Roughly half of Naia's bones were recovered, including an intact skull, both arms and one leg, making her among the most complete of the handful of New World skeletons that are more than 12,000 years old. Her bones reveal a teenager aged 15–17 at her death, which was probably the result of a fall into the deep pit where she was found. She was "rail-skinny", Chatters says, with one upper arm bone only as thick as his little finger.

Naia's slight build might have been linked to nutritional stress. Her shin bone and knee are striped with lines etched by halting growth, perhaps as a result of too little food, or health problems — such as parasite infections — that prevented her from absorbing nutrients. Irregularities in her teeth reinforce the suggestion that her nutrition was "rather limited quite often", Chatters says.

A small portion of Naia's pelvis broke off when she plummeted into the pit, and was lost. But her remaining pelvic bones are pitted in a way often seen in young, slight woman who have given birth. That's a strong indicator she had gone through labour, and the healing of the bone means that she gave birth well before her death, says Chatters, who is collaborating with scientists at the Autonomous University of Yucatán in Mérida, Mexico.

Naia's upper-arm muscles were not heavily developed, judging by the smoothness of the bones where those muscles were once attached. She didn't routinely grind seeds, work animal skins or carry heavy loads — common tasks during her time. But Naia's shin and thigh bones show that her legs were heavily muscled, meaning that she probably roamed widely over the landscape.

The team's analysis was competent and thorough, says Gary Haynes, an archaeologist at the University of Nevada, Reno. He thinks that Naia might have been thin because "environmental changes of the time were making life harder and harder by removing resources, or making them less dependable".

"We get the sense that the lives of the first Americans were wonderful and easy," Chatters says. "Well, it isn't necessarily the case." ■

The red-spotted newt and many other animals can somehow sense Earth's magnetic field.

GEORGE GRALL/NGC

NEUROSCIENCE

Magnetic protein attracts scrutiny

Molecule implicated in animal navigation could be a powerful research tool, but doubts are growing.

BY DAVID CYRANOSKI

For decades, scientists have wondered how animals can navigate huge distances using the weak signals of Earth's magnetic field. So, interest was piqued in 2015 when two teams released papers in quick succession describing the functions of a protein found in animals that seemed to sense magnetic fields. But the claims have proved controversial, and questions have been piling up.

The basic science behind the discovery was reported by Xie Can, a biophysicist at Peking University in Beijing, and his colleagues. In a paper in *Nature Materials*[1], they claimed that a protein in animal cells forms a structure that responds to magnetic fields, and so might help in navigation. In the same year, a group led by Zhang Sheng-jia, then at Tsinghua University in Beijing, had published a paper in *Science Bulletin*[2] reporting that the same protein could offer a powerful means of controlling brain cells.

An academic battle has long raged between Xie and Zhang, but mounting evidence has cast doubt on both of their discoveries. Several researchers have challenged Xie's claims that the protein reacts to magnetic fields. And last month, Xie co-authored a paper in *Frontiers in*

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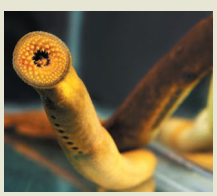

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Neural Circuits[3] disputing Zhang's work on the protein's potential to magnetically control cells.

This has all given rise to serious questions about the role of the molecule at the centre of the dispute. In their 2015 paper[1], Xie and his colleagues reported that a protein called IscA1 forms a complex with another protein, Cry4, that explains how organisms pick up magnetic cues. The study found that this complex incorporates iron atoms, which gives it magnetic properties, and has a rod-like shape that aligns with an applied magnetic field.

Two months earlier, Zhang had described using IscA1 to control neurons and muscle cells in worms[2]. Zhang learned of IscA1's properties and obtained his IscA1 samples from Xie, and so the fact that his team published first was an early source of tension in what quickly became a bitter dispute. Officials from both Tsinghua University and Peking University asked *Science Bulletin* to retract Zhang's paper. And that November, Zhang lost his position at Tsinghua — for reasons that the university did not specify.

Doubts about Xie's research have emerged since then. Michael Winklhofer, a geophysicist at the University of Oldenburg in Germany, examined Xie's data and found that the complex would be too weakly magnetic to sense Earth's field[4]. Markus Meister, a biophysicist at the California Institute of Technology in Pasadena, raised similar concerns: Xie had reported that the complex would contain only 40 iron atoms, but Meister argues that the smallest known naturally occurring iron-based magnet has 1 million iron atoms packed into a smaller space[5].

David Keays, a neuroscientist at the Institute of Molecular Pathology in Vienna, has also questioned the study. He says that IscA1 and Cry4 are found throughout many tissues, whereas one would expect them to be sequestered in specific areas if they were functioning as parts of a magnetic-field receptor. "Sensory receptors, whether they be taste, hearing or photoreceptors, tend to have a restricted expression pattern," he says.

Collaborators of Xie say that they have been able to reproduce some of his findings, and Xie told *Nature* that he stands by his results. He disputes the contention that the magnetic properties of IscA1 would be too weak by saying that Cry4 might boost its effect. "The data are what they are," he says. "This may expand our knowledge of molecular magnets."

The challenge to Zhang's paper has been more pointed. Zhang claimed to have transferred IscA1 into worm neurons and then used a magnetic field to induce the cells to take up calcium. The ability to manipulate such a basic cell function could promise neuroscientists a powerful tool that is less invasive than optogenetic techniques, which use light-sensitive proteins to control neurons in living animals.

But last month, Xie, Tsinghua University neuroscientist Lu Bai and Lu's student Pang Keliang reported[3] carrying out experiments under various conditions, including some almost identical to those used by Zhang. They found no change in calcium flowing into cells in any of the cases. The authors conclude that the "findings cast serious doubts" that IscA1 alone could influence the activity of neurons, as Zhang had claimed.

"The data are what they are. This may expand our knowledge of molecular magnets."

Several scientists outside China also told *Nature* that they could not reproduce Zhang's results. *Nature* tried to reach Zhang through multiple e-mails and phone calls to Shenzhen University in China, where he now has a position, but he did not respond to requests for comment. (Neither *Nature Materials*, which is editorially independent from *Nature*'s news team, nor *Science Bulletin* responded to requests for comment about criticism of the papers.)

Meanwhile, even as his critics become increasingly aggressive, Xie says he has convincing data that demonstrate the reaction of an IscA1 complex to a magnetic field, and that he plans to publish them within a year. "We are more and more confident — 100% sure — that we are right about this," he says. ■

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REPRODUCTIVE BIOLOGY

Baby's DNA mix revealed

But parents of boy conceived with DNA from three people plan to forego long-term monitoring.

When a US fertility clinic revealed last year that it had created a baby boy using a controversial technique that mixes DNA from three people, scientists were quick to raise the alarm. Some objected on ethical grounds, and others questioned the scientific claims made by the clinic's leader, physician John Zhang.

Now, after months of intense debate and speculation, Zhang's team has provided more details about the child's conception, in a paper published on 3 April in *Reproductive Biomedicine Online*[1]. But major questions remain about the boy's long-term health and the scientific value of the experiment.

Techniques to create 'three-parent babies' seek to offer mothers a way to have a child without passing on metabolic diseases caused by faulty mitochondria, the structures that provide energy to cells. Researchers do this by exchanging the diseased mitochondria of a prospective mother with those of a healthy, unrelated donor: the 'third parent'.

In this case, a team led by Zhang, who works at the New Hope Fertility Center in New York City, removed the nucleus from a healthy donor egg and replaced it with a nucleus taken from the egg cell of a woman who carries a rare neurological disease called Leigh syndrome, leaving the donor's healthy mitochondria intact. The scientists then fertilized the modified egg with the father's sperm before implanting it into the mother's uterus. The resulting baby was born in April 2016.

The paper reports new details about the procedure, such as the method used to transfer the mitochondria. The study also reveals that some diseased DNA from the mother was carried over inadvertently into the donor egg, which could have long-term repercussions for the child's health.

Other scientists welcomed the information. "Certainly, this is a landmark study," says Dietrich Egli, a stem-cell scientist at the New York Stem Cell Foundation.

But no one knows whether the child's health will be affected by the traces of the mother's mitochondrial DNA, which could prompt some of his mitochondria to function improperly. The percentage of affected mitochondria can differ between tissues. Zhang's paper reveals that just 2% of the mitochondrial DNA of cells in the boy's urine came from the mother, as compared to 9% in cells from the circumcised foreskin.

Scientists don't know what amount of diseased mitochondria would cause noticeable symptoms in a child created with genetic material from two women. But studies in mice have shown that mixtures of mitochondria can result in neurological disorders ▶