BRAINS IN SILICON
STANFORD UNIVERSITY

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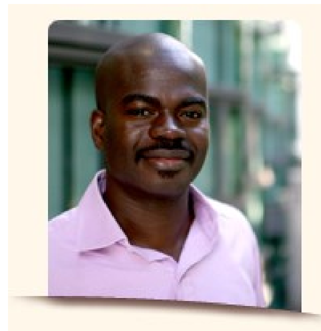
Principal Investigator

Educational Background



- BS, Electrical and Computer Engineering, *Johns Hopkins University*, 1989
- MSE, Electrical and Computer Engineering, *Johns Hopkins University*, 1989
- PhD, Computation and Neural Systems, *California Institute of Technology*, 1997

Honors and Awards

- Skirkanich Junior Chair, *University of Pennsylvania*, 1997
- Fellowship in Science and Engineering, *Packard Foundation*, 1999
- CAREER Award, *National Science Foundation*, 2001
- Young Investigator Award, *Office of Naval Research*, 2002
- Director's Pioneer Award, *National Institutes of Health*, 2006
- Director's Transformative Research Award, *National Institutes of Health*, 2011

Research Goals

Being a scientist at heart, I want to understand how cognition arises from neuronal properties. Being an engineer by training, I am using silicon integrated circuits to emulate the way neurons compute, linking the seemingly disparate fields of electronics and computer science with neurobiology and medicine. My group is at the vanguard of a profound shift in computing, away from the sequential, step-by-step Von Neumann machine towards a parallel, interconnected architecture more like the brain's.

My group's contributions to the field of neuromorphic engineering include a **silicon retina** that could be used to give the blind sight, a **self-organizing chip** that emulates the way the developing brain wires itself up, and a mixed analog-digital hardware platform (**Neurogrid**) that simulates a million cortical neurons in real-time—rivaling a supercomputer while consuming only a few watts. Our work is widely recognized, with over **eighty publications**, including a **cover story** in the May 2005 issue of *Scientific American*. My 2007 TED talk, "**A computer that works like the brain**", has been viewed half-a-million times.

My current research is driven by two major quests: First, finding methods to combat increasing heterogeneity (a.k.a., mismatch) and stochasticity (a.k.a., noise) as transistors scale down to a few nanometers. And second, exploiting these methods to develop novel computing paradigms that scale beyond the limits of the current paradigm (purely digital hardware and strictly deterministic programs). Intriguingly, the brain overcomes stochastic operation and heterogeneous expression of its nanoscale ion-channels by combining analog computation with digital communication.