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The diterpenoid phytohormone gibberellin (GA) plays pivotal roles in regulating growth and development throughout the life cycle of higher plants. Mutations affecting GA biosynthesis or GA response were the key to control plant stature in wheat and rice that led to dramatically increased grain yield and contributed greatly to the success of the 'Green Revolution' in the 1960s. By multi-faceted approaches using the reference plant *Arabidopsis*, my lab has made major breakthroughs in elucidating the sites and regulatory mechanisms of GA biosynthesis, and the conserved molecular events of GA perception and the early GA signaling pathway. We identified the nuclear transcriptional regulators DELLA proteins, which function as master growth repressors by inhibiting all aspects of GA responses. Binding of GA to its nuclear receptor GID1 enhances the GID1-DELLA interaction, which in turn leads to the rapid proteolysis of DELLA through the ubiquitin-proteasome pathway, and allows transcriptional reprogramming of GA-responsive genes. We and other researchers further showed that GA-GID1-DELLA is a key regulatory module that controls plant growth by integrating internal developmental cues, and external biotic and abiotic signals (light, cold, salt and pathogen stresses). DELLA proteins play a central role in these processes via direct protein-protein interactions with key transcription factors. Our recent studies using genetic and physiological analyses together with chemical biology methods indicate that DELLA's binding affinity to interacting proteins are oppositely regulated by two novel *O*-linked glycosylations on specific Ser/Thr residues: *O*-linked *N*-acetylglucosamine (*O*-GlcNAc) modification reduces DELLA activity, whereas *O*-fucosylation enhances DELLA activity. We are investigating the global functions of *O*-GlcNAcylation and *O*-fucosylation in regulating plant development.

### Education

- Ph.D. 1987 - Duke University
- B.S. 1980 - National Tsing Hua University (Taiwan)

### Grants

- [Elucidation of Molecular Mechanism of Master Growth Regulator DELLA](#)

- [Signaling in Arabidopsis](#) awarded by National Science Foundation 2024 - 2028
- [Elucidation of the Roles of Protein Glycosyltransferases SISPY and SISECs in Tomato Fruit Development](#) awarded by Department of Agriculture 2023 - 2027
- [Training Program in Developmental and Stem Cell Biology](#) awarded by National Institutes of Health 2001 - 2027
- [Genetic and Genomics Training Grant](#) awarded by National Institutes of Health 2020 - 2025
- [Molecular Mechanism of Master Growth Repressor DELLA Signaling in Arabidopsis](#) awarded by National Science Foundation 2018 - 2023
- [Functional Analysis of Protein O-Glycosylation in Regulating Nuclear Growth Repressor DELLA and Plant Development in Arabidopsis](#) awarded by National Institutes of Health 2012 - 2023
- [Plasmonics-Enhanced Optical Imaging Systems for Bioenergy Research](#) awarded by Department of Energy 2018 - 2022
- [DELLA-ARF/IAA Interactions Mediate Crosstalk between Gibberellin and Auxin Signaling in Regulating Fruit Development in Tomato](#) awarded by Department of Agriculture 2013 - 2021
- [Multi-functional Plasmonics Nanoprobes for Cellular Sensing and Imaging](#) awarded by Department of Energy 2015 - 2019
- [Acquisition of a MALDI-TOF Mass Spectrometer System at Duke University](#) awarded by North Carolina Biotechnology Center 2017 - 2018

#### Publications

- Li, Joy, Vanessa Cupil-Garcia, Hsin-Neng Wang, Pietro Strobbia, Barry Lai, Jianhong Hu, Martin Maiwald, et al. "[Plasmonics nanorod biosensor for in situ intracellular detection of gene expression biomarkers in intact plant systems.](#)" *Biosensors & Bioelectronics* 261 (October 2024): 116471. <https://doi.org/10.1016/j.bios.2024.116471>.
- Shani, Eilon, Peter Hedden, and Tai-Ping Sun. "[Highlights in gibberellin research: A tale of the dwarf and the slender.](#)" *Plant Physiology* 195, no. 1 (April 2024): 111–34. <https://doi.org/10.1093/plphys/kiae044>.
- Huang, Xu, Hao Tian, Jeongmoo Park, Dong-Ha Oh, Jianhong Hu, Rodolfo Zentella, Hong Qiao, Maheshi Dassanayake, and Tai-Ping Sun. "[The master growth regulator DELLA binding to histone H2A is essential for DELLA-mediated global transcription regulation.](#)" *Nature Plants* 9, no. 8 (August 2023): 1291–1305. <https://doi.org/10.1038/s41477-023-01477-y>.
- Hu, Jianhong, Xiao Li, and Tai-Ping Sun. "[Four class A AUXIN RESPONSE FACTORs promote tomato fruit growth despite suppressing fruit set.](#)" *Nature*

- Plants* 9, no. 5 (May 2023): 706–19. <https://doi.org/10.1038/s41477-023-01396-y>.
- Zentella, Rodolfo, Yan Wang, Emily Zahn, Jianhong Hu, Liang Jiang, Jeffrey Shabanowitz, Donald F. Hunt, and Tai-Ping Sun. “[SPINDLY O-fucosylates nuclear and cytoplasmic proteins involved in diverse cellular processes in plants.](#)” *Plant Physiology* 191, no. 3 (March 2023): 1546–60. <https://doi.org/10.1093/plphys/kiad011>.
  - Cupil-Garcia, Vanessa, Joy Q. Li, Stephen J. Norton, Ren A. Odion, Pietro Strobbia, Luca Menozzi, Chenshuo Ma, et al. “[Plasmonic nanorod probes' journey inside plant cells for \*in vivo\* SERS sensing and multimodal imaging.](#)” *Nanoscale* 15, no. 13 (March 2023): 6396–6407. <https://doi.org/10.1039/d2nr06235f>.
  - Kumar, Shivesh, Yan Wang, Ye Zhou, Lucas Dillard, Fay-Wei Li, Carly A. Sciandra, Ning Sui, et al. “[Structure and dynamics of the Arabidopsis O-fucosyltransferase SPINDLY.](#)” *Nature Communications* 14, no. 1 (March 2023): 1538. <https://doi.org/10.1038/s41467-023-37279-1>.
  - Cupil-Garcia, V., J. Q. Li, R. Odion, P. Strobbia, B. M. Crawford, H. N. Wang, J. Hu, et al. “[In vivo SERS monitoring in plants using plasmonic nanoprobes.](#)” In *Progress in Biomedical Optics and Imaging - Proceedings of SPIE*, Vol. 11978, 2022. <https://doi.org/10.1117/12.2617364>.
  - Sun, Tai-Ping. “[Novel nucleocytoplasmic protein O-fucosylation by SPINDLY regulates diverse developmental processes in plants.](#)” *Current Opinion in Structural Biology* 68 (June 2021): 113–21. <https://doi.org/10.1016/j.sbi.2020.12.013>.
  - Crawford, B. M., H. N. Wang, P. Strobbia, R. Zentella, Z. M. Pei, T. P. Sun, and T. Vo-Dinh. “Plasmonic Nanobiosensing: From in situ plant monitoring to cancer diagnostics at the point of care.” *JPhys Photonics* 2, no. 3 (July 7, 2020). <https://doi.org/10.1088/2515-7647/ab9714>.
  - Wang, Yan, Yuqing He, Chen Su, Rodolfo Zentella, Tai-Ping Sun, and Lei Wang. “Nuclear Localized O-Fucosyltransferase SPY Facilitates PRR5 Proteolysis to Fine-Tune the Pace of Arabidopsis Circadian Clock.” *Molecular Plant* 13, no. 3 (March 2020): 446–58. <https://doi.org/10.1016/j.molp.2019.12.013>.
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- Crawford, Bridget M., Pietro Strobbia, Hsin-Neng Wang, Rodolfo Zentella, Maxim I. Boyanov, Zhen-Ming Pei, Tai-Ping Sun, Kenneth M. Kemner, and Tuan Vo-Dinh. "Plasmonic Nanoprobes for in Vivo Multimodal Sensing and Bioimaging of MicroRNA within Plants." *ACS Applied Materials & Interfaces* 11, no. 8 (February 2019): 7743–54. <https://doi.org/10.1021/acsami.8b19977>.
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