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How many neurons make a human brain? Billions fewer than we thought

A technique that involves turning the brain into 'soup' and counting the nuclei of nerve cells reveals that we're 14bn short

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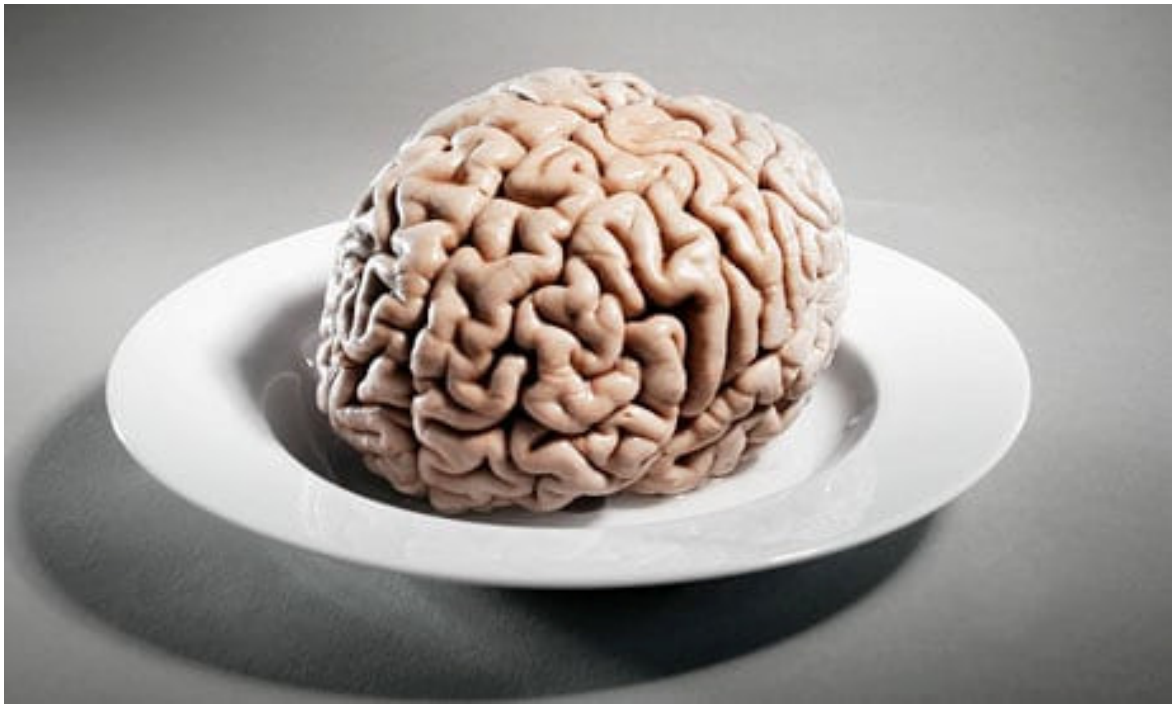

Even the lower estimate of brain neuron numbers puts us head and shoulders above other primates. Photograph: Sprint/Corbis

How many neurons are there in the human brain? It was a question that scientists thought they had nailed – and the answer was 100bn (give or take). If you went looking you would find that figure repeated widely in the neuroscience literature and beyond.

But when a researcher in Brazil called Dr Suzana Herculano-Houzel started digging, she discovered that no one in the field could actually remember where the 100bn figure had come from – let alone how it had been arrived at. So she set about discovering the true figure (HT to the excellent Nature neuroscience podcast NeuroPod).

This involved a remarkable – and to some I suspect unsettling – piece of research. Her team took the brains of four adult men, aged 50, 51, 54 and 71, and turned them into what she describes as "brain soup". All of the men had died of non-neurological diseases and had donated their brains for research.

"It took me a couple of months to make peace with this idea that I was going to take somebody's brain or an animal's brain and turn it into soup," she told Nature. "But the thing is we have been learning so much by this method we've been getting numbers that people had not been able to get … It's really just one more method that's not any worse than just chopping your brain into little pieces."

She told me that so far, she has only looked at four brains, all of them from men.

The method involves dissolving the cell membranes of cells within the brain and creating a homogeneous mixture of the whole lot. You then take a sample of the soup, count the number of cell nuclei belonging to neurons (as opposed to other cells in the brain such as glia) and then scale up to get the overall number. The great advantage of this method is that unlike counting the number of neurons in one part of the brain and then extrapolating from that, it gets over the problem that different brain regions may have more or less densely packed neurons.

So, what is the number?

"We found that on average the human brain has 86bn neurons. And not one [of the brains] that we looked at so far has the 100bn. Even though it may sound like a small difference the 14bn neurons amount to pretty much the number of neurons that a baboon brain has or almost half the number of neurons in the gorilla brain. So that's a pretty large difference actually."