

# 'Left-handed' fish and asymmetrical brains

November 15, 2017








Cichlids of the *Perissodus microlepis* species endemic to Lake Tanganyika in Africa. Credit: University of Konstanz

To humans, being right-handed or left-handed plays an important role. The majority of people are right-handed, while only about 3 percent of people innately use both hands equally well. Preferring one side of the body over another is not unique to humans: the phenomenon occurs in the animal kingdom as well, for instance in great apes or birds, although their "handedness" is typically not as obvious as it is in humans.

"Handedness" is particularly pronounced in cichlid fish of the species *Perissodus microlepis*, which is endemic to Lake Tanganyika in Africa. This cichlid is highly specialised, living exclusively on the scales of other fish obtained from only one side of the bodies of their prey. When hunting, not only do individual fish display a pronounced predilection for attacking their prey from one direction, this preference is also mirrored by the shape of their heads. Many individuals of this cichlid have asymmetrical jaws that

bend to the left or right.

Biologists from the University of Konstanz examined the relationship between the cichlids' preference for one side, the structure of their brains and their gene expression. A team led by Professor Axel Meyer, Professor of Zoology and Evolutionary Biology at the University of Konstanz, was able to demonstrate that the preference for one side in the animal's feeding behaviour correlates with a corresponding asymmetry of the cerebral hemispheres, as well as unequal gene expression between the hemispheres. The research results have been published in the current issue of *Genome Biology and Evolution*.

Featured	Last comments	Popular
	Musk beats deadline for building world's biggest battery	Nov 24, 2017 62
	Physicists make most precise measurement ever of the proton's magnetic moment	Nov 24, 2017 72
	High-speed quantum encryption may help secure the future internet	Nov 24, 2017 13
	Flies' disease-carrying potential may be greater than thought, researchers say	Nov 24, 2017 0
	'Trash islands' off Central America indicate ocean pollution problem	Nov 24, 2017 6
<a href="#">more »</a>		

Phys.org

[Phys.org on facebook](#)

"Our research helps us to understand handedness and hemispheric asymmetries better. We hope that our results also will contribute to further our understanding of handedness in humans," explains the Konstanz biologist Dr Ralf Schneider, who, along with Dr Hyuk Je Lee, is one of the lead authors of the study.

In their study, the biologists documented the preference for one side of approximately 40 individual cichlids, followed by an examination of their brains. "We found a clear asymmetry across the animals' brains, especially in the Tectum Opticum region of the brain. However, this asymmetry was present only in individuals who displayed a distinct preference for one side when hunting," says Ralf Schneider. The Tectum Opticum is the region in the brain responsible for processing vision. In the respective cichlids, the hemisphere of the Tectum Opticum that controls the eye on the preferred side of the body was more strongly developed than the other. Individuals that did not display a marked preference for one side showed greater symmetry within the Tectum Opticum. The same proved true for other regions of the animals' brains. "This is interesting because it suggests a functional relationship between the shape of the brain and behavioural laterality," says Schneider.



Cichlid fry with bent jaw. Credit: University of Konstanz

Analyses of the genes (gene expression profiling) across several parts of the brain showed which genes tend to be expressed more strongly in the respective regions of the brain. The analyses revealed similar patterns to what the researchers had found in the fishes' brains structures: in the Tectum Opticum region alone, as much as 140 genes showed differing activity in the two hemispheres – corresponding with the animals' preference for one side, gene activity in the respective hemispheres of the brain was increased or decreased. The most pronounced correspondence was determined for the gene synuclein gamma alpha (snca) – a particularly interesting result because previous studies on zebrafish have shown that this gene is expressed predominantly in the so-called habenula, a part of the brain that is asymmetric in all vertebrates, including humans. Besides synuclein gamma alpha, a range of other genes, some of which are associated with handedness and schizophrenia in humans, showed expression patterns in the brain hemispheres of the cichlids that suggest a link to handedness. There is reason to believe that some asymmetries in the brains of vertebrates could have originated in the habenula's asymmetry. The cichlids' preference for feeding on scales from just one side of their prey's body, as well as the asymmetrical shapes of their heads and brains, probably evolved due to the extremely fast "side-specific" development of gene regulation in their brains, the biologists suggest.

[Follow](#)

1.3M people are following [Phys.org](#). [Sign Up](#) to see who your friends are following.

#### Relevant PhysicsForums posts

[Why do Muscles Shake](#) 5 hours ago

[How the human MRCA possibly have lived just 3,000 years ago?](#) Nov 24, 2017

[Neuron lengths, sizes and quantity](#) Nov 23, 2017

[Humans in the Americas 130,000 years ago?](#) Nov 22, 2017

[All Things Sweet May Not Necessarily Be Sweet to You](#) Nov 22, 2017

[Is water really necessary for life?](#) Nov 21, 2017

[More from Biology and Medical](#)

Explore further: 'Handedness' in scale-eating fish

**More information:** Hyuk Je Lee et al. Lateralized Feeding Behavior Comes with Asymmetrical Neuroanatomy and Lateralized Gene Expressions in the Brain in Scale-Eating Cichlid Fish, *Genome Biology and Evolution* (2017). DOI: 10.1093/gbe/evx218


Provided by: [University of Konstanz](#)

3 shares

[feedback to editors](#)

6

Like



Tweet

↑

submit

↓

reddit

Favorites

Email

Print

PDF

Related Stories



'Handedness' in scale-eating fish

September 14, 2017

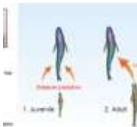
Two researchers from Nagoya University and the University of Toyama find scale-eating fish have a naturally stronger side for attacking prey fish, and learn to use the dominant side through experience.



Galapagos study finds that new species can develop in as little as two generations

November 23, 2017

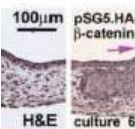
The arrival 36 years ago of a strange bird to a remote island in the Galapagos archipelago has provided direct genetic evidence of a novel way in which new species arise.



Research team sheds light on 'rightie' or 'leftie' behavior in a scale-eating cichlid

February 26, 2016

Behavioral laterality, or left- or right-handedness, has been reported in many animals, including humans, chimpanzees, toads, rats, mice, and invertebrates such as crustaceans and insects. The existence of this phenomenon ...



Using modern genomics to turn alligator scales into birdlike feathers

November 23, 2017

Upon first glance, most people wouldn't think alligators or birds were evolutionary cousins. But indeed, reptiles are the closest living relatives of birds, and all descended from the archosaurs, the "ruling reptiles" who ...

A possible explanation for how

User comments

Please sign in to add a comment. Registration is free, and takes less than a minute. [Read more](#)

email

password

Sign in

[Click here](#) to reset your password.  
Sign in to get notified via email when new comments are made.

Trending News

Powered by Ideal Media



End Of The Dream? Elon Musk’s Financial Woes Begin To Mount

Elon Musk’s empire, built with the help of government subsidies, is ...



A Determined Bengal Cat Skillfully Carries Matching Bed Upstairs

A beautiful and determined Bengal cat decided that she wanted to get away ...



Billy The Kid Photo Is Real, Experts Say, May Be Worth Millions

A photo of Billy the Kid bought for \$10 at a flea market is the real deal ...



Soros sells Twitter, Facebook, Apple and Snap

George Soros’s hedge fund, Soros Fund Management LLC, eliminated or reduced ...



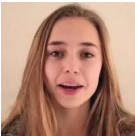
Where Did The Neanderthals Go?

Neanderthals – so named because their remains were first discovered in the ...



10 Signs You May Have Cancer

As a rule, cancer is hard to detect in its early stages



A Father Creates An Amazing Timelapse Of His Daughter Aging

Dutch photographer and filmmaker Frans Hofmeester filmed his lovely ...



Scientists Find Underwater City Built by Octopuses

Marine biologists have discovered a veritable underwater ‘settlement’ ...

<a href="#">Top</a>	<a href="#">Help</a>	<a href="#">Science X Account</a>	<a href="#">Feature Stories</a>	<a href="#">Android app</a>	<a href="#">Connect</a>
<a href="#">Home</a>	<a href="#">FAQ</a>	<a href="#">Sponsored Account</a>	<a href="#">Latest news</a>	<a href="#">iOS app</a>	
<a href="#">Search</a>	<a href="#">About</a>	<a href="#">Newsletter</a>	<a href="#">Week’s top</a>	<a href="#">Amazon Kindle</a>	
<a href="#">Mobile version</a>	<a href="#">Contact</a>	<a href="#">RSS feeds</a>	<a href="#">Archive</a>	<a href="#">Push notification</a>	