

GEPHE SUMMARY

	Gephebase Gene	GephelD
chordin (https://www.gephebase.org/search-criteria?/and+Gene Gephebase="chordin">#gephebase-summary-title)	GP00002346	Main curator
Published	Entry Status	Courtier

PHENOTYPIC CHANGE

	Trait Category
Morphology (https://www.gephebase.org/search-criteria?/and+Trait Category="Morphology">#gephebase-summary-title)	Trait
Fin morphology (skeleton; dorsal fin; caudal fin; tail; paired fin) (https://www.gephebase.org/search-criteria?/and+Trait=^Fin+morphology (skeleton; dorsal fin; caudal fin; tail; paired fin))#gephebase-summary-title)	Trait
non bifurcated caudal axial skeleton	Trait State in Taxon A
wild goldfish	Trait State in Taxon B
twin tail, bifurcated caudal axial skeleton	Ancestral State
domesticated twin-tail goldfish	
Taxon A	Taxonomic Status

Taxon A	Latin Name	Taxon B	Latin Name
Carassius auratus (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Carassius+auratus #gephebase-summary-title)		Carassius auratus (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Carassius+auratus #gephebase-summary-title)	
goldfish	Common Name	goldfish	Common Name
Carassius carassius auratus; Cyprinus auratus; goldfish; Carassius auratus (Linnaeus, 1758); Cyprinus auratus Linnaeus, 1758; Carassius auratus	Synonyms	Carassius carassius auratus; Cyprinus auratus; goldfish; Carassius auratus (Linnaeus, 1758); Cyprinus auratus Linnaeus, 1758; Carassius auratus	Synonyms
species	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Otomorpha; Ostariophysi; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Cyprininae; Carassius	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Otomorpha; Ostariophysi; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Cyprininae; Carassius	Lineage
Carassius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7956)	Parent	Carassius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7956)	Parent
7957 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7957)	NCBI Taxonomy ID	7957 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7957)	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	No	is Taxon B an Infraspecies?

GENOTYPIC CHANGE

chdA	Generic Gene Name	UniProtKB Carassius auratus
-	Synonyms	GenebankID or UniProtKB
-	String	
Belongs to the chordin family.	Sequence Similarities	
-	GO - Molecular Function	
-	GO - Biological Process	
GO:0007389 : pattern specification process (https://www.ebi.ac.uk/QuickGO/term/GO:0007389)		

Yes (#gephebase-summary-title)	Presumptive Null
Coding (#gephebase-summary-title)	Molecular Type
SNP (#gephebase-summary-title)	Aberration Type
Nonsense	SNP Coding Change
stop codon in codon 127. GAG (E) → TAG (STOP). Predicted to result in a truncated protein lacking the second to fourth CR domains.	Molecular Details of the Mutation
Candidate Gene (#gephebase-summary-title)	Experimental Evidence

Taxon A	Taxon B	Position
Codon	GAG	-
Amino-acid	Glu	127

The origin of the bifurcated axial skeletal system in the twin-tail goldfish. (2014) (https://pubmed.ncbi.nlm.nih.gov/24569511)	Main Reference
Abe G; Lee SH; Chang M; Liu SC; Tsai HY; Ota KG	Authors
Twin-tail goldfish possess a bifurcated caudal axial skeleton. The scarcity of this trait in nature suggests that a rare mutation, which drastically altered the mechanisms underlying axial skeleton formation, may have occurred during goldfish domestication. However, little is known about the molecular development of twin-tail goldfish. Here we show that the bifurcated caudal skeleton arises from a mutation in the chordin gene, which affects embryonic dorsal-ventral (DV) patterning. We demonstrate that formation of the bifurcated caudal axial skeleton requires a stop-codon mutation in one of two recently duplicated chordin genes; this mutation may have occurred within approximately 600 years of domestication. We also report that the ventral tissues of the twin-tail strain are enlarged, and form the embryonic bifurcated fin fold. However, unlike previously described chordin-deficient embryos, this is not accompanied by a reduction in anterior-dorsal neural tissues. These results provide insight into large-scale evolution arising from artificial selection.	Abstract
The Genetic Basis of Morphological Diversity in Domesticated Goldfish. (2020) (https://pubmed.ncbi.nlm.nih.gov/32392470)	Additional References

RELATED GEPHE

2 (Potassium channel subfamily K, Wnt receptor) (#gephebase-summary-title)	Related Genes
No matches found.	Related Haplotypes

EXTERNAL LINKS

COMMENTS

GWAS was performed in the Kon et al. 2021 study and found strong association. Twin-tail individuals are homozygous for the mutation. Twin-tail goldfish share three characteristic phenotypes (accumulation of blood cells, bifurcated fin folds and skeletal defects in the vertebral column) with the zebrafish chordin mutant.