DO BACTERIA CAUSE ENDOMETRIOSIS? STUDY OFFERS FRESH CLUES

Link to bacterial infection suggests a potential way to treat the painful disorder.

By Heidi Ledford

Infection by a particular group of bacteria could be linked to endometriosis, a painful condition that affects up to 10% of women and girls of reproductive age.

In a study of 155 women in Japan, members of the bacterial genus *Fusobacterium* were found in the uteruses of around 64% of those with endometriosis, and 7% of those who do not have the condition (A. Muraoka *et al. Sci. Transl. Med.* **15**, eadd1531; 2023). Follow-up experiments in mice infected with *Fusobacterium* showed that treatment with an antibiotic could reduce the size and frequency of lesions, associated with endometriosis.

Researchers will need to do more work before the findings, published on 14 June, can be used to develop treatments for the condition, says Elise Courtois, a genomicist who studies the disease at the Jackson Laboratory in Farmington, Connecticut.

But the results highlight growing interest in the potential role of microorganism in endometriosis, which has limited treatment options and whose origins are poorly understood. "There are definitely things that make us suspect the microbiome is implicated in endometriosis," says Courtois. "Genetics doesn't explain everything."

Painful lesions

Endometriosis is caused by the migration of tissue from the lining of the uterus, called the endometrium, to other parts of the body where it attaches and grows. It often causes lesions on reproductive organs and is associated with reduced fertility.

The most common symptom of endometriosis is pain, which can be severe. Treatments include hormone therapies, which also act as contraceptives, and surgery to remove the lesions. "We want to find new therapies," says Yutaka Kondo, a cancer biologist at Nagoya University in Japan and a co-author of the paper. "But first we have to know the reason why people suffer from endometriosis."

Kondo and his colleagues analysed endometrial tissue from women with and without the condition. They found that samples from those with endometriosis were more likely to host bacteria belonging to the genus *Fusobacterium*. The bacteria were often found in the mouth, gut and vagina, and have been linked to other conditions, such as gum disease.

***Fusobacterium* has been linked with endometriosis.**

CNRI/SPL

To see whether *Fusobacterium* could affect the course of endometriosis directly, the team transplanted endometrial tissue from one set of mice into the abdominal cavity of another. Within weeks, endometriotic lesions formed in the recipient mice. Using this model, the researchers found that lesions tended to be more abundant and larger in mice that had also been inoculated with *Fusobacterium* than in those that hadn't. Treating the mice with the antibiotics metronidazole or chloramphenicol reduced the development of endometriosis, and shrank the number and size of the lesions.

A clinical trial in women with endometriosis is now under way to find out whether antibiotics could relieve some of their symptoms, says Kondo.

Missing pieces

The results are compelling, but the story is still missing a few key pieces, says Courtois. For example, it would be useful to test the association between *Fusobacterium* and endometriosis in a more diverse population. Courtois and others have successfully lobbied the Connecticut state government to set up a repository of endometrial samples for research that will include tissue from an ethnically diverse population, as well as transgender and gender diverse people. (This article uses 'women' to describe people who are at risk of endometriosis, while recognizing that not all people who identify as women have a uterus, and not all people who have a uterus identify as women.)

More extensive research is particularly important because mice — which do not menstruate or form spontaneous endometrial lesions — are limited as models of the condition. "These are really intriguing results and potentially exciting," says Krina Zondervan, head of the Nuffield Women's and Reproductive Health department at the University of Oxford, UK. "But we're really at the infancy of this."

IBM QUANTUM COMPUTER PASSES CALCULATION MILESTONE

The company says that quantum computers could have real-world applications within two years.

By Davide Castelvecchi

Four years ago, physicists at Google announced that their quantum computer could outperform classical machines — although only at a niche calculation with no practical applications. Now their counterparts at IBM say they have evidence that quantum computers will soon beat ordinary ones at useful tasks, such as calculating properties of materials or the interactions of elementary particles.

In a proof-of-principle experiment described in *Nature* on 14 June (Y. Kim *et al. Nature* **618**, 500–505; 2023), the researchers simulated the behaviour of a magnetic material on IBM's Eagle quantum processor. Crucially, they managed to work around quantum noise — the main obstacle for this technology because it introduces errors in calculations — to get reliable results.

Their 'error-mitigating' techniques enabled

the team to do quantum calculation "at a scale where classical computers will struggle", says Katie Pizzolato, who heads IBM's quantum theory group in Yorktown Heights, New York.

Although the problem they attacked uses a much-simplified, unrealistic model of a material, "it makes you optimistic that this will work in other systems and more complicated algorithms", says John Martinis, a physicist at the University of California, Santa Barbara, who led the Google team to its 2019 milestone.

Sabrina Maniscalco, chief executive of quantum-computing start-up Algorithmiq in Helsinki, says that the experiment provides a benchmark for the state-of-the-art in quantum computers. "These machines are coming."

Uniquely quantum

Quantum computers employ peculiarly quantum phenomena, such as the ability of an object to exist in a simultaneous 'superposition' of two states, and of multiple objects to share a common quantum state, in what physicists call entanglement. Qubits are the quantum equivalent of the bits of ordinary computers, and can be in a superposition of the '0' and '1' states and be entangled with one another.

Physicists have been experimenting with a range of hardware for building quantum computers, including traps for individual ions or neutral atoms. IBM's approach — which is also used by Google and other companies — encodes each qubit in a tiny superconducting circuit. For quantum computers to be effective, the qubits have to keep their quantum state for long enough for a calculation to be carried out. So a crucial engineering effort went into increasing the lifetime of the qubits, the IBM team says.

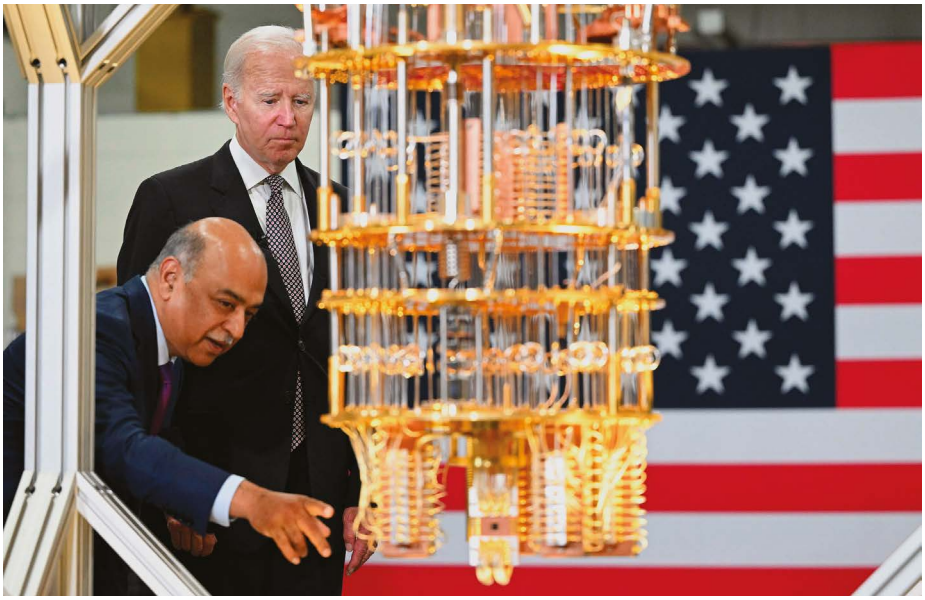
In the latest paper, IBM physicist Abhinav Kandala and his collaborators conducted precise measurements of the noise in each of their qubits, which can follow relatively predictable patterns determined by their position inside the device, microscopic imperfections in fabrication and other factors. Using this knowledge, the researchers extrapolated back to what their measurements — in this case, of the full state of magnetization of a 2D solid — would look like in the absence of noise. They were then able to run calculations involving all of Eagle's 127 qubits and up to 60 processing steps — more than any other reported quantum-computing experiment.

Error approach

Martinis says that the results validate IBM's short-term strategy, which aims to provide useful computing by mitigating, as opposed to correcting, errors. Over the longer term, IBM and most other companies hope to shift towards quantum error correction, a technique that will require large numbers of extra qubits for each data qubit. (Google's strategy has focused on refining quantum error-correction techniques.)

Some researchers are less optimistic about the potential of noise mitigation, and expect that only quantum error correction will enable calculations that would be impossible on even the largest classical supercomputers (A. Daley *et al. Nature* **607**, 667–676; 2022).

The Eagle has 127 qubits — but IBM expects to unveil its most powerful processor yet, the 1,121-qubit Condor chip, later this year. The company also has "utility-scale processors" with up to 4,158 qubits in its development pipeline, says Jay Gambetta, head of IBM's quantum-technology efforts. He adds that to achieve the longer-term goal of building 100,000-qubit machines that can do fully error-corrected algorithms by 2033, researchers will need to solve substantial engineering problems.



MANDEL NGAN/AFP VIA GETTY

US President Joe Biden and IBM chief executive Arvind Krishna examine a quantum computer.

CONCUSSION GUIDANCE FOR SPORT SIDESTEPS LINK TO BRAIN DISEASE

Critics are baffled by why statement does not connect repeated head traumas to high-profile condition.

By Katharine Sanderson

An influential team of researchers has updated the scientific consensus on how concussion in sport should be defined, treated and monitored. But critics say that the statement, which is revised every four to five years, excludes evidence that links head injuries in sport with long-term brain conditions such as chronic traumatic encephalopathy, or CTE — a high-profile issue in games such as American football and soccer.

The consensus statement, compiled by 114 co-authors after the International Conference on Concussion in Sport, held in Amsterdam last October, summarizes the latest evidence on sport-related concussion to help clinicians manage the trauma. The latest version, published on 14 June, introduces details including a description of brain-chemistry events that happen after a concussion (J. S. Patricios *et al. Br. J. Sports Med.* **57**, 695–711; 2023).

But some researchers have criticized the authors' work. "Their refusal to acknowledge a causal relationship between contact-sports participation and CTE is a danger to the public," says Chris Nowinski, a neuroscientist and chief executive of the Concussion Legacy Foundation in Middletown, Delaware, which supports athletes and veterans affected by concussion and CTE.

Many studies have linked repeated sport-related head injuries with CTE — a