The Y copies another chromosome's gene

The human Y chromosome is both a degenerate and a copycat.

The first accusation is an old one. Scientists believe this male chromosome once had thousands of genes in common with the X chromosome, the other mammalian sex chromosome. Early in mammalian evolution, however, the Y chromosome apparently began to degenerate rapidly. Today, it's a shadow of its former self, containing at most several dozen functional genes.

The copycat allegation is new. Researchers studying a recently discovered gene on the Y chromosome have concluded that it originated from a similar gene on chromosome 3. The new finding may support an old theory that the Y offers a home to genes beneficial to male fitness or fertility.

The gene in question is known as *DAZ.* A group headed by David C. Page of the Howard Hughes Medical Institute at the Whitehead Institute for Biomedical Research in Cambridge, Mass., has found that the region of the Y chromosome containing *DAZ* is sometimes missing in men with very low sperm counts and in men unable to make any sperm, a condition known as azoospermia (SN: 5/18/96, p. 310). The group contends that *DAZ,* which stands for deleted in azoospermia, may play a crucial role in the formation of sperm.

Other researchers have shown recently that the fruit fly and mouse versions of *DAZ* reside not on the sex chromosomes but on the animal's other chromosomes, known as autosomes.

Intrigued by this finding, Page's group looked through the human genome for copies of *DAZ.* They found an almost identical gene, which they call *DAZH,* on chromosome 3 and discovered that the Y chromosome actually holds several copies of the *DAZ* gene.

After analyzing the DNA sequences of *DAZ* and *DAZH,* the team found evidence that *DAZH* was the original gene. Sometime during primate evolution, a copy of *DAZH* apparently jumped to the Y chromosome, where the gene was subsequently duplicated several times to form the cluster of *DAZ* genes.

Page and his colleagues suggest that this finding is at odds with theories that the Y chromosome, once it started evolving separately from the X chromosome, only degenerated. The transfer of autosomal genes to the Y chromosome may have countered this deterioration somewhat, they say.

"The case of human *DAZ* challenges the prevailing view that most, if not all, Y chromosomal genes were once shared with the X chromosome. . . . We speculate that the direct acquisition of autosomal genes that enhance male fertility is an important component of Y chromosome evolution," the investigators conclude in the November NATURE GENETICS.

"The Y chromosome should be a hot spot for male-benefit genes," agrees William R. Rice of the University of California, Santa Cruz.

Rice notes that a theory arguing that the Y chromosome will accumulate genes that are beneficial to males but potentially detrimental to females dates back more than 60 years. In a recent test of this idea, Rice added synthetic Y-like chromosomes to fruit flies and bred the insects for many generations. The synthetic sex chromosome did indeed pick up genes that improved male fitness and would be harmful to female fitness, says Rice. *—J. Travis*

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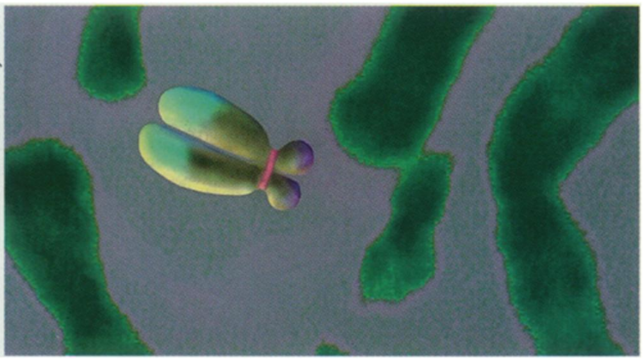


The human Y chromosome (center) harbors a gene copied from a chromosome 3 gene.

Early kin of vertebrates found in China

Looking something like a tiny squashed eel, a newfound fossil from southwest China will not win any beauty contests. Yet this 530-million-year-old specimen from Earth's Cambrian period holds a special allure for paleontologists. It may be the oldest known chordate, the phylum to which humans and all other vertebrates belong.

"We've managed to push the story back considerably," says Simon Conway Morris, a paleontologist at the University of Cambridge in England, who collaborated with D.-G. Shu and X.-L. Zhang at Northwest University in Xian, China. They describe the 2.2-centimeter-long animal, named *Cathaymyrus diadexus,* in the Nov. 14 NATURE.

Before the discovery of *Cathaymyrus,* the oldest fossil generally recognized as a chordate was the 520-million-year-old *Pikaia* from Canada's Burgess Shale fossil beds.

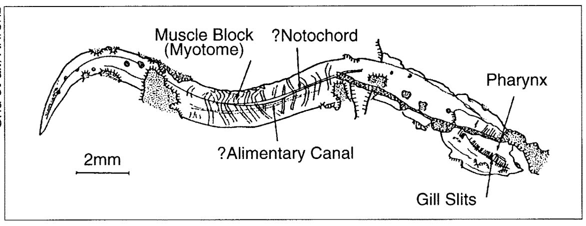
Cathaymyrus comes from the Chengjiang fossil site in Yunnan Province and has a number of key chordate features, according to the researchers. Along its abdomen, the creature has V-shaped segments that closely resemble the stacked muscle blocks in primitive living chordates such as amphioxus. The Chengjiang fossil also has a creaselike impression running partway down the back of its body. The scientists interpret this as the imprint left by the animal's notochord—a rodlike structure in primitive chordates that is related to the backbone of vertebrates.

The new fossil is not the only potential chordate from Chengjiang. Last year, paleontologists identified a creature called *Yunnanozoon* as the earliest known chordate (SN: 2/3/96, p. 74). But Shu and others contested that interpretation, arguing in the April 4 NATURE that *Yunnanozoon* was a hemichordate, a separate phylum that includes the modern acorn worm.

Although the two phyla appear quite different today, chordates are often linked with the hemichordates and another dissimilar phylum, the echinoderms, which include starfish. All three share a distinctive pattern of embryo development, suggesting a common ancestry. Scientists debate, however, how chordates evolved from such improbable stock.

The Chengjiang animals lived only a few million years after the Cambrian explosion, a biological Big Bang during which most modern animal phyla suddenly appeared in the fossil record. By pushing the record of chordates so close to this pivotal event, the new discovery "accentuates the speed of the diversification," says Conway Morris. He notes, however, that a controversial gene study, published in the Oct. 25 SCIENCE, suggests that modern animal phyla arose about a billion years ago, much earlier than the Cambrian explosion. *—R. Monastersky*

Shu *et al.*/NATURE



Drawing of chordate fossil from China.

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