

Stanford



William Weis

Bio

ACADEMIC APPOINTMENTS

- Member, Bio-X
- Faculty Fellow, Sarafan ChEM-H
- Member, Stanford Cancer Institute

ADMINISTRATIVE APPOINTMENTS

- Director, Graduate Program in Biophysics, (1999-2008)
- Chair, Department of Photon Science, (2013-2016)
- Chair, Department of Structural Biology, (2014-2022)

HONORS AND AWARDS

- Member, National Academy of Sciences (2019-)

PROFESSIONAL EDUCATION

- A.B., Princeton University , Biochemical Sciences (1981)
- Ph.D., Harvard University , Biochemistry (1987)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our laboratory studies molecular interactions that underlie the establishment and maintenance of cell and tissue structure. Our principal areas of interest are the architecture and dynamics of intercellular adhesion junctions, signaling pathways that govern cell fate determination, and determinants of cell polarity. We also have a long-standing interest in carbohydrate-based cellular recognition and adhesion. We take a strongly reductionist approach to these problems by reconstituting macromolecular assemblies with purified components in order to analyze them using biochemical, biophysical and structural methods. Mechanistic models derived from these studies are tested in cell culture systems.

Intercellular adhesion

Several distinct intercellular junctions connect epithelial cells. Two of these, the adherens junction and the desmosome, contain cadherin cell adhesion molecules. The extracellular regions of these transmembrane proteins mediate intercellular binding, while their cytoplasmic domains are linked to the actin- (adherens junction) or intermediate filament- (desmosome) based cytoskeletons. In this way the cytoskeletons of cells comprising a tissue are linked, imparting particular morphologies and

mechanical strength to the tissue. The dynamics of these complex assemblies underlie changes in cell and tissue architecture that occur during development and in many cancers. Our goal is to understand the architecture and dynamics of these junctions at a molecular level. A major current focus is in understanding how mechanical force regulates these assemblies by altering molecular conformation, how different junctional components alter force responsiveness, and different intercellular junctions communicate. We are also studying the interplay between cell adhesion and the development and maintenance of apical-basal polarity. Finally, we are examining how cell-cell junctional proteins have changed during metazoan evolution as part of the development of more complex tissue architectures.

Wnt signaling

The Wnt signaling pathway controls cell fate determination during embryogenesis and in the normal renewal of tissues in the adult. Moreover, dysregulation of the pathway drives progression of many cancers. In the Wnt/beta-catenin pathway, Wnt protein binding to cell surface receptors leads to activation of target genes by beta-catenin. In the absence of a Wnt signal, non-junctional beta-catenin is bound in a multiprotein “destruction complex”, where it is phosphorylated and targeted for degradation by the ubiquitin/proteasome pathway. Binding of a Wnt to cell surface receptors prevents beta-catenin destruction. We are biochemically reconstituting these complexes for mechanistic and structural studies. Our goals are to determine the mechanism of beta-catenin destruction in the absence of a Wnt signal, and how Wnt binding to receptors turns off beta-catenin destruction.

Teaching

COURSES

2023-24

- SEMINAR IN BIOPHYSICS: BIOPHYS 250 (Aut)

2022-23

- Seminar in Biophysics: BIOPHYS 250 (Aut)

2021-22

- Seminar in Biophysics: BIOPHYS 250 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Yousuf Khan

Doctoral Dissertation Advisor (AC)

Andras Sagi, Maiya Yu

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (Phd Program)
- Cancer Biology (Phd Program)
- Molecular and Cellular Physiology (Phd Program)
- Structural Biology (Phd Program)

Publications

PUBLICATIONS

- **Multi-level force-dependent allosteric enhancement of alphaE-catenin binding to F-actin by vinculin.** *Journal of molecular biology*
Bax, N. A., Wang, A., Huang, D. L., Pokutta, S., Weis, W. I., Dunn, A. R.
2023: 167969

- **PI(4,5)P2-stimulated positive feedback drives the recruitment of Dishevelled to Frizzled in Wnt- β -catenin signaling.** *Science signaling*
Mahoney, J. P., Bruguera, E. S., Vasishtha, M., Killingsworth, L. B., Kyaw, S., Weis, W. I.
2022; 15 (748): eabo2820
- **Mechanism of the cadherin-catenin F-actin catch bond interaction.** *eLife*
Wang, A., Dunn, A. R., Weis, W. I.
2022; 11
- **Reconstitution of purified membrane protein dimers in lipid nanodiscs with defined stoichiometry and orientation using a split GFP tether.** *The Journal of biological chemistry*
Bruguera, E. S., Mahoney, J. P., Weis, W. I.
1800: 101628
- **The C-terminal actin-binding domain of talin forms an asymmetric catch bond with F-actin.** *Proceedings of the National Academy of Sciences of the United States of America*
Owen, L. M., Bax, N. A., Weis, W. I., Dunn, A. R.
2022; 119 (10): e2109329119
- **Lattice micropatterning for cryo-electron tomography studies of cell-cell contacts.** *Journal of structural biology*
Engel, L., Vasquez, C. G., Montabana, E. A., Sow, B. M., Walkiewicz, M. P., Weis, W. I., Dunn, A. R.
2021: 107791
- **Distinct intramolecular interactions regulate autoinhibition of vinculin binding in α T-catenin and α E-catenin.** *The Journal of biological chemistry*
Heier, J. A., Pokutta, S., Dale, I. W., Kim, S. K., Hinck, A. P., Weis, W. I., Kwiatkowski, A. V.
2021: 100582
- **Structural analysis of carbohydrate binding by the macrophage mannose receptor CD206.** *The Journal of biological chemistry*
Feinberg, H., Jegouzo, S. A., Lasanajak, Y., Smith, D. F., Drickamer, K., Weis, W. I., Taylor, M. E.
2021: 100368
- **A resolution record for cryoEM.** *Faculty reviews*
Ashmore, J., Carragher, B., Rosenthal, P. B., Weis, W.
1800; 10: 64
- **Author Correction: Structural insights into mu-opioid receptor activation.** *Nature*
Huang, W., Manglik, A., Venkatakrishnan, A. J., Laeremans, T., Feinberg, E. N., Sanborn, A. L., Kato, H. E., Livingston, K. E., Thorsen, T. S., Kling, R. C., Granier, S., Gmeiner, P., Husbands, et al
2020
- **Limited Dishevelled/Axin oligomerization determines efficiency of Wnt/ β -catenin signal transduction.** *eLife*
Kan, W. n., Enos, M. D., Korkmazhan, E. n., Muennich, S. n., Chen, D. H., Gammons, M. V., Vasishtha, M. n., Bienz, M. n., Dunn, A. R., Skiniotis, G. n., Weis, W. I.
2020; 9
- **Structural basis of β E-catenin-F-actin catch bond behavior.** *eLife*
Xu, X. P., Pokutta, S. n., Torres, M. n., Swift, M. F., Hanein, D. n., Volkmann, N. n., Weis, W. I.
2020; 9
- **Extracellular matrix micropatterning technology for whole cell cryogenic electron microscopy studies.** *Journal of micromechanics and microengineering : structures, devices, and systems*
Engel, L., Gaietta, G., Dow, L. P., Swift, M. F., Pardon, G., Volkmann, N., Weis, W. I., Hanein, D., Pruitt, B. L.
2019; 29 (11)
- **Binding partner- and force-promoted changes in α E-catenin conformation probed by native cysteine labeling.** *Scientific reports*
Terekhova, K., Pokutta, S., Kee, Y. S., Li, J., Tajkhorshid, E., Fuller, G., Dunn, A. R., Weis, W. I.
2019; 9 (1): 15375
- **Solving the structure of Lgl2, a difficult blind test of unsupervised structure determination** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Ufimtsev, I. S., Almagor, L., Weis, W. I., Levitt, M.

2019; 116 (22): 10819–23

- **Structural insights into the aPKC regulatory switch mechanism of the human cell polarity protein lethal giant larvae 2** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Almagor, L., Ufimtsev, I. S., Ayer, A., Li, J., Weis, W. I.
2019; 116 (22): 10804–12
- **Structural insights into the activation of metabotropic glutamate receptors (vol 566, pg 79, 2019)** *NATURE*
Koehl, A., Hu, H., Feng, D., Sun, B., Zhang, Y., Robertson, M. J., Chu, M., Kobilka, T., Laeremans, T., Steyaert, J., Tarrasch, J., Dutta, S., Fonseca, et al
2019; 567 (7747): E10
- **Author Correction: Structural insights into the activation of metabotropic glutamate receptors.** *Nature*
Koehl, A., Hu, H., Feng, D., Sun, B., Zhang, Y., Robertson, M. J., Chu, M., Kobilka, T. S., Laeremans, T., Steyaert, J., Tarrasch, J., Dutta, S., Fonseca, et al
2019
- **Resolving indexing ambiguities in X-ray free-electron laser diffraction patterns.** *Acta crystallographica. Section D, Structural biology*
Uervirojnangkoorn, M., Lyubimov, A. Y., Zhou, Q., Weis, W. I., Brunger, A. T.
2019; 75 (Pt 2): 234–41
- **Structure of a Signaling Cannabinoid Receptor 1-G Protein Complex** *CELL*
Kumar, K., Shalev-Benami, M., Robertson, M. J., Hu, H., Banister, S. D., Hollingsworth, S. A., Latorraca, N. R., Kato, H. E., Hilger, D., Maeda, S., Weis, W. I., Farrens, D. L., Dror, et al
2019; 176 (3): 448+
- **CD23 is a glycan-binding receptor in some mammalian species.** *The Journal of biological chemistry*
Jégouzo, S. A., Feinberg, H. n., Morrison, A. n., Holder, A. n., May, A. n., Huang, Z. n., Jiang, L. n., Lasanajak, Y. n., Smith, D. F., Werling, D. n., Drickamer, K. n., Weis, W. I., Taylor, et al
2019
- **Processing simultaneously collected MAD data from two closely spaced (90 eV) wavelengths measured at an X-ray free-electron laser**
Mendez, D., Weis, W., Brunger, A., Wakatsuki, S., Sauter, N.
INT UNION CRYSTALLOGRAPHY.2019: A244
- **Publisher Correction: Structural insights into binding specificity, efficacy and bias of a beta2AR partial agonist.** *Nature chemical biology*
Masureel, M., Zou, Y., Picard, L., van der Westhuizen, E., Mahoney, J. P., Rodrigues, J. P., Mildorf, T. J., Dror, R. O., Shaw, D. E., Bouvier, M., Pardon, E., Steyaert, J., Sunahara, et al
2018
- **Structural insights into binding specificity, efficacy and bias of a beta2AR partial agonist.** *Nature chemical biology*
Masureel, M., Zou, Y., Picard, L., van der Westhuizen, E., Mahoney, J. P., Rodrigues, J. P., Mildorf, T. J., Dror, R. O., Shaw, D. E., Bouvier, M., Pardon, E., Steyaert, J., Sunahara, et al
2018; 14 (11): 1059–66
- **The Molecular Basis of G Protein-Coupled Receptor Activation.** *Annual review of biochemistry*
Weis, W. I., Kobilka, B. K.
2018; 87: 897–919
- **Structure of the μ -opioid receptor-Gi protein complex.** *Nature*
Koehl, A., Hu, H., Maeda, S., Zhang, Y., Qu, Q., Paggi, J. M., Latorraca, N. R., Hilger, D., Dawson, R., Matile, H., Schertler, G. F., Granier, S., Weis, et al
2018
- **Analysis of a vinculin homolog in a sponge (phylum Porifera) reveals that vertebrate-like cell adhesions emerged early in animal evolution.** *The Journal of biological chemistry*
Miller, P. W., Pokutta, S., Mitchell, J. M., Chodaparambil, J. V., Clarke, D. N., Nelson, W., Weis, W. I., Nichols, S. A.
2018
- **Epithelial barrier dysfunction in desmoglein-1 deficiency.** *The Journal of allergy and clinical immunology*
Polivka, L. n., Hadj-Rabia, S. n., Bal, E. n., Leclerc-Mercier, S. n., Madrange, M. n., Hamel, Y. n., Bonnet, D. n., Mallet, S. n., Lepidi, H. n., Ovaert, C. n., Barbet, P. n., Dupont, C. n., Neven, et al
2018

- **Vinculin forms a directionally asymmetric catch bond with F-actin** *SCIENCE*
Huang, D. L., Bax, N. A., Buckley, C. D., Weis, W. I., Dunn, A. R.
2017; 357 (6352): 703–6
- **Mechanism of pathogen recognition by human dectin-2.** *The Journal of biological chemistry*
Feinberg, H., Jégouzo, S. A., Rex, M. J., Drickamer, K., Weis, W. I., Taylor, M. E.
2017; 292 (32): 13402-13414
- **Structural and functional characterization of *Caenorhabditis elegans* alpha-catenin reveals constitutive binding to beta-catenin and F-actin** *JOURNAL OF BIOLOGICAL CHEMISTRY*
Kang, H., Bang, I., Jin, K. S., Lee, B., Lee, J., Shao, X., Heier, J. A., Kwiatkowski, A. V., Nelson, W. J., Hardin, J., Weis, W. I., Choi, H.
2017; 292 (17): 7077-7086
- **a-catenin reveals constitutive binding to β -catenin and F-actin.** *journal of biological chemistry*
Kang, H., Bang, I., Jin, K. S., Lee, B., Lee, J., Shao, X., Heier, J. A., Kwiatkowski, A. V., Nelson, W. J., Hardin, J., Weis, W. I., Choi, H.
2017; 292 (17): 7077-7086
- **Cell-cell adhesion in metazoans relies on evolutionarily conserved features of the #-catenin-#-catenin-binding interface.** *The Journal of biological chemistry*
Shao, X. n., Kang, H. n., Loveless, T. n., Lee, G. R., Seok, C. n., Weis, W. I., Choi, H. J., Hardin, J. n.
2017; 292 (40): 16477–90
- **Mechanism of intracellular allosteric β 2AR antagonist revealed by X-ray crystal structure.** *Nature*
Liu, X. n., Ahn, S. n., Kahsai, A. W., Meng, K. C., Latorraca, N. R., Pani, B. n., Venkatakrisnan, A. J., Masoudi, A. n., Weis, W. I., Dror, R. O., Chen, X. n., Lefkowitz, R. J., Kobilka, et al
2017; 548 (7668): 480–84
- **Structure of photosystem II and substrate binding at room temperature** *NATURE*
Young, I. D., Ibrahim, M., Chatterjee, R., Gul, S., Fuller, F. D., Koroidov, S., Brewster, A. S., Tran, R., Alonso-Mori, R., Kroll, T., Michels-Clark, T., Laksmono, H., Sierra, et al
2016; 540 (7633): 453-?
- **Advances in X-ray free electron laser (XFEL) diffraction data processing applied to the crystal structure of the synaptotagmin-1 / SNARE complex.** *eLife*
Lyubimov, A. Y., Uervirojnangkoorn, M., Zeldin, O. B., Zhou, Q., Zhao, M., Brewster, A. S., Michels-Clark, T., Holton, J. M., Sauter, N. K., Weis, W. I., Brunger, A. T.
2016; 5
- **Binding Sites for Acylated Trehalose Analogs of Glycolipid Ligands on an Extended Carbohydrate Recognition Domain of the Macrophage Receptor Mincle** *JOURNAL OF BIOLOGICAL CHEMISTRY*
Feinberg, H., Rambaruth, N. D., Jegouzo, S. A., Jacobsen, K. M., Djurhuus, R., Poulsen, T. B., Weis, W. I., Taylor, M. E., Drickamer, K.
2016; 291 (40): 21222-?
- **Characterization of the Cadherin-Catenin Complex of the Sea Anemone *Nematostella vectensis* and Implications for the Evolution of Metazoan Cell-Cell Adhesion** *MOLECULAR BIOLOGY AND EVOLUTION*
Clarke, D. N., Miller, P. W., Lowe, C. J., Weis, W. I., Nelson, W. J.
2016; 33 (8): 2016-2029
- **Allosteric nanobodies reveal the dynamic range and diverse mechanisms of G-protein-coupled receptor activation** *NATURE*
Staus, D. P., Strachan, R. T., Manglik, A., Pani, B., Kahsai, A. W., Kim, T. H., Wingler, L. M., Ahn, S., Chatterjee, A., Masoudi, A., Kruse, A. C., Pardon, E., Steyaert, et al
2016; 535 (7612): 448-?
- **25 Years of Tension over Actin Binding to the Cadherin Cell Adhesion Complex: The Devil is in the Details.** *Trends in cell biology*
Nelson, W. J., Weis, W. I.
2016; 26 (7): 471-473
- **IOTA: integration optimization, triage and analysis tool for the processing of XFEL diffraction images** *JOURNAL OF APPLIED CRYSTALLOGRAPHY*
Lyubimov, A. Y., Uervirojnangkoorn, M., Zeldin, O. B., Brewster, A. S., Murray, T. D., Sauter, N. K., Berger, J. M., Weis, W. I., Brunger, A. T.
2016; 49: 1057-1064
- **Crystal structures of the M1 and M4 muscarinic acetylcholine receptors.** *Nature*

- Thal, D. M., Sun, B., Feng, D., Nawaratne, V., Leach, K., Felder, C. C., Bures, M. G., Evans, D. A., Weis, W. I., Bachhawat, P., Kobilka, T. S., Sexton, P. M., Kobilka, et al
2016; 531 (7594): 335-340
- **Purification, crystallization and initial crystallographic analysis of the alpha-catenin homologue HMP-1 from *Caenorhabditis elegans*** *ACTA CRYSTALLOGRAPHICA SECTION F-STRUCTURAL BIOLOGY COMMUNICATIONS*
Kang, H., Bang, I., Weis, W. I., Choi, H.
2016; 72: 234-239
 - **A Small-Molecule Antagonist of the beta-Catenin/TCF4 Interaction Blocks the Self-Renewal of Cancer Stem Cells and Suppresses Tumorigenesis** *CANCER RESEARCH*
Fang, L., Zhu, Q., Neuenschwander, M., Specker, E., Wulf-Goldenberg, A., Weis, W. I., von Kries, J. P., Birchmeier, W.
2016; 76 (4): 891-901
 - **Structure of the Intermediate Filament-Binding Region of Desmoplakin** *PLOS ONE*
Kang, H., Weiss, T. M., Bang, I., Weis, W. I., Choi, H.
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 - **High-density grids for efficient data collection from multiple crystals.** *Acta crystallographica. Section D, Structural biology*
Baxter, E. L., Aguila, L., Alonso-Mori, R., Barnes, C. O., Bonagura, C. A., Brehmer, W., Brunger, A. T., Calero, G., Caradoc-Davies, T. T., Chatterjee, R., DeGrado, W. F., Fraser, J. S., Ibrahim, et al
2016; 72: 2-11
 - **Purification and Structural Analysis of Desmoplakin.** *Methods in enzymology*
Choi, H. J., Weis, W. I.
2016; 569: 197-213
 - **Reevaluating alpha E-catenin monomer and homodimer functions by characterizing E-cadherin/alpha E-catenin chimeras** *JOURNAL OF CELL BIOLOGY*
Bianchini, J. M., Kitt, K. N., Gloerich, M., Pokutta, S., Weis, W. I., Nelson, W. J.
2015; 210 (7): 1065-1074
 - **Reevaluating #E-catenin monomer and homodimer functions by characterizing E-cadherin/#E-catenin chimeras.** *The Journal of cell biology*
Bianchini, J. M., Kitt, K. N., Gloerich, M., Pokutta, S., Weis, W. I., Nelson, W. J.
2015; 210 (7): 1065-74
 - **Architecture of the synaptotagmin-SNARE machinery for neuronal exocytosis.** *Nature*
Zhou, Q., Lai, Y., Bacaj, T., Zhao, M., Lyubimov, A. Y., Uevirojngankoom, M., Zeldin, O. B., Brewster, A. S., Sauter, N. K., Cohen, A. E., Soltis, S. M., Alonso-Mori, R., Chollet, et al
2015; 525 (7567): 62-67
 - **Structural insights into μ -opioid receptor activation.** *Nature*
Huang, W., Manglik, A., Venkatakrishnan, A. J., Laeremans, T., Feinberg, E. N., Sanborn, A. L., Kato, H. E., Livingston, K. E., Thorsen, T. S., Kling, R. C., Granier, S., Gmeiner, P., Husbands, et al
2015; 524 (7565): 315-321
 - **A Novel Mechanism for Binding of Galactose-terminated Glycans by the C-type Carbohydrate Recognition Domain in Blood Dendritic Cell Antigen 2.** *journal of biological chemistry*
Jégouzo, S. A., Feinberg, H., Dungarwalla, T., Drickamer, K., Weis, W. I., Taylor, M. E.
2015; 290 (27): 16759-16771
 - **The linac coherent light source single particle imaging road map** *STRUCTURAL DYNAMICS*
Aquila, A., Barty, A., Bostedt, C., Boutet, S., Carini, G., Deponte, D., DRELL, P., Doniach, S., Downing, K. H., Earnest, T., Elmlund, H., Elser, V., Guehr, et al
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 - **Munc18a Does Not Alter Fusion Rates Mediated by Neuronal SNAREs, Synaptotagmin, and Complexin.** *journal of biological chemistry*
Zhang, Y., Diao, J., Colbert, K. N., Lai, Y., Pfuetzner, R. A., Padolina, M. S., Vivona, S., Ressler, S., Cipriano, D. J., Choi, U. B., Shah, N., Weis, W. I., Brunger, et al
2015; 290 (16): 10518-10534
 - **A Conserved Phosphorylation Switch Controls the Interaction between Cadherin and beta-Catenin In Vitro and In Vivo** *DEVELOPMENTAL CELL*
Choi, H., Loveless, T., Lynch, A. M., Bang, I., Hardin, J., Weis, W. I.

2015; 33 (1): 82-93

- **Enabling X-ray Free Electron Laser Crystallography for Challenging Biological Systems from a Limited Number of Crystals** *ELIFE*
Uervirojnangkoon, M., Zeldin, O. B., Lyubimov, A. Y., Hattne, J., Brewster, A. S., Sauter, N. K., Brunger, A. T., Weis, W. I.
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- **Data Exploration Toolkit for serial diffraction experiments** *ACTA CRYSTALLOGRAPHICA SECTION D-BIOLOGICAL CRYSTALLOGRAPHY*
Zeldin, O. B., Brewster, A. S., Hattne, J., Uervirojnangkoon, M., Lyubimov, A. Y., Zhou, Q., Zhao, M., Weis, W. I., Sauter, N. K., Brunger, A. T.
2015; 71: 352-356
- **Three aSNAP and 10 ATP Molecules Are Used in SNARE Complex Disassembly by N-ethylmaleimide-sensitive Factor (NSF).** *journal of biological chemistry*
Shah, N., Colbert, K. N., Enos, M. D., Herschlag, D., Weis, W. I.
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- **Studying epithelial morphogenesis in Dictyostelium.** *Methods in molecular biology (Clifton, N.J.)*
Dickinson, D. J., Nelson, W. J., Weis, W. I.
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- **Mapping the conformational landscape of a dynamic enzyme by multitemperature and XFEL crystallography.** *eLife*
Keedy, D. A., Kenner, L. R., Warkentin, M., Woldeyes, R. A., Hopkins, J. B., Thompson, M. C., Brewster, A. S., Van Benschoten, A. H., Baxter, E. L., Uervirojnangkoon, M., McPhillips, S. E., Song, J., Alonso-Mori, et al
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2014; 22 (11): 1657-1664
- **Mechano-Transduction: From Molecules to Tissues** *PLOS BIOLOGY*
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Pokutta, S., Choi, H., Ahlsen, G., Hansen, S. D., Weis, W. I.
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- **Structural and Thermodynamic Characterization of Cadherin center dot beta-Catenin center dot alpha-Catenin Complex Formation** *JOURNAL OF BIOLOGICAL CHEMISTRY*
Pokutta, S., Choi, H., Ahlsen, G., Hansen, S. D., Weis, W. I.
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- **Molecular functions of the TLE tetramerization domain in Wnt target gene repression.** *EMBO journal*
Chodaparambil, J. V., Pate, K. T., Hepler, M. R., Tsai, B. P., Muthurajan, U. M., Luger, K., Waterman, M. L., Weis, W. I.
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- **Drugging a Stem Cell Compartment Using Wnt3a Protein as a Therapeutic** *PLOS ONE*
Dhamdhere, G. R., Fang, M. Y., Jiang, J., Lee, K., Cheng, D., Olveda, R. C., Liu, B., Mulligan, K. A., Carlson, J. C., Ransom, R. C., Weis, W. I., Helms, J. A.
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- **Structural basis of GSK-3 inhibition by N-terminal phosphorylation and by the Wnt receptor LRP6.** *eLife*
Stamos, J. L., Chu, M. L., Enos, M. D., Shah, N., Weis, W. I.

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Hansen, S. D., Kwiatkowski, A. V., Ouyang, C., Liu, H., Pokutta, S., Watkins, S. C., Volkman, N., Hanein, D., Weis, W. I., Mullins, R. D., Nelson, W. J.
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