Membrane editing with proximity labeling reveals regulators of lipid homeostasis

Reika Tei, Xiang-Ling Li, Lin Luan & Jeremy M. Baskin

Nat Chem Biol (2026). https://doi.org/10.1038/s41589-025-02104-x

- blue light
- Optogenetics
- Light-driven proximity-dependent biotin labeling method
- Proteome
- Protein interactions

Inhibition of Mitochondrial Complex III Causes Dopaminergic Neurodegeneration by Redox Stress in Caenorhabditis elegans

Javier Huayta, Joel N. Meyer

bioRxiv Oct 23 2025. doi: https://doi.org/10.1101/2025.10.21.683798

- yellow light
- Optogenetics
- Reactive oxygen species
- SuperNova (Photomolecular inactivation by CALI method)
- Mitochondria
- Nematodes

Biallelic variants in DNAJC7 cause familial amyotrophic lateral sclerosis with the TDP-43 pathology

Toru Yamashita, Osamu Yokota, Daiki Ousaka, Hongming Sun, Takashi Haraguchi, Ricardo Satoshi Ota-Elliott, Chika Matsuoka, Tomohito Kawano, Hanae Nakashima-Yasuda, Yusuke Fukui, Yumiko Nakano, Ryuta Morihara, Masato Hasegawa, Yasuyuki Hosono, Seishi Terada, Manabu Takaki, Hiroyuki Ishiura

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- blue light
- Optogenetics
- Cry2olig (photoprotein aggregation)
- ALS
- Zebrafish

Optogenetic mitochondrial preconditioning enhances cardiomyocyte survival under stress

Seulhee Kim, Hwayeon Lim, Patrick Ernst, Li Zhu, Jiashuai Zhang, Min Xie, Xiaoguang Margaret Liu, Lufang Zhou

J Mol Cell Cardiol . 2025 Jun 8:205:24-36. doi: 10.1016/j.yjmcc.2025.06.004.

- blue light
- Optogenetics
- Regenerative medicine
- iPS cells
- Human iPS cell-derived cardiomyocyte
- mOpto
- Anti-aging

- Mitochondria

Cryo-ET of actin cytoskeleton and membrane structure in lamellipodia formation using optogenetics

Hironori Inaba, Tsuyoshi Imasaki, Kazuhiro Aoyama, Shogo Yoshihara, Hiroko Takazaki, Takayuki Kato, Hidemasa Goto, Kaoru Mitsuoka, Ryo Nitta, Takao Nakata

iScience 2025 June, Volume 28, Issue 6, DOI: 10.1016/j.isci.2025.112529

- blue light
- Optogenetics
- PA-RAC1
- Ultrastructure analysis of cells

A modular toolbox for the optogenetic deactivation of transcription

Philipp Muench, Matteo Fiumara, Nicholas Southern, Davide Coda, Sabine Aschenbrenner, Bruno Correia, Johannes Gräff, Dominik Niopek, Jan Mathony

Nucleic Acids Res . 2025 Jan 24;53(3):gkae1237. doi: 10.1093/nar/gkae1237.

- blue light
- Optogenetics
- Photogenome editing
- Magnets System
- CRISPR-Cas9

Complex I superoxide anion production is necessary and sufficient for complex I inhibitor-induced dopaminergic neurodegeneration in Caenorhabditis elegans

Katherine S. Morton, Alex J. George, Joel N. Meyer

Redox Biol. 2025 Feb 8;81:103538. doi: 10.1016/j.redox.2025.103538.

- yellow light
- Optogenetics
- SuperNova (Photomolecular inactivation by CALI method)
- Parkinson's disease

Optogenetic tools for inducing organelle membrane rupture

Yuto Nagashima, Tomoya Eguchi, Ikuko Koyama-Honda, Noboru Mizushima

Nucleic Acids Res. 2025 March doi: 10.1016/j.jbc.2025.108421.

- blue light
- Optogenetics
- Light Organelle Destruction
- LOV2-BAX
- Autophagy
- Apoptosis

RNA G-quadruplexes forming scaffolds for α-synuclein aggregation lead to progressive neurodegeneration

Kazuya Matsuo, Sefan Asamitsu, Kohei Maeda, Hiroyoshi Suzuki, Kosuke Kawakubo, Ginji Komiya, Kenta Kudo, Yusuke Sakai, Karin Hori, Susumu Ikenoshita, Shingo Usuki, Shiori Funahashi, Hideki Oizumi, Atsushi Takeda,

Yasushi Kawata, Tomohiro Mizobata, Norifumi Shioda, Yasushi Yabuki

Cell . 2024 Nov 27;187(24):6835-6848.e20. doi: 10.1016/j.cell.2024.09.037.

- blue light
- Optogenetics
- Parkinson's disease
- Cry2olig (photoprotein aggregation)

Human induced pluripotent stem cell-derived dopaminergic neurons release alpha-synuclein through neuronal activity

Maierdanjiang Nuermaimaiti, Kei-Ichi Ishikawa, Genko Oyama, Risa Nonaka, Takahiro Shiga, Takayuki Jo, Taiji Tsunemi, Ryota Nakamura, Rejko Krüger, Wado Akamatsu, Nobutaka Hattori

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- blue light
- Optogenetics
- Regenerative medicine
- iPS cells
- iPS cell-derived dopamine neurons
- Parkinson's disease
- channelrhodopsin

Engineering Proximity Labeling Techniques to Map Translocating Proteomes and Rna Reporters to Surveil Cell States

Joleen Cheah

Stanford University ProQuest Dissertations & Theses, 2024. 31643292.

- blue light
- Optogenetics
- Light-driven proximity-dependent biotin labeling method
- Proteome
- Protein interactions
- LOV-Turbo

Optogenetic tools for inducing organelle membrane rupture

Yuto Nagashima, Tomoya Eguchi, Ikuko Koyama-Honda, Noboru Mizushima

BioRxyv 2024 Aug doi: https://doi.org/10.1101/2024.08.13.607738

- blue light
- Optogenetics
- Light Organelle Destruction
- LOV2-BAX
- Autophagy
- Apoptosis

Detecting material state changes in the nucleolus by label-free digital holographic microscopy

Christiane Zorbas, Aynur Soenmez, Jean Léger, Christophe De Vleeschouwer, Denis Lj Lafontaine

EMBO Rep. 2024 Apr 23. doi: 10.1038/s44319-024-00134-5

- blue light
- Optogenetics
- nucleolus
- Digital Holographic Microscope
- Cry2olig (photoprotein aggregation)

Multicolor optogenetics for regulating flux ratio of three glycolytic pathways using EL222 and CcaSR in Escherichia coliMulticolor optogenetics for regulating flux ratio of three glycolytic pathways using EL222 and CcaSR in Escherichia coli

Hayato Akagi, Hiroshi Shimizu, Yoshihiro Toya

Biotechnol Bioeng . 2024 Mar;121(3):1016-1025. doi: 10.1002/bit.28628.

- Green light
- Red light
- Optogenetics
- metabolic engineering
- Photometabolic flux control
- E. coli
- Glycolysis regulation

Dynamic mapping of proteome trafficking within and between living cells by TransitID

Wei Qin Xu, Joleen S. Cheah, Charles Xu, James Messing, Brian D. Freibaum, Steven Boeynaems, J. Paul Taylor, Namrata D. Udeshi, Steven A. Carr, Alice Y. Ting

Cell 2023 June, DOI: https://doi.org/10.1016/j.cell.2023.05.044

- blue light
- Optogenetics
- Light-driven proximity-dependent biotin labeling method
- Proteome
- Protein interactions
- LOV-Turbo

A modular toolbox for the optogenetics deactivation of transcription

Philipp Muench, Matteo Fiumara, Nicholas Southern, Davide Coda, Sabine Aschenbrenner, Bruno Correia, Johannes Gräff, Dominik Niopek, Jan Mathony

bioRxiv 2023 Nov doi: https://doi.org/10.1101/2023.11.06.565805

- blue light
- Optogenetics
- Photogenome editing
- Magnets System
- CRISPR-Cas9

Lateral preoptic area glutamate neurons relay nociceptive information to the ventral tegmental area

David J. Barker, Shiliang Zhang, Huiling Wang, David J. Estrin, Jorge Miranda-Barrientos, Bing Liu, Rucha J. Kulkarni, Junia Lara de Deus, and Marisela Morales

Cell Reports. 2023 Aug. DOI:https://doi.org/10.1016/j.celrep.2023.113029

- blue light
- Optogenetics
- Pain assessment
- in-vivo

RNA G-quadruplexes forming scaffolds for α-synuclein aggregation lead to progressive neurodegeneration

Kazuya Matsuo, Sefan Asamitsu, Kohei Maeda, Kosuke Kawakubo, Ginji Komiya, Kenta Kudo, Yusuke Sakai, Karin Hori, Susumu Ikenoshita, Shingo Usuki, Shiori Funahashi, Yasushi Kawata, Tomohiro Mizobata, Norifumi Shioda, Yasushi Yabuki

bioRxyv. July 12, 2023.doi: https://doi.org/10.1101/2023.07.10.548322

- blue light
- Optogenetics
- Parkinson's disease
- Cry2olig (photoprotein aggregation)

Engineered allostery in light-regulated LOV-Turbo enables precise spatiotemporal control of proximity labeling in living cells

Song-Yi Lee, Joleen S. Cheah, Boxuan Zhao, Charles Xu, Heegwang Roh, Christina K. Kim, Kelvin F. Cho, Namrata D. Udeshi, Steven A. Carr & Alice Y. Ting

Nat Methods (2023). https://doi.org/10.1038/s41592-023-01880-5

- blue light
- Optogenetics
- Light-driven proximity-dependent biotin labeling method
- Proteome
- Protein interactions
- LOV-Turbo

Engineered allostery in light-regulated LOV-Turbo enables precise spatiotemporal control of proximity labeling in living cells

Song-Yi Lee, Joleen S. Cheah, Boxuan Zhao, Charles Xu, Heegwang Roh, Christina K. Kim, Kelvin F. Cho, Namrata D. Udeshi, Steven A. Carr, Alice Y. Ting

bioRxiv 2023 Mar, doi: https://doi.org/10.1101/2023.03.09.531939

- blue light
- Optogenetics
- Light-driven proximity-dependent biotin labeling method
- Proteome
- Protein interactions

- LOV-Turbo

Dynamic mapping of proteome trafficking within and between living cells by TransitID

Wei Qin Xu, Joleen S. Cheah, Charles Xu, James Messing, Brian D. Freibaum, Steven Boeynaems, J. Paul Taylor, Namrata D. Udeshi, Steven A. Carr, Alice Y. Ting

bioRxiv 2023 Feb, doi: https://doi.org/10.1101/2023.02.07.527548

- blue light
- Optogenetics
- Light-driven proximity-dependent biotin labeling method
- Proteome
- Protein interactions
- LOV-Turbo

Comparative and Temporal Characterization of LPS and Blue-Light-Induced TLR4 Signal Transduction and Gene Expression in Optogenetically Manipulated Endothelial Cells

Anna Stierschneider, Benjamin Neuditschko, Katrin Colleselli, Harald Hundsberger, Franz Herzog, Christoph Wiesner

Cells . 2023 Feb 22;12(5):697. doi: 10.3390/cells12050697.

- blue light
- Optogenetics
- opto-TLR4
- TLR4 receptor signaling
- immunity
- inflammation

Network-driven intracellular cAMP coordinates circadian rhythm in the suprachiasmatic nucleus

Daisuke Ono, Huan Wang, Chi Jung Hung, Hsin-Tzu Wang, Naohiro Kon, Akihiro Yamanaka, Yulong Li, Takashi Sugiyama

Sci Adv . 2023 Jan 4;9(1):eabq7032. doi: 10.1126/sciadv.abq7032. Epub 2023 Jan 4.

- blue light
- Optogenetics
- bPAC
- cAMP
- Cultured brain slices
- Circadian rhythm

Bioluminescent Optogenetics 2.0: Harnessing Bioluminescence to Activate Photosensory Proteins In Vitro and In Vivo

Emmanuel L Crespo, Andreas Bjorefeldt, Mansi Prakash, Ute Hochgeschwender

J Vis Exp . 2021 Aug 4;(174). doi: 10.3791/62850.

- blue light
- Red light

- Optogenetics
- Bioluminescence

Synaptic disruption and CREB-regulated transcription are restored by K + channel blockers in ALS

Alberto Catanese, Sandeep Rajkumar, Daniel Sommer, Dennis Freisem, Alexander Wirth, Amr Aly, David Massa-López, Andrea Olivieri, Federica Torelli, Valentin Ioannidis, Joanna Lipecka, Ida Chiara Guerrera, Daniel Zytnicki, Albert Ludolph, Edor Kabashi, Medhanie A Mulaw, Francesco Roselli, Tobias M Böckers

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- blue light
- yellow light
- Optogenetics
- channelrhodopsin
- ArchT
- ALS

Self-organization of human dorsal-ventral forebrain structures by light induced SHH

Riccardo De Santis, Fred Etoc, Edwin A Rosado-Olivieri, Ali H Brivanlou

Nat Commun . 2021 Nov 19;12(1):6768. doi: 10.1038/s41467-021-26881-w.

- blue light
- Optogenetics
- Photogenome editing
- ES cells
- Differentiation induction
- morphogenesis
- Magnets System
- Sonic Hedgehog

Polycomb condensates can promote epigenetic marks but are not required for sustained chromatin compaction

Jorine M Eeftens, Manya Kapoor, Davide Michieletto, Clifford P Brangwynne

Nat Commun . 2021 Oct 7;12(1):5888. doi: 10.1038/s41467-021-26147-5.

- blue light
- Optogenetics
- Corelet (photo-oligomer formation)

Optical Control of CD8+ T Cell Metabolism and Effector Functions

Andrea M. Amitrano, Brandon J. Berry, Kihong Lim, Kyun-Do Kim, Richard E. Waugh, Andrew P. Wojtovich, Minsoo Kim

Front Immunol . 2021 Jun 3;12:666231. doi: 10.3389/fimmu.2021.666231. eCollection 2021.

- yellow light
- Optogenetics
- Corelet (photo-oligomer formation)

Light-Inducible Spatio-Temporal Control of TLR4 and NF-κB-Gluc Reporter in Human Pancreatic Cell Line

Anna Stierschneider, Petra Grünstäudl, Katrin Colleselli, Josef Atzler, Christian T Klein, Harald Hundsberger, Christoph Wiesner

Int J Mol Sci . 2021 Aug 26;22(17):9232. doi: 10.3390/ijms22179232.

- yellow light
- Optogenetics
- Photoimmunotherapy
- cancer
- Mitochondria
- opto-TLR4
- CD8+T cells

A muscle fatigue-like contractile decline was recapitulated using skeletal myotubes from Duchenne muscular dystrophy patient-derived iPSCs

Tomoya Uchimura, Toshifumi Asano, Takao Nakata, Akitsu Hotta, Hidetoshi Sakurai

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- blue light
- Optogenetics
- Regenerative medicine
- iPS cells
- iPS cell differentiated muscle
- Watch
- Muscle contraction training

The mammalian circadian pacemaker regulates wakefulness via CRF neurons in the paraventricular nucleus of the hypothalamus

Daisuke Ono, Yasutaka Mukai, Chi Jung Hung, Srikanta Chowdhury, Takashi Sugiyama, Akihiro Yamanaka

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- yellow light
- Optogenetics
- Cultured brain slices
- Circadian rhythm
- ChrimsonR

Chromatin mechanics dictates subdiffusion and coarsening dynamics of embedded condensates

Daniel SW Lee, Ned S. Wingreen, Clifford P. Brangwynne

Nature Physics 2021 Jan, DOI: 10.1038/s41567-020-01125-8

- yellow light
- Optogenetics
- Corelet (photo-oligomer formation)

Epigenetic memory as a time integral over prior history of Polycomb phase separation

Jorine M. Eeftens, Manya Kapoor, Clifford P. Brangwynne

bioRxiv 2020 Aug, DOI: 10.1101/2020.08.19.254706

- blue light
- Optogenetics
- Corelet (photo-oligomer formation)

Controlling the material properties and rRNA processing function of the nucleolus using light.

Lian Zhu, Tiffany M. Richardson, Ludivine Wacheul, Ming-Tzo Wei, Marina Feric, Gena Whitney, Denis LJ Lafontaine, Clifford P. Brangwynne

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- blue light
- Optogenetics
- nucleolus
- Cry2olig (photoprotein aggregation)

Repeat-associated non-AUG translation in C9orf72-ALS/FTD is driven by neuronal excitation and stress.

Thomas Westergard, Kevin McAvoy, Katelyn Russell, Xinmei Wen, Yu Pang, Brandie Morris, Piera Pasinelli, Davide Trotti, Aaron Haeusler

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- blue light
- Optogenetics
- channelrhodopsin