1135-92-2073 **Trey Ideker*** (trey.ideker@gmail.com). *Using Deep Learning to Model the Hierarchical Structure and Function of a Cell.*

Although artificial neural networks capture a variety of human functions, their internal structures are hard to interpret. In the life sciences, extensive knowledge of cell biology provides an opportunity to design 'visible' neural networks (VNNs) which couple the model's inner workings to those of real systems. Here we develop DeepCell, a VNN embedded in the hierarchical structure of 2526 subsystems comprising a eukaryotic cell (http://deep-cell.ucsd.edu/).

Trained on 12 million genotypes, DeepCell simulates cellular growth nearly as accurately as laboratory observations. During simulation, genotypes induce patterns of subsystem activities, enabling in-silico investigations of the molecular mechanisms underlying each genotype-phenotype association. These mechanisms can be validated and many are unexpected; some are governed by Boolean logic. Cumulatively, 80% of the importance for growth prediction is captured by 484 subsystems (21%), reflecting the emergence of a complex phenotype. DeepCell provides a foundation for decoding the genetics of disease, drug resistance, and synthetic life. (Received September 25, 2017)