Neuroscience research has long way to go

The human brain contains roughly 86 billion neurons and trillions, perhaps hundreds of trillions, of intricate interconnections among those neurons. There are hundreds, maybe thousands of different kinds of cells within the brain. And—after nearly two centuries of research—exactly zero convincing theories of how it all works.

Why is it so hard to figure out how the brain functions, and what can we do to face the challenges?

The time to address these questions is now; in 2013, President Obama announced a projected 12-year project known as the BRAIN Initiative, and a few months earlier Europe announced big steps of its own, a 1.2-billion-euro effort to simulate the human brain. China, Japan, and a number of nations are also planning major investments. There is real reason to believe that the field is on the verge of a number of methodological breakthroughs: Soon we will be able to study the operation of the brain in unprecedented detail, yielding orders of magnitude more data than the field has ever seen before.

And that is a good thing. On virtually any account, neuroscience needs more data—a lot more data—than it has.

To begin with, we desperately need a parts list for the brain. The varied multitude of cells in the human brain have names like “pyramidal cells,” “basket cells,” and “chandelier cells,” based on their physical structures. But we don’t know exactly how many cell types there are—some, like Cajal-Retzius cells (which play a role in brain development) are quite rare. And we know neither what all these different cell types do nor why there are so many. Until we have a fuller understanding of the parts list, we can hardly expect to understand how the brain as a whole functions.

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