TOOLBOX

Tool tracks brain proteins from infancy to adulthood

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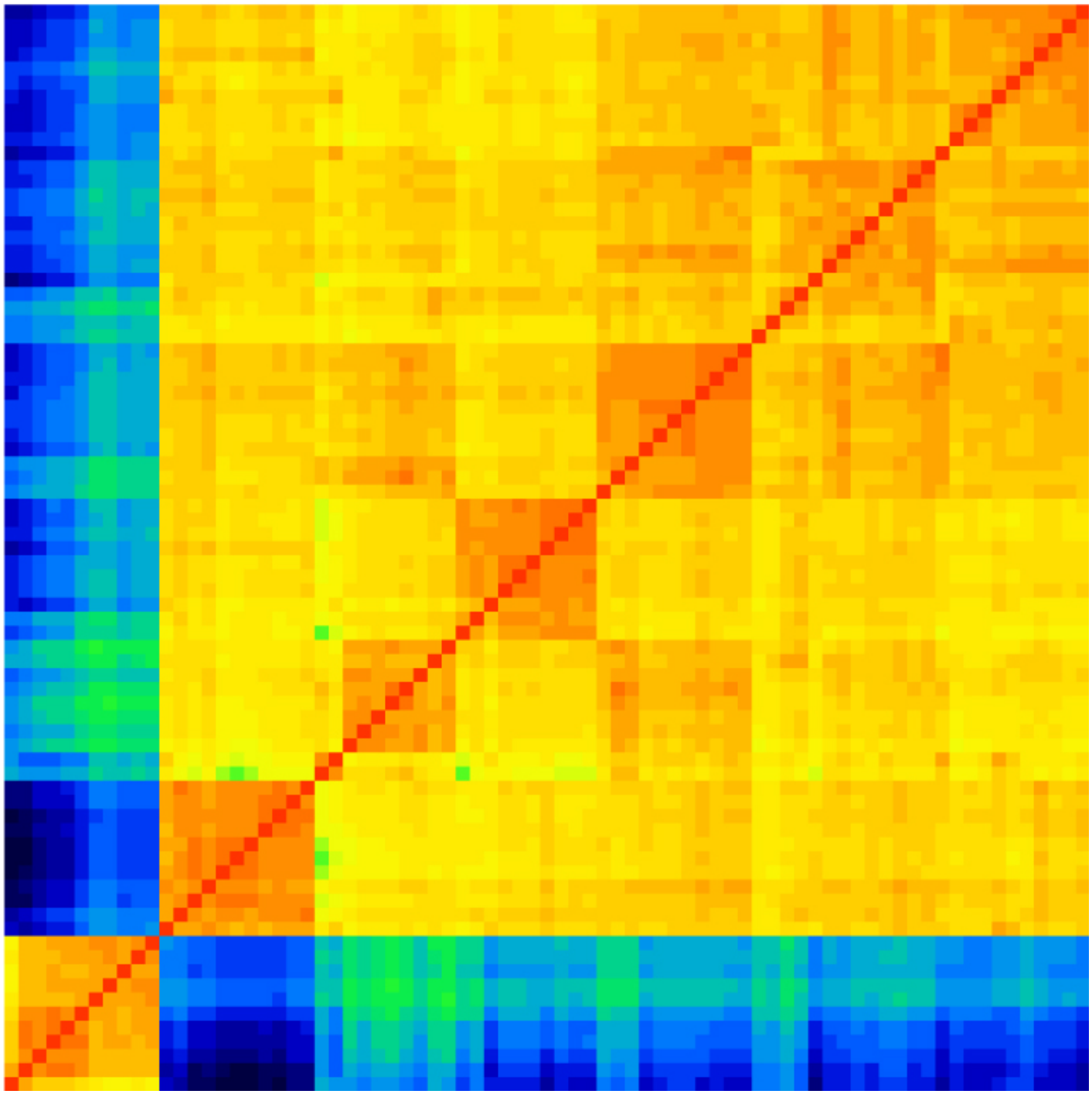

A new inventory of proteins reveals their abundance in seven brain regions from infancy through adulthood[1]. The resource could help scientists accurately determine how protein levels in the brain are altered in conditions such as autism.

Scientists can estimate protein levels in tissue by sequencing messenger RNA (mRNA), the molecular template for proteins. But mRNA levels do not always correspond closely to protein amounts.

For the new inventory, researchers used mass spectrometry, a technique that identifies molecules by their mass and charge, to measure protein levels directly. They then compared the results with an analysis of mRNA in the same brain tissue samples.

The frozen tissue came from several collections that contributed to the **BrainSpan** atlas, an effort to map gene expression in the brain. The samples include tissue from the amygdala, the hippocampus, the striatum, the cerebellum, the thalamus and two parts of the cerebral cortex: a visual region and a planning region. All of these regions have been implicated in autism.

The brains are from seven adults, seven children aged 1 to 12 years and two infants. Altogether, the 16 samples span an age range from birth to about 40 years and include an equal mix of males and females.

Adding enzymes to the samples breaks the proteins into smaller peptides, which produce unique signatures in a mass spectrometer. The signatures of peptides from a particular protein together form the fingerprint for that protein.

The researchers found signatures for more than 111,000 peptides from 8,980 proteins — from which they determined protein levels in the brain regions.

About 35 percent of the proteins vary in abundance between regions of the adult brain, the researchers found. The cerebellum showed the greatest differences relative to other regions, perhaps reflecting the higher density of cells there.

Controlling for regional differences, the levels of only 123 proteins changed between infancy and adulthood.

The researchers compared the protein profiles with mRNA profiles from BrainSpan in each region. They found that some regional differences are only apparent from the mass spectrometry results.

REFERENCES:

1. Carlyle B. C.*et al. Nat. Neurosci*. **20**, 1787-1795 (2017) **PubMed**