

## COLUMBIA | Zuckerman Institute

## Larry F. Abbott, PhD

William Bloor Professor of Theoretical Neuroscience and Professor of Physiology and Cellular Biophysics (in Biological Sciences); Principal Investigator at Columbia's Zuckerman Institute; Codirector of Columbia's Kavli Institute for Brain Science

## Computation: Mathematical Models of the Brain Created

Among Zuckerman Institute researchers, it's called, simply, the Theory Center: a space lined with whiteboards all crowded with equations and diagrams. There, computational neuroscientists use math and physics to sharpen the questions we ask about the brain and the answers we find.

"Neuroscientists usually have a model in their heads of what they study, often constructed of words," said <u>Larry Abbott</u>. "We can augment that with a precise mathematical model."

Dr. Abbott builds models to test predictions about how neurons guide behavior. He also uses these models to make new predictions, tested at the lab bench by the experimenters he works closely with. As with other computationalists in the center, collaboration is at the heart of his work. His name appears on dozens of research papers from different labs at the Zuckerman Institute and elsewhere.

When Nobel laureate <u>Richard Axel</u> wanted to better understand how a fly smells, for instance, he called Dr. Abbott, whose math helped reveal how these animals use olfaction to recognize and react to their environment. Neuroscientist <u>Nate Sawtell</u> realized that mathematical models could help him better understand how the brain filters out stimuli it wants to ignore, a topic with potential implications for mental health. Dr. Abbott has worked on projects ranging from how neurons move the body to how they degenerate. In these **partnerships** he can offer fresh perspectives on the brain, often uncovering inconsistencies or gaps in our knowledge.

"What drives me is the beauty of the biology we're studying," Dr. Abbott said. "And the beauty of the mathematics underlying that biology."

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