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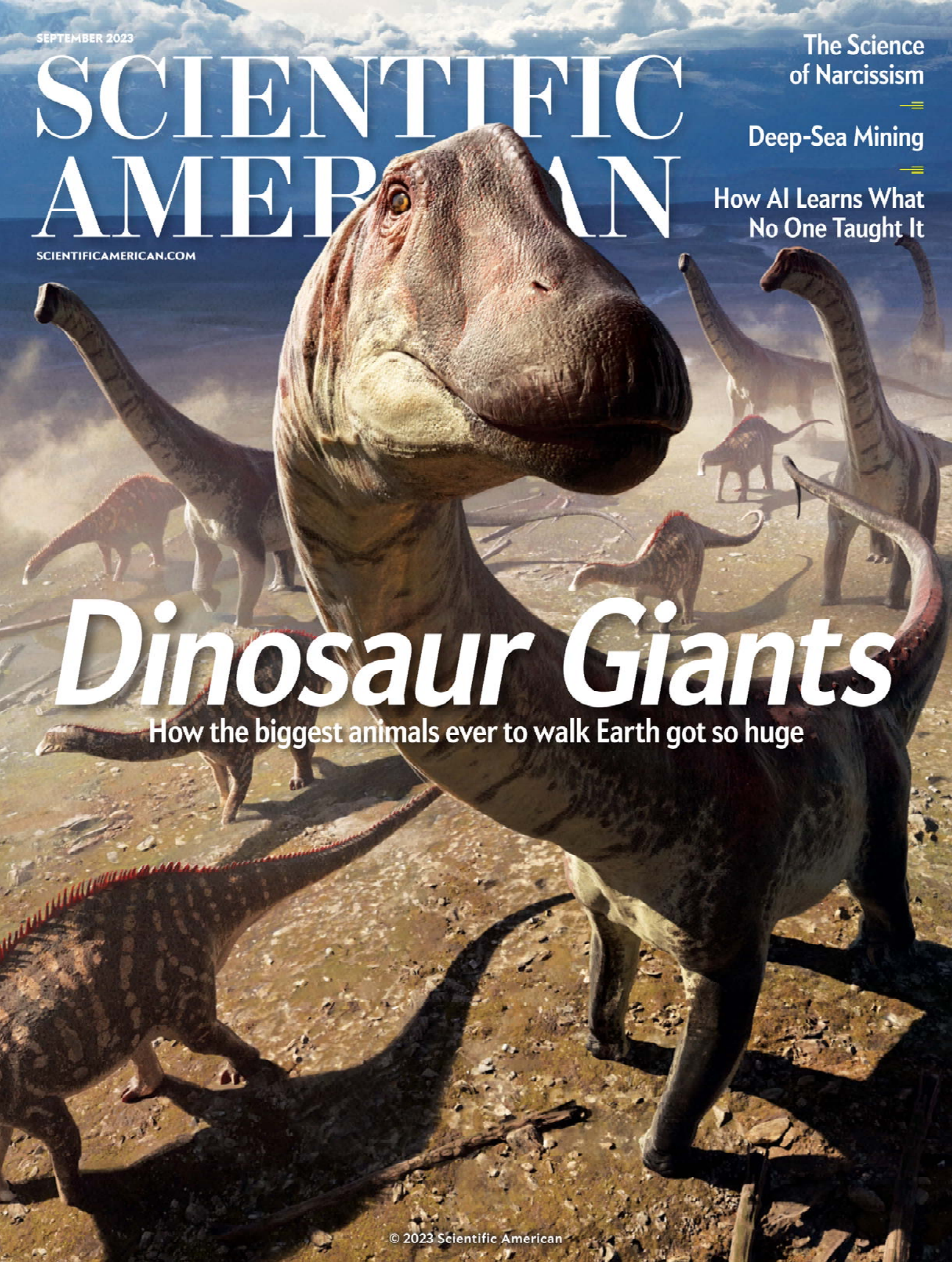

Dinosaur Giants

How the biggest animals ever to walk Earth got so huge

Is E.T. Eavesdropping on Us?

Cell-phone towers leak radio waves into space, but the signals will be tough for aliens to detect

By Phil Plait

Ever worry about shadowy forces tapping your phone calls and listening in on your private conversations? Well, astronomers have some good news for you: it won't be aliens with their ears (or whatever auditory sensory organs they have evolved) to the speaker getting into your business—unless they've done a lot better than we have at funding radio astronomers. And even then, they'd have to be *really* close by.

Scientists working on SETI—the search for extraterrestrial intelligence—have long pondered how to detect life outside Earth. Assuming there are technologically advanced aliens out there, they might be trying to communicate with us, or they might just be leaking radio energy into the cosmos by accident. Either way, can we pick up that signal? One way to tackle this question is to turn it around: We know how much energy *we're* broadcasting into space. Given our own level of technology, could we detect such a signal from light-years away? If so, then maybe we can hear extraterrestrials, too.

SETI scientists have focused their efforts mostly on radio waves because they're easy to make; any young technological civilization will figure that out pretty quickly—after all, we did. They can be beamed with a lot of power, have lots of information encoded in them, and can travel easily through the myriad dust and gas clouds littering our local space environment. They're ideal for cross-galactic communication.

This kind of study has been done in the past; research published in the journal *Science* in 1978 looked at our television signals and military radar, the most powerful transmissions we could send into space. At that time radio telescopes could detect those emanations out to 25 and 250 light-years away, respectively. This is a volume of space that encompasses several hundred thousand stars. In the decades since, our broadcast TV signal has waned as we've turned to cable and the Internet to deliver our shows. The days of wondering whether aliens loved *Lucy* as much as we did are behind us, I'm afraid.

But other communication methods are on the rise, and they could prove more fruitful for any aliens looking for another lonely civilization with which to chat. Research by SETI scientists published in the *Monthly Notices of the Royal Astronomical Society* looks at how our cell-phone usage might be detectable from other stars.

David Wall/Getty Images

Without going into too much technical detail, cell phones emit a weak signal that can be detected by a nearby tower, which in turn emits a much stronger signal to send the transmission along. Coverage for a given phone company is divided into small areas called cells, each populated with one or perhaps a few towers that can pick up nearby phone signals.

The signal strength of an individual phone is only a fraction of a watt, but a tower emits a couple of hundred watts—about the same as a bright lightbulb. That's not much, but there are a lot of them. OpenCelliD, an open database of cell locations, has tens of millions of cells listed globally. The total power emitted by cell-phone transmissions can be measured in gigawatts.

What an alien would detect when pointing a radio telescope at Earth depends on more than just the combined signal strength of all those towers, though. The direction the towers transmit in is also important. Most human cell-phone users are located near Earth's surface, so the tower antennae are configured to send their signals parallel to the ground, covering it like lawn sprin-

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klers spraying water. If you're on the ground near a tower, you'll get a strong signal from it, but if you're above it, you'll get at best a weak signal.

Tower locations matter as well. There are very few towers in the Pacific Ocean nations, compared with a huge number in the U.S. And there are more towers in the Northern Hemisphere than the Southern, so our alien friends would see a different signal depending on where their home star is located in the sky.

Putting this together, the scientists modeled what aliens would see from hypothetical planets orbiting three nearby stars: HD 95735, Barnard's Star and Alpha Centauri A. All of these are less than nine light-years away, practically in our galactic backyard, maximizing the snooping capabilities of any nosy aliens. The stars are also widely spread in declination (the measure of latitude on the sky), meaning observers in those spots would see how Earth appears from different directions.

The conclusion? If the alien tech is the same as ours—with a radio telescope as big as the 100-meter Green Bank Telescope in West Virginia—our overall cell-phone signal is still far too weak to be detected from any of the three stars. The next-generation Square Kilometer Array, currently under construction in Australia and South Africa, will be more sensitive but still will have only about 1 percent of the sensitivity needed to detect Earth's transmissions from tens of trillions of kilometers away.

If aliens are anything like us, then, we're safe from eavesdropping. Judging from my time spent in airports and other public places, however, a lot of people don't care at all who overhears their calls. I wouldn't go so far as to say I hope aliens abduct them, but I'm not *not* saying that.

What if our galactic neighbors are more advanced technologically? Telescopes detecting interstellar radiation are like buckets set outside in a rain shower: the bigger the bucket, the more water it collects. It's technically feasible to build far larger radio telescopes than we have now. There are even serious proposals to build huge radio telescopes on the moon. These would be far more sensitive than what we have today, perhaps capable of picking up transmissions such as our mobile signals even from interstellar distances.

There's still a chance that extraterrestrials could listen in on our cell-phone conversations, provided they are close enough and are in the right part of the sky.

So there's still a chance that extraterrestrials could listen in on our cell-phone conversations, provided they are close enough, are in the right part of the sky, and have slightly better tech on hand (or tentacle or pseudopod) than we do now. You can decide which part of that last sentence is the most far-fetched, but in any case, that's a lot of ifs. The longest odds are that they're sufficiently close to us; if their home world is 1,000 light-years away, they'll need a telescope the size of a moon to pick up our transmissions. Possible, but a lot of effort.

Still, the scientists note that the number of terrestrial cell-phone towers is increasing, and we get brighter in radio emissions every day. They also plan on expanding their work to include more powerful 5G towers, radar, satellite services, and more to get a better handle on just how loudly we're announcing our presence in the galaxy. Remember, too, that all of this is to solve the more pertinent puzzle of whether *we* can hear *them*. That remains a maybe, an ambiguous and somewhat maddening conclusion. And of course, everything depends on the answer to the biggest question of all: Are they even out there?

If so, E.T., please phone Earth; we're eagerly awaiting your call. SA

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