation: High finesse optical cavities in single atom detection

Dissertation advisor: Murray D. Barrett

## PROFESSIONAL APPOINTMENTS

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### **Research Associate** 2019 - Present

BioFrontiers Institute

University of Colorado Boulder

### **Affiliated Lecturer** 2020- Present

Department of Molecular, Cellular, and Developmental Biology

University of Colorado Boulder

### **Professional Research Assistant** 2016 - 2019

BioFrontiers Institute and RASEI (joint appointment)

University of Colorado Boulder

## RESEARCH EXPERIENCE

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### **Postdoctoral Research Associate** 2014 - 2016

Department of Electrical Engineering, University of Colorado Boulder

Advisor: Rafael Piestun

### **Postdoctoral Research Associate** 2011 - 2014

Department of Biomedical Engineering, Washington University in St Louis

Advisor: Lihong Wang

### **Summer Research Assistant** 2006

Department of Physics, University of Otago

Advisor: Warwick P. Bowen

### **Summer Research Assistant** 2005

Department of Physics, University of Otago

Advisor: Murray D. Barrett

## PUBLICATIONS

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### PEER-REVIEWED ARTICLES

1. **Tay, J. W.**, and Cameron, J. C. *Computational and biochemical methods to measure the activity of carboxysomes and protein organelles in vivo*. Meth. Enzymol. In press. (2022).
2. Lee, L. A., Barrick, S. K., Meller, A., Walklate, J., Lotthammer, J. M., **Tay, J. W.**, Stump, W. T., Bowman, G., Geeves, M. A., Greenburg, M. H., and Leinwand, L. A. *Functional divergence of the sarcomeric myosin, MYH7b, supports species-specific biological roles*. *J. Biol. Chem.* 299, 102657 (2023).
3. **Tay, J. W.**, and Cameron, J. C. *Asymmetric survival in single-cell lineages of cyanobacteria in response to photodamage*. Photosynth. Res. (2022).
4. Fenster, J., Werner, A. Z., **Tay, J. W.**, Gillen, M., Schirokauer, L., Hill, N., Watson, A., Johnson, C. W., Beckham, G. T., Cameron, J., Eckert, C. *Dynamic and single cell characterization of a CRISPR-interference toolset in Pseudomonas putida KT2440 for beta-ketoadipate production from p-coumarate*. Metab. Eng. Commun. 15, e00204 (2022).
5. Corbet, G. A., Burke, J. M., Bublitz, G. R., **Tay, J. W.**, and Parker, R. dsRNA-induced condensation of antiviral proteins modulates PKR activation. PNAS 119, e2204235119 (2022).
6. Lauridsen, K. Ly, A., Prévost, E. D., McNulty, C., McGovern, D. J., **Tay, J. W.**, Dragavon, J., Root, D. H. *A Semi-Automated Workflow for Brain Slice Histology Alignment, Registration, and Cell Quantification (SHARCQ)*. eNeuro 9, ENEURO.0483-21.2022 (2022).
7. Hill, N. C., **Tay, J. W.**, Altus, S., Bortz, D. M., and Cameron, J. C. *Lifecycle of a cyanobacterial carboxysome*. Sci. Adv. 6, eaba1269 (2020).
8. Moore, K. A., Altus, S., **Tay, J. W.**, Fox, J., Johnson, E. B., Bortz, D. M. and Cameron, J. C. *Mechanical regulation of photosynthesis in cyanobacteria*. Nature Microbiol. 5, 757-767 (2020).
9. Lo, M., Damon, L. J., **Tay, J. W.**, and Palmer, A. E. *Single cell analysis reveals multiple requirements for zinc in the mammalian cell cycle*. eLife 9, e51107 (2020).
10. Mahadevan, J., Rudolph, J., Jha, A., **Tay, J. W.**, Dragavon, J., Grumstrup, E. M., and Luger, K. *Q-FADD: A mechanistic approach for modeling the accumulation of proteins at sites of DNA damage*. Biophys. J 116, 2224 - 2233 (2019).
11. Connacher, M. K., **Tay, J. W.**, and Ahn, N. G. *Rear-polarized Wnt5a-receptor-actin-myosin-polarity (WRAMP) structures promote the speed and persistence of directional cell migration*. Mol. Biol. Cell. 28, 1924-1936 (2017).
12. Hemphill, A. S., **Tay, J. W.**, and Wang, L. V. *Hybridized wavefront shaping for high-speed, high-efficiency focusing through dynamic diffusive media*. J. Biomedical Optics 21, 121502 (2016).
13. Lai, P.\* , Wang, L.\* , **Tay, J. W.\***, and Wang, L. V. *Photoacoustically guided wavefront shaping for enhanced optical focusing in scattering media*. Nature Photon. 9, 126-132 (2015).
14. **Tay, J. W.\***, Liang, J. Y.\* , and Wang, L. V. *Amplitude-masked photoacoustic wavefront shaping and application in flowmetry*. Opt. Lett. 39, 5499-5502 (2014).

15. Suzuki, Y., **Tay, J. W.**, Yang, Q. and Wang, L. V. *Continuous scanning of the time-reversed ultrasonically encoded optical focus by reflection-mode digital phase conjugation*. Opt. Lett. 39, 3441-3444 (2014).
16. **Tay, J. W.\***, Lai, P., Suzuki\*, Y., and Wang, L. V. *Ultrasonically encoded wavefront shaping for focusing into random media*. Sci. Rep. 4, 3918 (2014).
17. **Tay, J. W.**, Farr, W. G., Ledingham, P. M., Korystov, D., and Longdell, J. J. *Hybrid optical and electronic laser locking using slow light due to spectral holes*. Phys. Rev. A. 87, 063824 (2013).
18. **Tay, J. W.**, Ledingham, P. M., and Longdell, J. J. *Coherent optical ultrasound detection with rare-earth ion dopants*. Appl. Opt. 49, 4331-4334 (2010).
19. **Tay, J. W.**, Hsu, M. T. L., and Bowen, W. P. *Quantum limited particle sensing in optical tweezers*. Phys. Rev. A. 80, 063806 (2009).
20. **Tay, J. W.**, Taylor, M. A., and Bowen, W. P. *Sagnac-interferometer-based characterization of spatial light modulators*. Appl. Opt. 48, 2236-2242 (2009).

#### IN PREPARATION

1. Moore, K. A., Tay, J. W., and Cameron, J. C. *Multi-generational analysis and manipulation of chromosomes in a polyploid cyanobacterium*. In Preparation. bioRxiv doi: 10.1101/661256.

#### PROCEEDINGS

1. Lai, P.\*, Tay, J. W.\*, Wang, L.\* and Wang, L. V. *Optical focusing in scattering media with photoacoustic wavefront shaping (PAWS)*. Proc. SPIE 8943, 894318, (2014).
2. Tay, J. W., Lai, P., Suzuki, Y. and Wang, L. V. *Focusing light in scattering media by ultrasonically encoded wavefront shaping (SEWS)*. Proc. SPIE 8943, 89434P (2014).
3. Suzuki, Y., Tay, J. W., Yang, Q., and Wang, L. V. *Digital reflection-mode time-reversed ultrasonically encoded (TRUE) optical focusing*. Proc. SPIE 8943, 89431B (2014).
4. Liang, J.\*, Tay, J. W.\*, Hemphill, A. S., and Wang, L. V. *Amplitude-masked photoacoustic wavefront shaping: theory and application in flowmetry*. Proc. SPIE 9323, 932310 (2015).
5. Tay, J. W., Ledingham P. M., and Longdell, J. J. *Coherent detection of ultrasound using dispersion due to spectral holes*. Proc. SPIE 7948, 794809, Feb 11 (2011).
6. Tay, J. W., Ledingham, P. M., and Longdell, J. J. *Ultrasound detection using dispersion due to spectral holes* in Frontiers in Optics 2010/Laser Science XXVI, FThP2 (2010).
7. Tay, J. W., Jiang, X., and Bowen, W. P. *On shotnoise and Brownian motion limits to the accuracy of particle positioning with optical tweezers*. Proc. SPIE 6801, 68010Z (2008).

#### BOOK CHAPTERS

1. Bowen, W. P., Hsu, M. T. L., and **Tay, J. W.** *Fundamentals and Applications of Quantum Limited Optical Imaging*. In Costa, N., and Cartaxo, A. (Eds.), Advances in Lasers and Electro Optics (pp. 633- 654). Croatia: INTECH (2010).

#### PATENTS

1. Cameron, J. C., Hill, N. C., **Tay, J. W.**, Altus, S., Bortz, D. M., inventors; University of Colorado Boulder, assignee. *Methods for Measuring and Optimizing the Structure, Location,*

*and Activity of Natural and Engineered Microcompartments, Organelles, and Macromolecules*. United States provisional patent 62/935,738. 2019 November 15.

2. Cameron J. C., Moore, K. M., Johnson, E. B., **Tay, J. W.**, Meehl, J. B., Altus, S., Bortz, D. M., inventors; University of Colorado Boulder, assignee. *Methods and Systems for the Use of Photosynthetic Microbes as Mechanical Transducers and Sensors*. United States provisional patent 16/036,645. 2018 July 16.
3. Wang, L. V., Wang, L., Zhang, C., Lai, P., **Tay, J. W.**, inventors; Washington University in St Louis, assignee. *Systems and methods of Grueneisen-relaxation photoacoustic microscopy and photoacoustic wavefront shaping*. Publication number: 20160305914. Filed 19 November 2014. Issued 20 October 2016.
4. Longdell, J. J., and **Tay, J. W.**, inventors; Washington University in St Louis, assignee. *Method and apparatus for detection of ultrasound*. Publication number: 2011068417. Filed 30 November 2010. Issued 9 June 2011.

## FUNDING

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### Internal competitions

**Race to AWS Credits (PI: Tay)** 2022  
Amount awarded: \$5000

**Core Facilities Voucher Program (PI: Tay)** 2022  
Amount awarded: \$4848

## AWARDS AND HONORS

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**Best Postdoctoral Poster**, Front Range Computational & Systems Biology Symposium 2021  
**Waters Outstanding Scientific Poster**, Association of Biomolecular Resource Facilities 2021  
**Seno Medical Best Paper**, SPIE Photonics West (BIOS conference) 2014  
**PhD Scholarship**, Jack-Dodd Centre for Quantum Technology, University of Otago 2007 - 2010  
**Divisional Award**, Division of Sciences, University of Otago 2007  
**Bursary in Physics**, Beverly Trust Fund, University of Otago 2004 - 2006

## PRESENTATIONS (\* indicates award)

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### CONFERENCES

1. **Tay, J. W.** & Cameron, J. C. *Single-cell microscopy reveals asymmetric survival to photodamage in cyanobacteria*. World Microbe Forum, American Society of Microbiology, Virtual seminar. June 20 - 24, 2021.
2. \***Tay, J. W.** & Cameron, J. C. *Illuminating photosynthesis in single cyanobacterial cells*. Front Range Computational & Systems Biology Symposium, Colorado State University. May 3, 2021.
3. \***Tay, J. W.** & Cameron, J. C. *Illuminating photosynthesis in single cyanobacterial cells*. Waters award winners presentation, Association of Biomolecular Resource Facilities Annual Meeting, Virtual seminar. March 11, 2021.
4. **Tay, J. W.** & Cameron, J. C. *Illuminating photosynthesis in single cyanobacterial cells*. 46th Midwest/Southeast Photosynthesis Meeting, Virtual seminar, October 23-24, 2020. (Recorded presentation: <https://youtu.be/NwzByz46kfM>)
5. **Tay, J. W.**, & Cameron, J. C. *CyAn: A cyanobacteria image analysis toolbox*. 13th Workshop on Cyanobacteria, University of Colorado Boulder, June 6-9 (2019).

6. **Tay, J. W.**, Lai, P., Suzuki, Y. & Wang, L. V. *Focusing light in scattering media by ultrasonically encoded wavefront shaping (SEWS)*. SPIE BiOS 8943-42, San Francisco, CA, Feb 3 (2014).
7. **\*Tay, J. W.**, Lai, P., Wang, L. & Wang, L. V. *Optical wavefront shaping-enhanced photoacoustic microscopy*. SPIE BiOS 8943-167, San Francisco, CA, February 3 (2014).
8. **Tay, J. W.**, Ledingham P. M., and Longdell, J. J. *Coherent detection of ultrasound using dispersion due to spectral holes*. Frontiers in Optics, Rochester, NY, October 24-28, (2010).
9. **Tay, J. W.**, Farr, W. G., Korystov, D., Ledingham P. M., and Longdell, J. J. *Hybrid laser stabilisation using spectral hole burning*. Jack-Dodd Centre Student Symposium, Dunedin, New Zealand, December (2009).
10. **Tay, J. W.**, and Bowen, W. P. *Towards determining the classical resolution limit of optical tweezers*. KOALA student conference, Brisbane, Australia, December (2008).
11. **Tay, J. W.**, Jiang, X., and Bowen, W. P. *The classical resolution limit of optical tweezers*. SPIE: Microelectronics, MEMS and Nanotechnology, Canberra, Australia, December 4-7, (2007).
12. **Tay, J. W.**, Jiang, X., and Bowen, W. P. *Classical Resolution Limit of Optical Tweezers*. New Zealand Institute of Physics (NZIP), Dunedin, New Zealand, July 4, (2007).

#### DEPARTMENTAL TALKS

1. **Tay, J. W.** *Computational toolboxes for single cell microscopy*. SCR Single Molecule Single Cell supergroup. University of Colorado Boulder. February 17 (2020).
2. **Tay, J. W.** *An Introduction to Neural Networks for Image Classification*. Quantitative Optical Imaging supergroup. University of Colorado Boulder. October 1 (2018).
3. **Tay, J. W.** *Introduction to Biophotonics*. Short course at IONS-KOALA student conference, Dunedin, New Zealand, November 28-December 3 (2010).

#### TEACHING EXPERIENCE

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##### **Quantitative Optical Imaging (MCDB/BCHM 4312/5312)** 2019 - Present University of Colorado Boulder, CO

- Co-lecturers: Joseph Dragavon, PhD (current) and Thomas Cech, PhD (former)
- 3 credits lecture-based course, 30 students per year (average)
- I teach 1.5 hours a week, develop image analysis syllabus, write and grade assignments, write and grade 3 exams, and participate in approximately 2 course planning activities per year

##### **Special Topics in MCD Biology: Microscopy Lab Course (MCDB 4100/6440)** 2016 - 2021 University of Colorado Boulder, CO

- Co-lecturer: Joseph Dragavon, PhD
- 1 credit lab course, 9 students per year (average)
- I teach 3 hours a week, develop lab syllabus, grade lab reports, and participate in approximately 2 course planning activities per year
- Note: This course was officially listed as an MCD Biology course in Fall 2021. It was previously offered as a one credit extension of MCDB/BCHM 4312/5312.

##### **Teaching Assistant** 2004 - 2010 University of Otago, Dunedin, New Zealand

- Electromagnetism and Optics (PHSI232) 2009, 2010
- Quantum and Thermal Physics (PHSI331) 2009
- Fundamentals of Modern Physics (PHSI132) 2008, 2009
- Physical Law and its Applications (PHSI131) 2008, 2009
- Quanta and Uncertainty (PHSI231) 2007
- Biological Physics (PHSI191) 2005, 2007

- Undergraduate Physics Tutor, Aquinas College 2004

## **SERVICE AND OUTREACH**

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<b>CU Science Discovery Program</b>	2021
• <i>Guest Lecturer - Introduction to Microscopy</i>	
<b>Postdoctoral Association of Colorado Boulder</b>	2020 - Present
• <i>Interim Treasurer, 2021 - Present</i>	
• <i>Advisory Committee Member, 2020 - 2021</i>	
<b>Boulder Valley School District</b>	2020
• <i>Science Fair Judge</i>	

## **PROFESSIONAL AFFILIATIONS**

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<b>American Society of Microbiology (ASM)</b>	2021 - Present
<b>Optical Society of America (OSA)</b>	2006 - Present
<b>Association of Biomedical Research Facilities (ABRF)</b>	2020 - Present
<b>Bioimaging North America (BINA)</b>	2020 - Present
<b>Institute of Electrical and Electronics Engineers (IEEE)</b>	2012 - 2014

## **REVIEWING ACTIVITIES**

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### Peer-reviewed Journals:

*Applied optics*  
*Biomedical Optics Express*  
*Journal of the Optical Society of America B*  
*Optics Letters*  
*Optics Express*  
*Sensors*  
*Applied Sciences*  
*AIP Advances*  
*Biosensors*

### Awards and Grants:

OSA Activity and Youth Education Grants  
 ASM World Microbe Forum 2021 Student Poster Award  
 LatinXinBME 2021 Short Talk Award  
 CU Boulder AB Nexus Grant  
 CU Boulder Undergraduate Research Opportunities (UROP) Program  
 American Society for Microbiology, Annual Biomedical Research Conference for Minoritized Scientists