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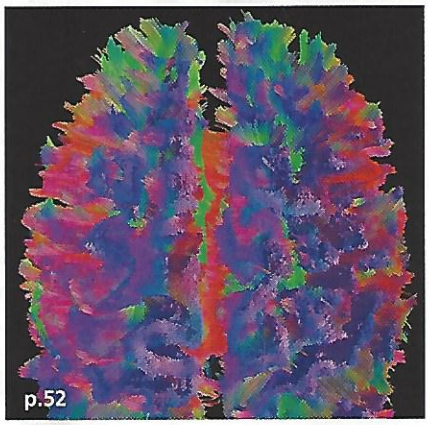

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One of 3,000 skeletons found during a London railway dig.

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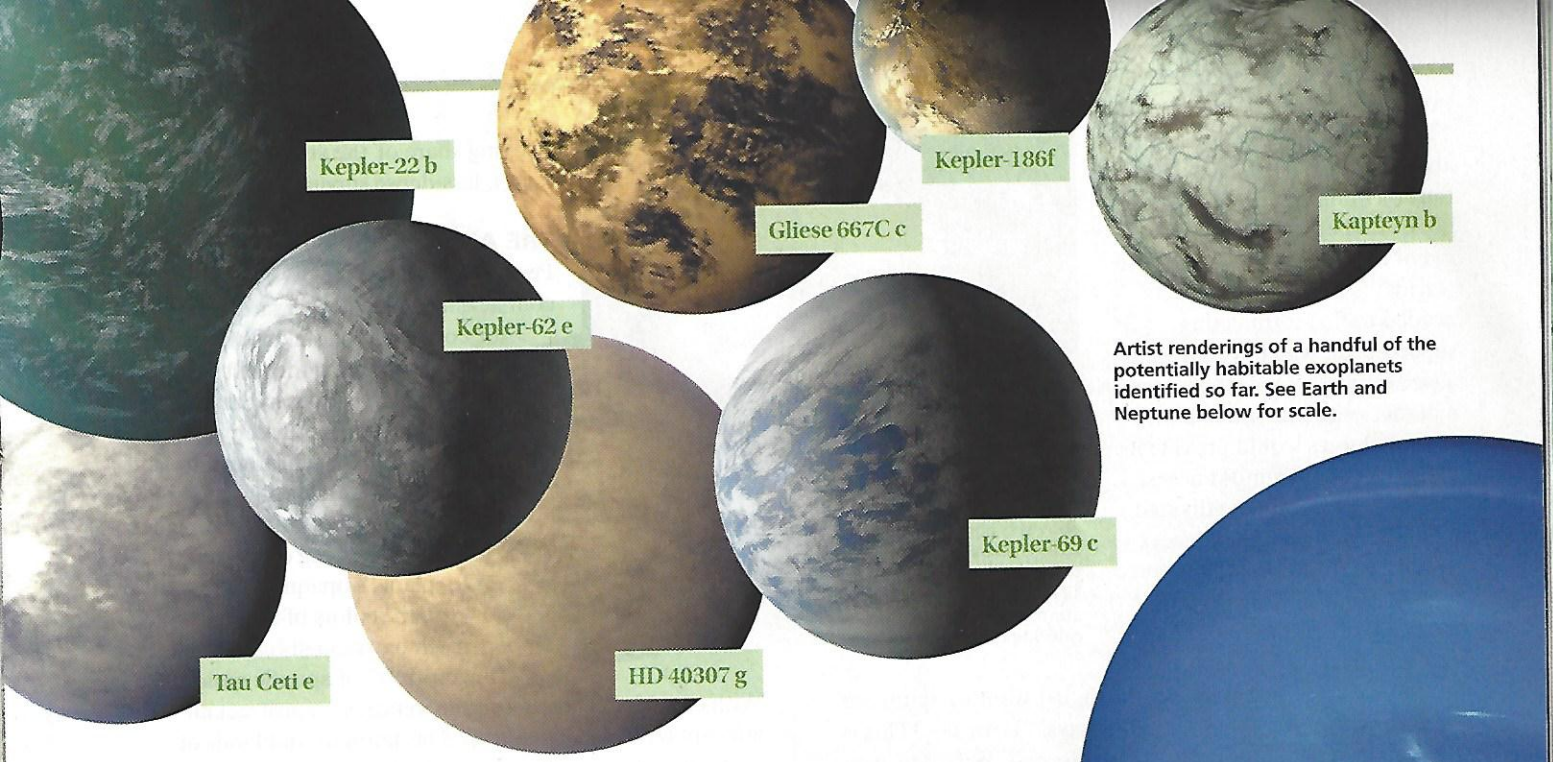

Artist renderings of a handful of the potentially habitable exoplanets identified so far. See Earth and Neptune below for scale.

EARTH

NEPTUNE

SUPER-EARTHS are loosely defined as having up to 10 times Earth's mass and fall into the size and mass gap between Earth and Neptune or Uranus.

Buoyed, astronomers began planning for the planet-harvesting mission that would launch 14 years later as Kepler. Over the space telescope's first run, cut short due to a component failure in spring 2013, Kepler patiently stared at 150,000 stars, looking for the tiniest of flickers as planets crossed their faces — so-called "transits." These crossings not only betray an exoplanet's presence but also reveal its size, based on how much starlight the world blocks.

In 1999, while writing up the Kepler proposal, Sasselov wondered if we might find bigger versions of Earth. For lack of a better term, he blurted out "super-Earth." "I said at the time, 'I don't necessarily want to use that word, so if you have a better option. …'" Sasselov recalls. "But people started using it, and now it's become so entrenched."

For years afterward, though, even as scores of hot Jupiters piled up, super-Earths remained elusive. Nevertheless, Sasselov, his student Diana Valencia and their colleague Richard O'Connell went out on a limb. In 2004 they submitted a paper speculating on theoretical super-Earths' interior structures. The concepts were so unheard of that the journal editor struggled to drum up peer reviewers with relevant expertise.

A year later, these stabs in the dark paid off when researchers proved super-Earths are not just a funky phenomenon around pulsars. Prior scrutiny of the typical star Gliese 876 had rustled up two Jupiter-size companions, and further research revealed a third body, dubbed Gliese 876 d, pegged at 7.5 Earth-masses — the smallest-mass exoplanet then known.

"Gliese 876 d was really an important threshold event," says Sasselov. The long-in-limbo interior structure paper he co-authored with O'Connell and Valencia was finally published in the journal *Icarus* in 2006, and super-Earth science was born.

For Valencia, this finding came in the nick of time. A physicist from Colombia, she was captivated by the idea of super-Earths, but "there was no data," says Valencia, now an assistant professor of physics at the University of Toronto Scarborough. A colleague "teased me that I was studying imaginary planets." Seeking a potential backup plan, Valencia took a summer seismology internship at Shell Oil. She was planning to return to Harvard, but the Gliese 876 d discovery sealed the deal. She left the oil industry and returned to her passion, never looking back. "I was lucky," Valencia says. "The stars aligned."

WHAT ARE YE?

Valencia's excitement proved justified, as ecstatic planet hunters added more super-Earths to the rolls. Yet for several years, scientists knew nothing else about these worlds except their masses. Without a direct analog in the solar system, no one could guess if these newfangled planets were predominantly rocky (Earth-like), gassy (Neptune-like), something in between (water worlds?) or all of the above.

EARTH: NASA/JPL-CALTECH. NEPTUNE: NASA