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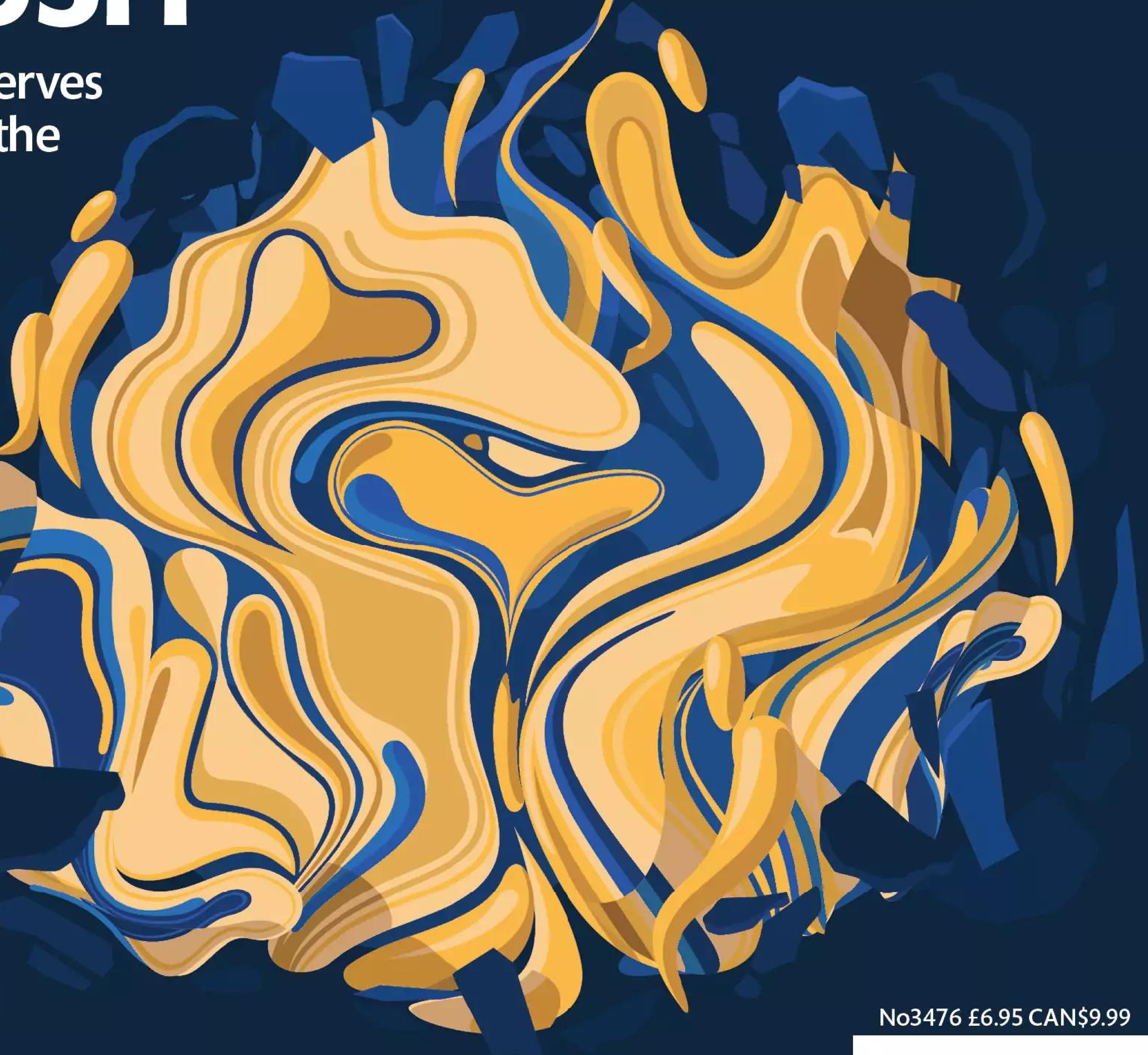

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Space

What we know about the stars where NASA will hunt for life

Jonathan O'Callaghan

ASTRONOMERS have examined the stars that a new multibillion-dollar space telescope might target, to prepare for one of the most advanced searches for life on other planets. They have found which systems may be better suited to hunt in for potential alien life.

In the 2040s, NASA plans to launch the Habitable Worlds Observatory (HWO). Its big goal is to image about 25 Earth-like planets in the habitable zones of sun-like stars – where water, or even life, could exist. Before construction on the HWO begins, scientists are tackling some of the key hurdles it will face.

One of those is selecting the stars within about 100 light years of Earth that the telescope might target. Caleb Harada at the University of California, Berkeley, and his colleagues have analysed 164 candidate stars to gauge what we know of them. "We're trying to get the ball rolling so we can fill in our knowledge gaps," says Harada. These may become some of the most studied stars in history.

The list of candidates includes Tau Ceti, a sun-like star 12 light years away that is believed to host multiple planets, and 82 G. Eridani, 20 light years away, which is known to have at least three super-Earths, with masses bigger than Earth's but smaller than Neptune's. So far about 47 of the stars have been ranked as "Tier A", the most promising targets for HWO. However, Eric Mamajek at NASA's Jet Propulsion Laboratory in California, who jointly drew up the initial group of 164, says the full list is "very much provisional".

Harada and his team showed that 102 of the stars are binary ones, which may complicate a search for life. HWO will use a tool known as a coronagraph to block out the starlight to try to image planets in orbit, also picking apart the gases in their atmospheres. "If [binaries are] too close together, the unblocked star would swamp the image and you wouldn't be able to see planets," says Bruce Macintosh at the University of California Observatories.

Giant Earth-like exoplanets may host extreme forms of life in hot spring craters

STEVEN HOBBS/STOCKTREK IMAGES/ALAMY

Of the stars, 33 are also known to have debris discs that could make it hard to image planets. "It's an extra source of flux," says Harada. And some of the stars are prone to flaring events. These aren't necessarily deadly to life, considering our sun emits solar flares, but they will need to be studied to make sure they aren't too intense. "These can affect life and habitability," says Harada.

The composition of many of the stars is known, which can directly translate to the composition and habitability of any orbiting planets. "We might want to [focus our search on stars with] the chemical elements that are essential for life, including carbon, nitrogen and phosphorus," says Harada. But not all stars are known in such detail, making them prime targets for follow-up study in future (arXiv, doi.org/md9s).

Any of these stars could be where life is first detected outside our solar system, so telescopes will be trained on them before HWO launches. "People are going to study the heck out of them," says Macintosh. ▮

Animal behaviour

Bees tend wounds, which suggests that they feel pain

BEES have been observed grooming hurt body parts, which may indicate that they feel pain.

Many insects continue to feed and mate when wounded, which had previously led researchers to assume that insects don't feel pain.

"This [grooming] in itself is not direct evidence for pain," says Lars Chittka at Queen Mary University of London. "But it's an important dent in the argument that insects obviously don't feel pain."

A creature might be able to process hurtful stimuli in its brain without necessarily experiencing an unpleasant feeling of pain. However, measuring this is tricky and we can't ask an insect to communicate what it feels.

Instead, Chittka's team looked at whether buff-tailed bumblebees (*Bombus terrestris*) responded to a painful stimulus by grooming the resulting wound. The researchers divided 82 bees into three groups. One group received a touch on one of their antennae with a soldering iron heated to 65°C (149°F), while another group was prodded on an antenna with an unheated iron. The third set wasn't poked at all. In the 2 minutes following the burn, the scorched insects groomed and tended to their antennae more often, and for longer, than the other groups (bioRxiv, doi.org/md9b).

"It's a very strong difference," says Chittka. "No subtlety at all."

The finding is part of a growing body of research indicating that insects may feel emotions. It builds on previous studies suggesting that bumblebees will accept a painful experience only in exchange for a particularly sugary reward and that they might feel enjoyment because they freely engage in play.

"It's an important dent in the argument that insects obviously don't feel pain"

"This study provides an important part of the overall picture," says Heather Browning at the University of Southampton, UK.

But Nicholas Humphrey at the London School of Economics says grooming an injury could just be an evolved response to mitigate damage, not a sign of pain. ▮

Sofia Quaglia