

## The Future of Thermodynamics of Computation

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November 10-12, 2021

### Background papers:

#### *Neuroscience*

- [Bassett, Danielle S., Daniel L. Greenfield, Andreas Meyer-Lindenberg, Daniel R. Weinberger, Simon W. Moore, and Edward T. Bullmore. "Efficient physical embedding of topologically complex information processing networks in brains and computer circuits."](#)
- [Levy, William B., and Victoria G. Calvert. "Communication consumes 35 times more energy than computation in the human cortex, but both costs are needed to predict synapse number."](#)
- [Balasubramanian, Vijay. "Heterogeneity and efficiency in the brain."](#)

#### *Stochastic thermodynamics:*

- [Van den Broeck, Christian, and Massimiliano Esposito. "Ensemble and trajectory thermodynamics: A brief introduction."](#)
- [Horowitz, Jordan M., and Todd R. Gingrich. "Thermodynamic uncertainty relations constrain non-equilibrium fluctuations."](#)
- [Wolpert, David H. "The stochastic thermodynamics of computation."](#)

#### *Computer Engineering:*

- [Zhang, Wenqiang, Bin Gao, Jianshi Tang, Peng Yao, Shimeng Yu, Meng-Fan Chang, Hoi-Jun Yoo, He Qian, and Huaqiang Wu. "Neuro-inspired computing chips."](#)
- [Melanie Moses, George Bezerra, Benjamin Edwards, James Brown, and Stephanie Forrest. "Energy and time determine scaling in biological and computer designs."](#)

***Please also see a large database of relevant papers, including those suggested above, at***

<https://santafe.edu/pages/dynamics-equilibrium-brain-information-processing-?uid=NjA4&pw=IDIKXLaC2>

### Background videos:

#### *Neuroscience:*

- Dani Bassett's introductory lecture to her network neuroscience course: <https://www.youtube.com/watch?v=QYODBS5BIEg>
- Christof Koch's lecture on information processing in the brain: <https://www.youtube.com/watch?v=Bm40BSZJRck>

- Olaf Sporns on mapping and modeling complex brain networks: <https://www.youtube.com/watch?v=Fsr6FIU0XCc>
- Public lecture by Robin Hiesinger on the self-assembling brain: [https://youtu.be/Xv\\_JJ2ZuDJM](https://youtu.be/Xv_JJ2ZuDJM)
- Public lecture by Mark Humphries on how the brain uses spike to communicate: <https://www.youtube.com/watch?v=ZACJnu0XWZs>

*Stochastic thermodynamics:*

- Massimiliano Esposito's introductory talk: <https://www.youtube.com/watch?v=FDaM-MOG9IM&list=WL&index=18&t=2538s>
- Christian van den Broek's introductory talk: <https://www.youtube.com/watch?v=6pfqVEWCUPI&list=WL&index=20&t=2459s>
- Udo Seifert's talk, focused on biophysics and biochemistry: <https://www.youtube.com/watch?v=WYLi8SXyuTc&list=WL&index=21&t=863s>
- Edgar Roldan's full course: <https://www.youtube.com/watch?v=CEqRezI6OfM&list=WL&index=19&t=587s>