

Critical Thinking in Systems Biology

Fall 2019

Location: Bio Sci III, CCBS Conference Room

Time: Mondays, 3:00-5:20 (or as indicated)

1. MONDAY Sept 30 Models and model exploration

Arthur Lander

Tyson JJ (1991) Modeling the cell division cycle: cdc2 and cyclin interactions. Proceedings of the National Academy of Sciences of the United States of America 88(16): 7328-7332.

Meir E, von Dassow G, Munro E, Odell GM (2002) Robustness, flexibility, and the role of lateral inhibition in the neurogenic network. Curr Biol 12(10): 778-786.

2. MONDAY Oct 7 Non-linear dynamics and sensitivity

Eric Mjolsness and Arthur Lander

Goldbeter A, Koshland DE, Jr. (1981) An amplified sensitivity arising from covalent modification in biological systems. Proceedings of the National Academy of Sciences of the United States of America 78(11): 6840-6844.

Paulsson J, Berg OG, Ehrenberg M (2000) Stochastic focusing: fluctuation-enhanced sensitivity of intracellular regulation. Proceedings of the National Academy of Sciences of the United States of America 97(13): 7148-7153.

3. MONDAY Oct 14 Robustness and control

Tim Downing and Arthur Lander

Barkai N, Leibler S (1997) Robustness in simple biochemical networks. Nature 387(6636): 913-917.

Muzzey D, Gómez-Uribe CA, Mettetal JT, van Oudenaarden A (2009) A Systems-Level Analysis of Perfect Adaptation in Yeast Osmoregulation. Cell 138: 160-171.

4. MONDAY Oct 21 Network inference

Qing Nie and Arthur Lander

Gardner TS, di Bernardo D, Lorenz D, Collins JJ (2003) Inferring genetic networks and identifying compound mode of action via expression profiling. Science 301(5629): 102-105.

Stuart JM, Segal E, Koller D, Kim SK. A gene-coexpression network for global discovery of conserved genetic modules. Science. 2003 Oct 10;302(5643):249-55. Epub 2003 Aug 21. PubMed PMID: 12934013.

5. MONDAY Oct 28 Synthetic biology

Chang Liu and Arthur Lander

Gardner TS, Cantor CR, Collins JJ (2000) Construction of a genetic toggle switch in Escherichia coli. Nature 403: 339-342.

Kalhor R, Mali P, Church GM. Rapidly evolving homing CRISPR barcodes. Nat Methods. 2017 Feb;14(2):195-200. doi: 10.1038/nmeth.4108. Epub 2016 Dec 5. PubMed PMID: 27918539; PubMed Central PMCID: PMC5322472.

6. MONDAY Nov 4 Genomics and Bioinformatics

Devon Lawson and Xiaohui Xie

Tavazoie S, Hughes JD, Campbell MJ, Cho RJ, Church GM. Systematic determination of genetic network architecture. *Nat Genet.* 1999 Jul;22(3):281-5. PubMed PMID: 10391217.

La Manno G, Soldatov R, Zeisel A, Braun E, Hochgerner H, Petukhov V, Lidschreiber K, Kastrioti ME, Lönnerberg P, Furlan A, Fan J, Borm LE, Liu Z, van Bruggen D, Guo J, He X, Barker R, Sundström E, Castelo-Branco G, Cramer P, Adameyko I, Linnarsson S, Kharchenko PV. RNA velocity of single cells. *Nature* 2018 Aug;560(7719):494-498. doi: 10.1038/s41586-018-0414-6. Epub 2018 Aug 8. PubMed PMID: 30089906; PubMed Central PMCID: PMC6130801.

7. MONDAY Nov 18 Noise and stochastic behavior

Elizabeth Read and Arthur Lander

Hasty J, Pradines J, Dolnik M, Collins JJ (2000) Noise-based switches and amplifiers for gene expression. *Proceedings of the National Academy of Sciences of the United States of America* 97(5): 2075-2080.

Neuert G, Munsky B, Tan RZ, Teytelman L, Khammash M, van Oudenaarden A. Systematic identification of signal-activated stochastic gene regulation. *Science.* 2013 Feb 1;339(6119):584-7. doi: 10.1126/science.1231456. PubMed PMID: 23372015; PubMed Central PMCID: PMC3751578.

8. MONDAY Nov. 25 The microbiome

Katrine Whiteson and Arthur Lander

Modi SR, Lee HH, Spina CS, Collins JJ. Antibiotic treatment expands the resistance reservoir and ecological network of the phage metagenome. *Nature.* 2013 Jul 11;499(7457):219-22. doi: 10.1038/nature12212. Epub 2013 Jun 9. PubMed PMID: 23748443; PubMed Central PMCID: PMC3710538.

Yelin, I., Flett, K.B., Merakou, C. *et al.* Genomic and epidemiological evidence of bacterial transmission from probiotic capsule to blood in ICU patients. *Nat Med* 25, 1728–1732 (2019) doi:10.1038/s41591-019-0626-9

9. MONDAY Dec 2 Gene Regulation

Zeba Wunderlich and Arthur Lander

Sun F, Chronis C, Kronenberg M, Chen XF, Su T, Lay FD, Plath K, Kurdistani SK, Carey MF. Promoter-Enhancer Communication Occurs Primarily within Insulated Neighborhoods. *Mol Cell.* 2019 Jan 17;73(2):250-263.e5. doi:10.1016/j.molcel.2018.10.039. Epub 2018 Dec 6. PubMed PMID: 30527662; PubMed Central PMCID: PMC6338517.

Williamson I, Kane L, Devenney PS, Flyamer IM, Anderson E, Kilanowski F, Hill RE, Bickmore WA, Lettice LA. Developmentally regulated Shh expression is robust to TAD perturbations. *Development.* 2019 Sep 30;146(19). pii: dev179523. doi: 10.1242/dev.179523. PubMed PMID: 31511252.