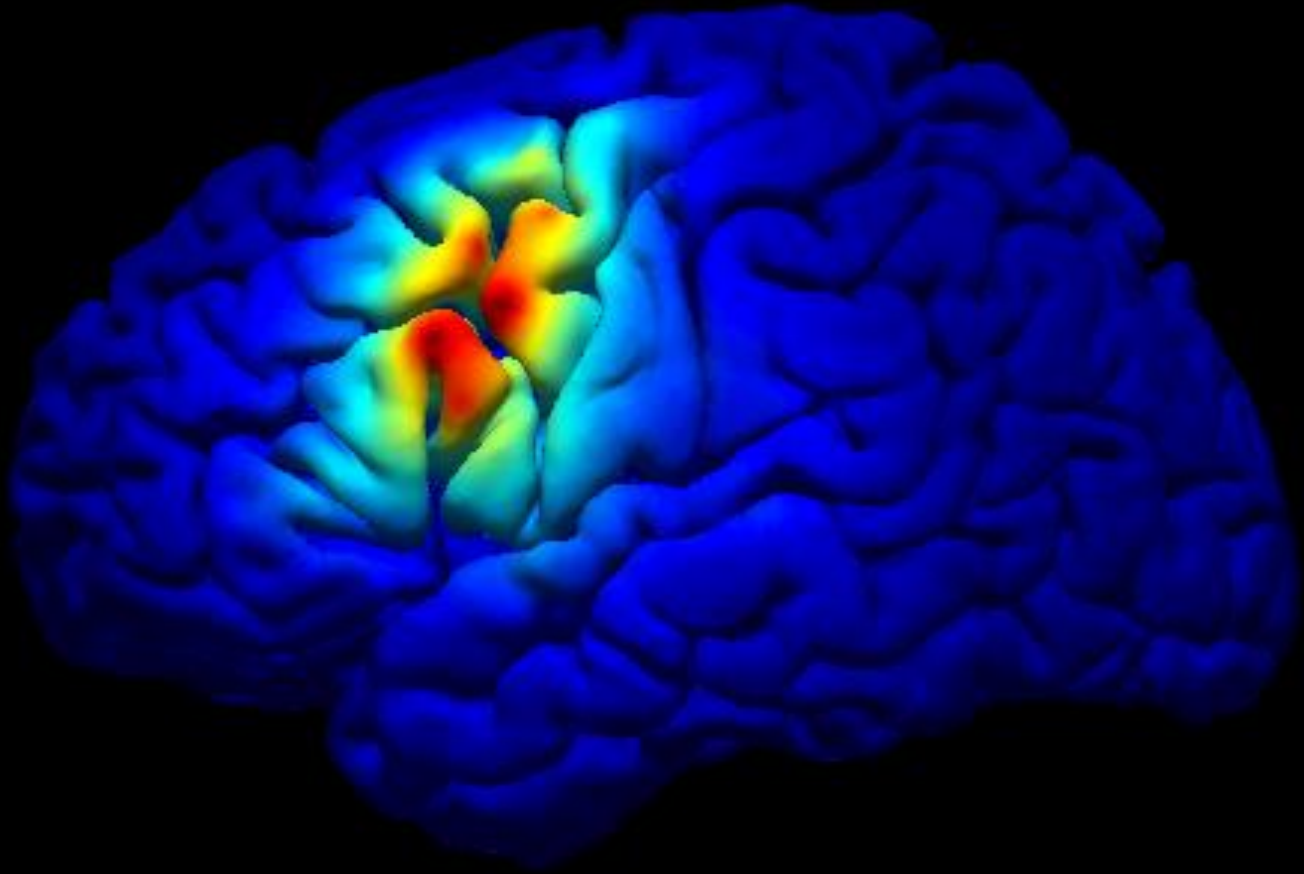


Computational Neuroscience



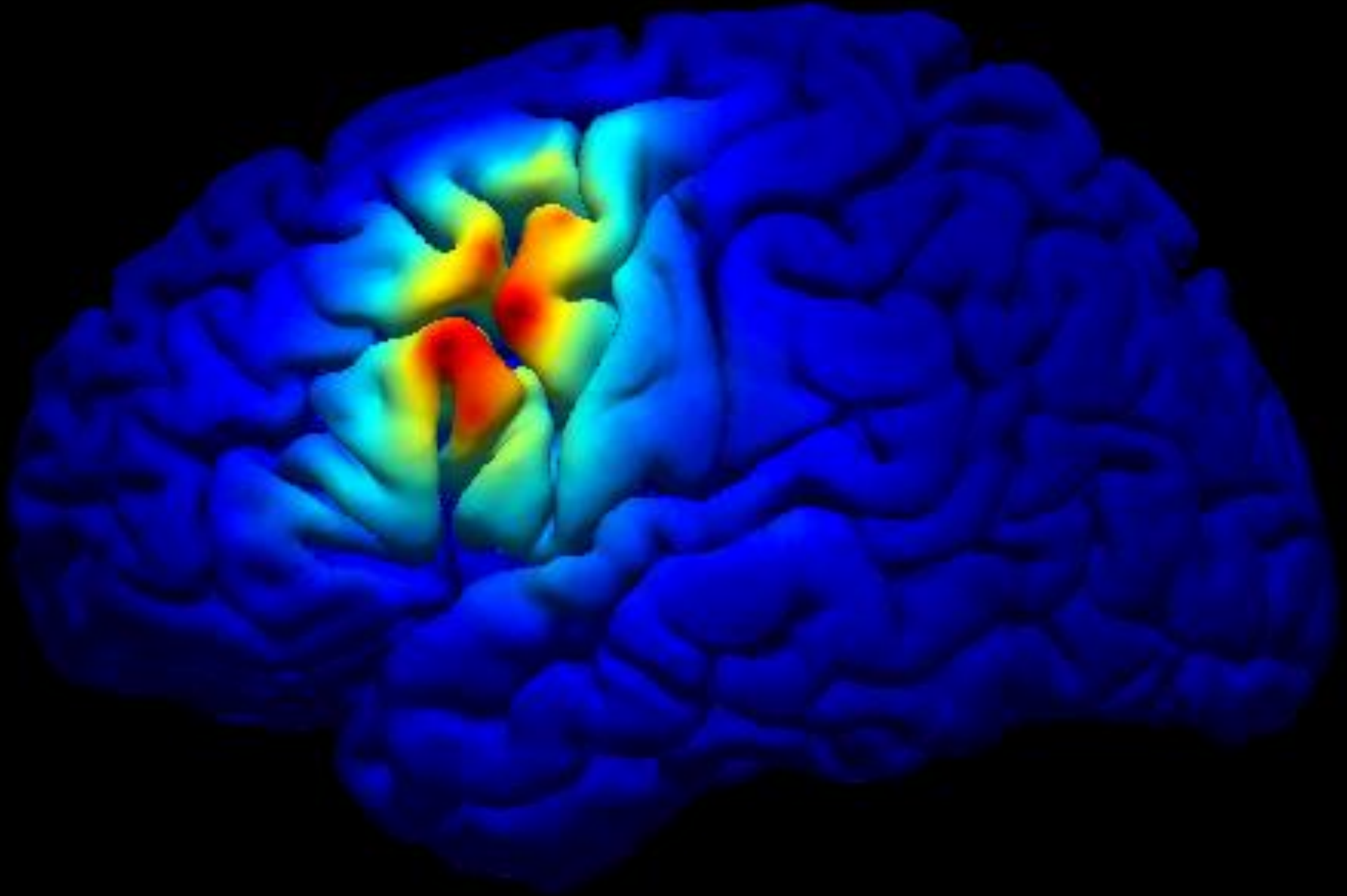
Rajesh P. N. Rao

Adrienne Fairhall

University of Washington, Seattle, USA



Our 3-pound universe



Understanding the Brain using Computational Models

♦ *Descriptive Models of the Brain*

- ⇒ How do neurons respond to external stimuli and how do we describe this quantitatively with a neural *encoding* model?
- ⇒ How can we extract information from neurons (*decoding*)?

♦ *Mechanistic Models of Brain Cells and Networks*

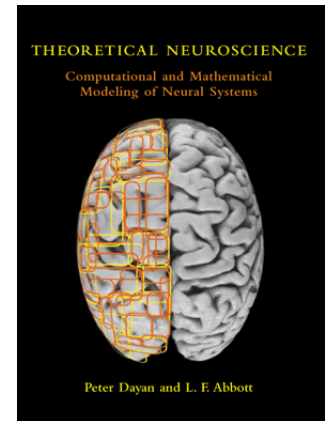
- ⇒ How can we *simulate* the behavior of a *single neuron* on a computer?
- ⇒ How do we simulate a *network* of neurons?

♦ *Interpretive (or Normative) Models of the Brain*

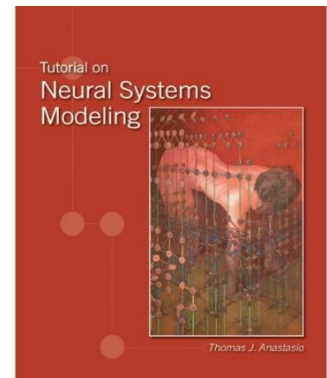
- ⇒ *Why* do brain circuits operate the way they do?
- ⇒ What are the *computational principles* underlying their operation?

Recommended Textbooks

♦ *Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems* by P. Dayan & L. Abbott



♦ *Tutorial on Neural Systems Modelling* by T. Anastasio



Course Goals: What you can expect to learn

- ♦ **At the end of the course, you will be able to:**
 1. **Quantitatively describe** what a biological neuron or network of neurons is doing given experimental data
 2. **Simulate on a computer** the behavior of neurons and networks
 3. **Formulate computational principles** underlying the operation of neurons and networks in the brain

Computational Neuroscience



Let's begin!

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Adrienne Fairhall

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