ing permission to study Kennewick Man, a 9000-year-old skeleton found in 1996 in Washington state.

Anthropologist Alan Goodman of Hampshire College in Amherst, Massachusetts, agrees with Gravlee that it's risky to rely on cranial data to identify the origins of long-gone populations. "The evidence does suggest that crania do change," he says. "If you want to apply [craniometrics] to Kennewick Man and you know there's instability over a 10-year period, what can you expect over a 9000-year period?" Sparks responds that the instability is largely owing to genetic changes, not plasticity, and that a common ancestor can still be inferred by comparing an ancient skull with a modern one that resembles it.

Heavy media coverage of the Sparks paper prompted the American Anthropological Association to post the Gravlee paper, scheduled for March 2003, on its Web site. The two authors will go head-to-head again in June when the *American Anthropologist* revisits the issue. **–CONSTANCE HOLDEN**

EVOLUTIONARY BIOLOGY

Placentas May Nourish Complexity Studies

It's one of the oldest riddles in evolutionary biology: How does natural selection gradually create an eye, or any complex organ for that matter? The puzzle troubled Charles Darwin, who nevertheless gamely nailed together a ladder of how it might have happened—from photoreceptor cells to highly refined orbits—by drawing examples from living organisms such as mollusks and arthropods. But holes in this progression have persistently bothered evolutionary biologists and left openings that creationists have been only too happy to exploit. Now a team of researchers presents a model system for studying the evolution of complex organs—in this case, the placenta—that Darwin could only dream about.

"Darwin had to use organisms from different classes," explains David Reznick, an evolutionary biologist at the University of California (UC), Riverside, "because there isn't a living group of related organisms that have all the steps for making an eye." And there's no way to put Darwin's solution on firm scientific footing through experiments, Reznick notes, because the organisms in his model are so distantly related to one another.

On page 1018, Reznick and his colleagues propose that guppylike fish in the genus *Poeciliopsis* can solve such problems for the placenta and, by extension, other complex organs. Placentas have evolved independently three times in closely related *Poeciliopsis* species, they report. Other species in the genus lack placentas, and some have partial maternal provisioning by means of tissues that might be precursors of placentas. Thus the fish present the full trajectory of steps involved in the evolution of this organ, Reznick says, allowing researchers to "see what's been added, or what has changed, and eventually identify the genes associated with the evolution of each trait." Adds Stephen Stearns, an evolutionary biologist at Yale University, "Since these placentas have evolved multiple times, we now have a promising model that can be explored and manipulated in the lab—something we've needed for a long time."

Placentas serve as a decent stand-in for eyes and other complex organs such as the heart or kidney whose histories evolutionary biologists have never been able to trace, Reznick and colleagues argue. By definition, complex organs are composites of independently derived features; for instance, the human eye focuses light and also perceives color. In the case of the placenta, the organ provides nutrients for the fetus while simultaneously managing waste products and regulating gas exchanges. Evidence of the intermediate steps for acquiring such organs is missing from the fossil record, enabling creationists to claim they were "created" de novo.

Reznick began to suspect that the poeciliid fish and their placentas could serve as a model for addressing thorny evolutionary questions 15 years ago, while writing a review of live-bearing fish. Earlier this year, one of his co-authors, Mariana Mateos of the Monterey Bay Aquarium Research Institute in Moss Landing, California, developed a phylogenetic tree for *Poeciliopsis*. By combining the tree with Reznick's earlier research and phylogenetic analysis by UC Riverside's Mark Springer, the team now demonstrates that there were three independent origins for placentas in six species of *Poeciliopsis*.

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Recurring theme. Placentas (left) that provision embryos (right) have evolved three times in *Poeciliopsis* fish.

The team also estimates the amount of time required for the separation of the poeciliid species. They based their clock on the rate of mutations in the fishes' mitochondrial DNA and incorporated dates of geological events that probably led the species to diverge. The shortest time interval between a poeciliid species with a placenta and its last common ancestor without one was 750,000 years—a period in keeping with the 400,000 years other researchers have calculated for the evolution of the eye. Despite this relatively short period, "it's not a problem for evolution to create this kind of complexity," says Stearns.

Other researchers, such as Günter Wagner, an evolutionary biologist who is also at Yale, caution that Reznick has yet to demonstrate convincingly that the poeciliids' placenta is a complex organ. But even with this caveat, Wagner concedes that the poeciliid model offers evolutionary biologists a rare opportunity: "We should welcome any model, and especially one like this that has several related species with all the variations in the evolution of this trait."

Reznick admits that the poeciliid placenta might not be as sophisticated as the mammalian placenta. But like the evolution of the eye, the evolution of the mammalian placenta is lost in history. "We can't ask how this kind of adaptation evolved with mammals because it only happened once over 100 million years ago," he says. The answer might come instead from small, guppylike fish. **–VIRGINIA MORELL**

PFIESTERIA DEBATE

Is Sugary Toxin the Smoking Gun?

A team of researchers claims to have found more support for the controversial assertion that a toxic microbe called *Pfiesteria* is responsible for massive fish die-offs along the eastern United States. But the new studies, which include the first rough sketch of the toxin, have failed to convince skeptics.

For 10 years, aquatic ecologist JoAnn Burkholder of North Carolina State University in Raleigh has argued that a potent neurotoxin from the dinoflagellate *Pfiesteria* has killed more than a billion fish in East Coast estuaries and sickened lab workers and fishers. However, the toxin has not been identified. This past summer, doubts escalated when researchers at the Virginia Institute of Marine Science (VIMS) in Gloucester Point and other universities reported in two top journals that