The researchers conducting the study were operating under different memories start and stop? These were some of the questions a team funded by the NIH BRAIN Initiative set out to answer in a new study. The BRAIN Initiative’s transcontinental researchers discovered “boundary” and “event” cells that are involved in making and marking memories and are activated at hard boundaries. The team believes hard boundaries activate both boundary and event cells and are what trigger the brain to create a new memory.

“Something may have happened to you this morning— you saw somebody in the street, or somebody called to you—and that memory might very well last a lifetime. It has permanently modified you,” says Ueli Rutishauser, Ph.D., a professor of neurosurgery, neurology, and biomedical sciences at Cedars-Sinai Medical Center in Los Angeles and a senior investigator in the BRAIN Initiative consortium. “We want to figure out how that works and what breaks down when it doesn’t work so we can remediate that.”

Project setup
The BRAIN Initiative research team got the consent of 20 patients across the country undergoing intracranial recordings for epilepsy treatment to look at their brain activity while they were shown clips mimicking soft and hard boundaries.

Findings
When patients reacted to the cuts in the footage they were watching, researchers noticed two groups of cells activated more consistently: “Boundary” cells were activated by both soft and hard boundaries, and “event” cells were activated only by hard boundaries. The team believes hard boundaries activate both boundary and event cells and are what trigger the brain to create a new memory.

The clip for a soft boundary might look like footage of a baseball game cutting from the batter hitting the ball to the fielder catching that ball—it’s two separate images from the same event. A clip for a hard boundary would be that baseball game cutting to a commercial—two entirely separate events.

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Memories and How the Brain Works
This study is looking for participants from the Washington, D.C., metro region. One of the goals of this study is to evaluate how the brain activates and represents memories. Participants will undergo an MRI brain scan and a magnetoencephalography (MEG) scan while watching videos created by researchers funded by the NIH BRAIN Initiative.

Possible treatments
Now that we know what cells are involved with memory production, Dr. Rutishauser says the next step is to figure out what activates the cells. Figuring out what could have a huge effect on treating memory-related issues like Alzheimer’s disease and dementia. The team plans to try to answer that question by looking at dopamine and the brain’s theta rhythm. Dopamine—a neurotransmitter that plays a role in pleasure and learning—might be involved in the activation of boundary and event cells, and the theta rhythm—the brain’s normal internal rhythm that affects learning and memory—could be the essential beat at which the boundary and event cells need to fire. Learn more about this study.

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“A finding like this is exceptionally rare because looking inside the human brain at the resolution we were able to it is so rarely possible,” says Dr. Rutishauser. “That’s one of the main reasons why we know so little about how human memory works. This study was a really precious opportunity, and it was striking that we found these boundary cells behaving so consistently.”