Biologists find gene network that gave rise to first tooth

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A paper in this week's *PLoS Biology* reports that a common gene regulatory circuit controls the development of all dentitions, from the first teeth in the throats of jawless fishes that lived half a billion years ago, to the incisors and molars of modern vertebrates, including you and me.

"It's likely that every tooth made throughout the evolution of vertebrates has used this core set of genes," said Gareth Fraser, postdoctoral fellow at Georgia Tech's School of Biology.

The first vertebrates to have teeth were a group of eel-like jawless fish known as the conodonts that had teeth not in their mouth, but lining the throat. This particular group is long since extinct, but some modern fish retain teeth in the throat (pharynx). Dr. Fraser and colleagues studied tooth formation in a group of fish known for their rapid rate of evolution, the cichlids of Africa's Lake Malawi. The cichlids have teeth both in their oral jaws, like humans, and deep in their throats on a pharyngeal jaw. A co-author of the paper, Darrin Hulsey, first identified a surprising positive correlation between the number of teeth in the oral jaw and in the throat in these fish.

"Originally, I thought there wouldn't be a correlation due to the developmental differences and the evolutionary distinction between the two jaw regions, but it turns out there is," explained Fraser. "So fish that have fewer oral teeth also have fewer pharyngeal teeth. This shows that on some level there's a genetic control that governs the number of teeth

in both regions."

The team investigated what this control might be by using a technique localizing gene expression in the cells during tooth development, known as in situ hybridization, and found that a common genetic network governs teeth in the two locations.

"So seemingly, regardless of where you grow a tooth, whether it's in the jaw or the pharynx, you use the same core set of genes to do it," said co-author J. Todd Streelman. "We also think it's probable that this network is not just acting in teeth, but also in other similarly patterned structures like hair and feathers."

Citation: Fraser GJ, Hulsey CD, Bloomquist RF, Uyesugi K, Manley NR, et al. (2009) An ancient gene network is co-opted for teeth on old and new jaws. *PLoS Biol* 7(2): e1000031. doi:10.1371/journal.pbio.1000031
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