Incest Isn't Taboo in Nature: Study

Avoiding inbreeding appears to be the exception rather than the norm for animals, according to a new meta-analysis of experimental studies.

Christie Wilcox, PhD

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Biologists have long believed that it's adaptive for most species to avoid mate pairings between close kin because of the potential genetic fallout, but a meta-analysis published May 3 in *Nature Ecology & Evolution* challenges this long-held assumption.

Regina Vega-Trejo with a net she used during her doctoral studies on the effects of inbreeding in mosquitofish.

SHARYN WRAGG RSB, THE AUSTRALIAN NATIONAL UNIVERSITY

The authors examined nearly 140 experimental studies of inbreeding avoidance conducted on 88 species—everything from fruit flies to humans—and found little evidence that animals on the whole prefer non-relatives.

The inclusion criteria limited the analysis to explicit studies of mate choice, notes Regina Vega-Trejo, an evolutionary biologist at Stockholm University in Sweden and a coauthor of the new paper. Although in the wild, numerous mechanisms can interfere with those choices—such as living in a large, intermingled population where the odds of pairing up with kin are low—the results align with what theoretical models predict: that animals only avoid mating with kin when the costs of inbreeding are high. The finding also bolsters what were previously considered to be unexpected findings of frequent inbreeding or a lack of inbreeding avoidance in some wild populations.

Furthermore, Vega-Trejo and her colleagues found what they consider evidence for publication bias in favor of studies that support kin avoidance, indicating that a distaste for incestuous relationships may be even rarer in animals than their data suggest.

The Scientist spoke with Vega-Trejo about the results.

The Scientist: Why might mating with relatives be an issue for animals?

Regina Vega-Trejo: If you think about how populations are becoming smaller and more fragmented, the fact that animals choose a related mate might mean that the genetic diversity might be lower. . . . Animals mating with a relative, it might not be bad for themselves, but their offspring might be less fertile, or might have a shorter lifespan, for example.

TS: But it really depends, right?

RV-T: Yeah . . . it can depend on whether the animals disperse. If one sex, for example, in a certain population stays, and the other one goes away, then they may be less likely to actually encounter related individuals. There's the range of conditions that can affect who animals decide to mate with.

TS: How did you decide to approach this overall question of whether animals avoid inbreeding?

RV-T: We knew that there were a lot of studies made on single species, but that didn't answer, 'Do animals, overall, avoid inbreeding?' That's why we did a meta-analysis. And what that does is that it summarizes a lot of studies so we can actually then answer the bigger question.

TS: And in your data, do they?

RV-T: What we found is that they don't differentiate. When making a decision to choose between an unrelated and a related individual, they don't seem to care.

Of course, we're looking across a lot of studies. I think what's important to keep in mind is that, in seventy percent of the studies, they didn't care. Of course, some did avoid inbreeding, and then some preferred inbreeding. But when you do these studies, what you really focus on is the average, and in seventy percent of our studies, they didn't care… they basically just want to mate.

TS: You said some seem to prefer inbreeding. Why might that be?

RV-T: One of the things to keep in mind is that when you make a decision to mate or to reproduce, what you basically want is to pass on your genes. And half of your genetic material will go to your offspring, but the other half of the genetic material will come from your partner. And if you mate with your brother, for example, you're actually passing on more genes that belong to you [because he has some of the same genes]. So, that might be one of the things that animals—I mean, they don't think or consider—but that's one of the advantages [of inbreeding].

TS: Where did people fall on this spectrum?

RV-T: We decided to include humans, but I need to highlight that it's a very unnatural setting. The only studies we were able to include in our study were those where people have manipulated images. What you do [in these studies is] compare images that look more like yourself, versus those images that are far away from that. So, you have different levels of relatedness. And what we did was compared that setting against animals that use visual signals. What we found was that there, again, was no difference. Humans, as well, fell into that particular category—they didn't care whether it was related or unrelated.

Keywords:
animal behavior, bias, **evolution**, genetics & genomics, human behavior, inbreeding, incest, mate preferences, mating behavior, meta-analyses, publication bias, publishing, Q&A, research integrity, **zoology**

Of course, we would have loved to have different experiments, but human studies come with their own caveats. There's a lot of ethical issues. So, of course, there are way more cues that humans use [when choosing a mate]. But it's a bit more difficult to do those experiments with humans.

> **In seventy percent of our studies, they didn't care . . . they basically just want to mate.**

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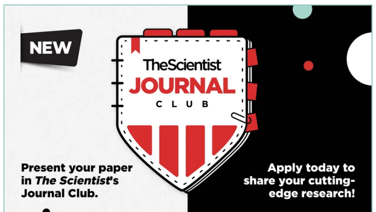

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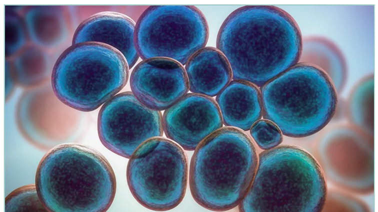

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The Evolutionary Shaping of Modern Whales

A survey of more than 200 whale skulls has unveiled bursts of evolution over the past 50 million years.

Connor Lynch

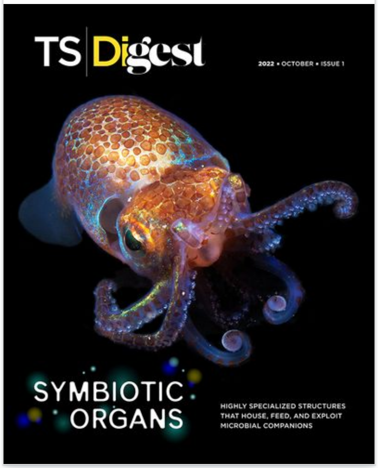
Oct 3, 2022 | 4 min read

PDF VERSION

Whales are weird. The Cetacea clade contains the largest animal to ever live—the blue whale—as well as other gigantic baleen whales and a diverse array of toothed whales, including dolphins, porpoises, narwhals, sperm whales, and more. The group contains some of the only fully aquatic mammals that give birth to live young in saltwater. Whales' nostrils are on the tops of their heads. The list of bizarre

ABOVE:
A blue whale (*Balaenoptera musculus*)

characteristics goes on.



Whales' skulls are one of their crowning oddities. Skulls in general are a paleontological treasure trove, explains paleontologist and macroevolutionary ecologist Ellen Coombs, a postdoc at the National Museum of Natural History. They host the brain, the sensory organs, and the teeth, all of which can tell researchers about the animals' behavior and diet. For several years now, Coombs has been studying whale skull peculiarities—such as the structure's unusual asymmetry in some species—and their implications for cetacean evolution.

She first started collecting 3D scans of whale skulls in 2018, when she was a PhD student at the Natural History Museum in London. She aimed to collate data on skulls that came from not only different periods across whales' evolutionary history, but also various geographies, from Europe and North America to Peru and New Zealand. The basic procedure was straightforward. Using a 3D scanner, she'd take several images, then process them, clean them up, and merge them into a single, coherent 3D model.

> **Whales' cranial evolution came in three waves.**

That's easier said than done when you're scanning hundreds of skulls, especially when they're from whales. The skull of a vaquita (*Phocoena sinus*), the world's smallest cetacean, is pretty manageable, as it's around the size of a melon. But the skull of a blue whale (*Balaenoptera musculus*) is more on the scale of a family sedan. Scanning a single skull could take Coombs anywhere from 30 minutes to an entire day.

Once she'd assembled the images, Coombs could place digital markers on them to note the position of particular structures. For each of the 200 or so skulls she studied, she placed more than 2,000 markers, for more than 400,000 markers in total. "It took me the good part of a year to finish," she says. Coombs adds that she also listened to a lot of podcasts during that time.

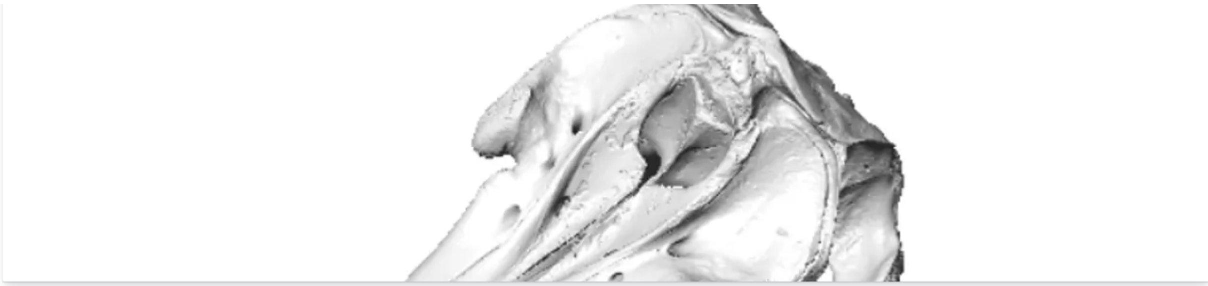
Some findings jumped out right away, she notes. For example, the odontocetes, or toothed whales, "have very asymmetrical skulls." In 2020, Coombs coauthored a paper on some of her initial findings, which revealed that skulls of the toothed whales had evolved to accommodate the melon, a mass of fatty tissue that amplifies the high-pitched calls that these whales produce for echolocation.

Ellen Coombs uses a 3D scanner on skulls at the Los Angeles County Museum of Natural History.
VANESSA RHUE, LOS ANGELES COUNTY MUSEUM

Looking deeper by mapping the skull markers onto the cetacean phylogenetic tree, she and a team of fellow whale experts and evolutionary modelers could infer when particular changes in structure had taken place—and how quickly. The findings, published this year, show that whales' cranial evolution came in three waves. The first was right at the beginning of whale evolution, just shy of 50 million years ago, when the archaeocetes—the ancestors of modern cetaceans, which emerged in the Eocene Epoch—were first entering the water. "Within eight to twelve million years," she says, "they went from being fully terrestrial to fully aquatic."

The next major shift came roughly 39 million years ago when the two suborders of whales—the mysticetes (baleen whales) and the odontocetes—went their separate ways. The baleen whales began developing the long keratin sheets that enable filter feeding. That carried on until about 23 million years ago, when their rate of skull evolution slowed to a crawl. The toothed whales, meanwhile, developed echolocation, which enabled them to hunt in low-light conditions and in difficult terrain, such as murky rivers clogged with rocks or ice.

In the final wave of evolution, from roughly 18 million to 10 million years ago, there was an explosion in diversity among the toothed whales. Echolocation, unlike baleen, was a tool that could help the animals exploit many different niches, Coombs explains, thereby encouraging new adaptations and creating new species, from the river dolphins to the deep-diving sperm whales.



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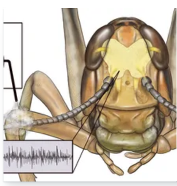

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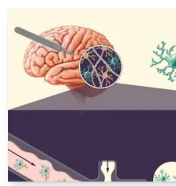

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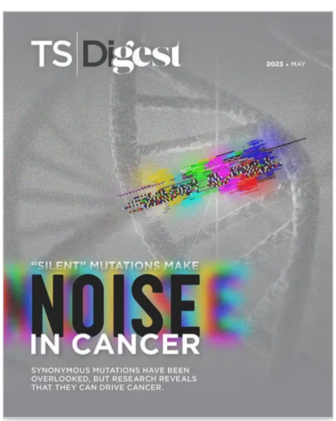

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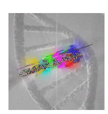

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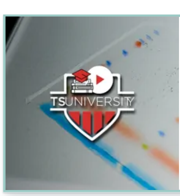

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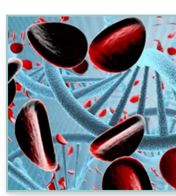

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