Behavior of parent organisms may influence genes passed on to next generation

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Timing is everything, and if there was ever a scientist whose legacy was tarnished by bad timing, it was Jean Baptiste Lamarck. The French naturalist lived from 1744 to 1829 - and published his own evolutionary theory decades before Darwin's theory went public in 1859.

In the popular imagination, those who've heard of Lamarck tend to associate him with a wrongheaded version of evolution in which giraffes can grant their offspring longer necks by reaching for high leaves. Historians say this unfair portrayal was engineered by Lamarck's enemies.

Lamarck's name was in the news recently when Columbia University Medical Center researchers published work they said could be viewed as a partial vindication of so-called Lamarckian evolution - a term that's come to mean the inheritance of acquired traits, no DNA needed.

In this case, flatworms were exposed to viruses; they mounted a defensive mechanism, and then passed that immunity down through several generations of offspring.

This is not exactly a vindication of Lamarck, because he did not invent what people think of as Lamarckian evolution, said historian Robert Richards of the University of Chicago.

It was popular wisdom in Lamarck's time that offspring could inherit acquired traits, Richards said. Lamarck's error was in accepting that, but

then Darwin did, too.

What Lamarck should be remembered for was proposing that living things evolved and that over long periods of time this process could transform one species into another.

In Lamarck's time, the general view among naturalists was that God had created each species, said Richards. Lamarck's writings were courageous in light of this, and he was mercilessly attacked by the most eminent French naturalist of the time, Georges Cuvier, who embraced a creationist view. Cuvier, said Richards, "was Lamarck's greatest nemesis."

The other famous proponent of evolution in the 1700s was Darwin's own grandfather, Erasmus, though the earlier Darwin's ideas were considered less systematic than Lamarck's.

Lamarck had earned renown as a botanist, and in studying animals, was first to draw the distinction between vertebrates and invertebrates. His theory of evolution was based partly on his study of seashells, where he noted a gradation of traits from one species to another.

Charles Darwin tried to distance his own theory from the much-derided Lamarck's. Darwin also recognized two key factors in making his theory the long-term winner. First, Darwin saw a common origin of all living things, all branching out in one tree of life. Lamarck thought there were multiple origins of life, each one starting a trajectory from simple creatures to more complex ones.

Even more importantly, Darwin figured out the mechanism known as natural selection - animals vary in their traits through chance, and those individuals that do best at survival and reproduction proliferate and pass on those advantageous traits.

Darwin recognized the importance of chance variation, but he didn't discount the possibility that an animal's "use or disuse" of an organ could influence future generations. Darwin wrote that his own good handwriting could be attributed to the years of practice his father put into his own writing, Richards said.

"It's an idea that seemed so intuitively clear," he said. "The sons of blacksmiths usually did have big arms." The image that's often associated with Lamarck of giraffes stretching their neck goes back to a cartoon in a French magazine lampooning Lamarck, but what they were deriding was evolution.

Columbia biologist Oliver Hobert did the work in worms that seemed to support the spirit of Lamarck. He said his project involved a common mechanism by which worms defend themselves against viral infections. They make little fragments of RNA - a single-stranded relative of DNA.

The worm can use the genetic code of the virus to make these bits of RNA specifically attack the infection. "It's like a vaccine," he said, except that worms apparently inherit it from their parents. He showed this by genetically modifying worms so that one of their two copies of a gene for making small RNAs was destroyed. That meant that some of their offspring would inherit two bad copies of the gene and should not be able to make these virus-fighting molecules themselves.

And yet, said Hobert, all the offspring were able to attack viruses with small RNAs, meaning some of them inherited these molecules directly. These same virus-fighting molecules were transferred down the line four or five generations.

There are hints that other acquired traits can be passed down. Penn biologist Tracy Bane has shown that stress in male mice can influence the size of their offspring, and feeding a high-fat diet to females can

influence the offspring of their offspring.

All this shows Lamarck was not so wrong to have assumed nurture could be passed down as nature. But his name should be remembered for the idea he got right - the birth of new species through evolution.

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