http://phenomena.nationalgeographic.com/2013/08/12/in-dying-brains-signs-of-heightened-consciousness/

Jimo Borjigin, a neuroscientist at the University of Michigan

Her team implanted several electrodes across the brains of nine rats to measure their brain waves—rhythmic pulses of neural activity that are denoted by Greek letters, depending on their frequency. The rats were sedated with anesthetic, and then killed with either a lethal injection that stopped their hearts, or a fatal dose of carbon dioxide.

As you'd expect, after their hearts stopped, most of these brainwaves weakened with time. But one set—the low-gamma waves produced when neurons fire between 25-55 times per second—became stronger for a brief period, in all of the nine rodents. "We weren't surprised that we found brain activity but we were surprised by the high degree of it," says Borjigin.

The activity in different parts of their brains also became more synchronized. Their low-gamma waves, in particular, became twice as synchronized when they were in their near-death state than when they were anaesthetized or awake….

These features have been linked to conscious perception in earlier studies. For example, low-gamma waves suddenly become synchronized across distant brain regions at the moment when people recognize a face among some arbitrary shapes.

Conscious thought has also been linked to the strength of connections between the front-most areas, associated with many complex mental abilities, and those nearer the back that deal with sensory information. And sure enough, the team saw that these areas became 5-8 times more strongly connected after cardiac arrest than during either anesthesia or their waking moments. "That's astonishing," says Borjigin. "It helps to explain why [humans experiencing NDEs] can 'see' during clinical death, and why they claim they can hear conversations during that period."

scientists are still arguing about which neural signals are indicators of consciousness, so decoding the patterns that Borjigin saw isn't straightforward. "It's terribly hard to make strong claims about what these rats actually perceived, or about possible conscious experiences," Mashour says. "But the study definitely shows that there is a lot more electrical activity than expected, and it's very interesting activity. It's tempting to link that to what we hear in patients, but we need to be very careful."

Sam Parnia, a cardiologist from Stony Brook University Hospital, shares that view. He has studied resuscitation and near-death experiences for years and believes that comparing the rat results to the intense visions that humans recount after NDEs "is extremely premature and unsupported by evidence".

"We have a long way to go," admits Mashour. "We haven't correlated the observed brain activity with a conscious experience." The only way to get around that would be to gather electrode recordings in someone who had a near-death experience and returned to tell the tale.

Meanwhile, Parnia says that there could be other explanations for the results. “After blood flow to the brain is stopped, there is an influx of calcium inside brain cells that eventually leads to cell damage and death,” he says. “That would lead to measurable electroencephalography (EEG) activity, which could be what is being measured.” This would explain why Borjigin saw the same pattern in every dying rat, while only 20 percent of people experience NDEs after a heart attack.

Parnia also notes that other EEG studies of humans during cardiac arrest haven’t found similar patterns, suggesting that these results might be due to some quirk of the experiment. But Borjigin counters that other groups have mostly placed electrodes on their patients’ scalps, with bone, flesh and skin standing between them and the underlying neurons. Her team, however, surgically implanted their electrodes right on top of the rats’ brains, making them more sensitive to subtle signals.

This raises some other intriguing questions, beyond the relevance to NDEs. “We didn’t realize that brains can have heightened consciousness when oxygen and glucose are taken away,” she says.