

GEPHE SUMMARY

	Gephebase Gene	
BCO2 = beta-carotene oxygenase 2 (<a +bco2+beta-carotene+oxygenase+2+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+BCO2+beta-carotene+oxygenase+2+"#gephebase-summary-title)	GP00000139	GepheID
Published	Entry Status	Main curator
	Martin	

PHENOTYPIC CHANGE

Trait Category

Morphology, Physiology ([https://www.gephebase.org/search-criteria?/and+Trait+Category="+Morphology+and+Physiology+"#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Trait+Category=))

Trait

Carotenoid content (skin ; shanks) ([https://www.gephebase.org/search-criteria?/and+Trait="+Carotenoid+content+\(skin+;+shanks\)+"#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Trait=))

Trait State in Taxon A

Domestic chicken breeds and red jungle fowl with white skin and shanks

Trait State in Taxon B

Breeds with yellow skin and shanks

Ancestral State

Taxon A

Taxonomic Status

Interspecific ([https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Interspecific+"#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=))

Taxon A	
Latin Name	
Gallus gallus (<a +gallus+gallus+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Gallus+gallus+"#gephebase-summary-title)	
Common Name	
chicken	
Synonyms	
Gallus gallus domesticus; chicken; bantam; chickens	
Rank	
species	
Lineage	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Archelosauria; Archosauria; Dinosauria; Saurischia; Theropoda; Coelurosauria; Aves; Neognathae; Galloanserae; Galliformes; Phasianidae; Phasianinae; Gallus	
Parent	
Gallus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9030)	
NCBI Taxonomy ID	
9031 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9031)	
is Taxon A an Intraspecies?	
No	

Taxon B #1	
Latin Name	
Gallus sonneratii (<a +gallus+sonneratii+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Gallus+sonneratii+"#gephebase-summary-title)	
Common Name	
gray junglefowl	
Synonyms	
gray junglefowl	
Rank	
species	
Lineage	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Archelosauria; Archosauria; Dinosauria; Saurischia; Theropoda; Coelurosauria; Aves; Neognathae; Galloanserae; Galliformes; Phasianidae; Phasianinae; Gallus	
Parent	
Gallus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9030)	
NCBI Taxonomy ID	
9033 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9033)	
is Taxon B an Intraspecies?	
No	

Taxon B #2	
Latin Name	
Gallus gallus (<a +gallus+gallus+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Gallus+gallus+"#gephebase-summary-title)	
Common Name	
chicken	
Synonyms	
Gallus gallus domesticus; chicken; bantam; chickens	
Rank	
species	
Lineage	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Archelosauria; Archosauria; Dinosauria; Saurischia; Theropoda; Coelurosauria; Aves; Neognathae; Galloanserae; Galliformes; Phasianidae; Phasianinae; Gallus	
Parent	
Gallus () - (Rank: genus)	

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9030>)
 NCBI Taxonomy ID
 9031
 (<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9031>)
 is Taxon B an Intraspecies?
 Yes
 Taxon B Description
 domestic chicken breeds with yellow fat and shanks

GENOTYPIC CHANGE

BCO2
 BCDO2; B-DIOX-II
 9606.ENSPO0000350314
 (http://string-db.org/newstring_cgj/show_network_section.pl?identifier=9606.ENSPO0000350314)

Generic Gene Name
 Q9BYV7 (<http://www.uniprot.org/uniprot/Q9BYV7>)
 Synonyms
 0
 String

UniProtKB Homo sapiens
 GenebankID or UniProtKB

Sequence Similarities
 Belongs to the carotenoid oxygenase family.

GO - Molecular Function
 GO:0046872 : metal ion binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0046872>)
 GO:0003834 : beta-carotene 15,15'-monooxygenase activity
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0003834>)
 GO:0010436 : carotenoid dioxygenase activity
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0010436>)
 GO:0004744 : retinal isomerase activity
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0004744>)
 GO:0102076 : beta,beta-carotene-9',10'-cleaving oxygenase activity
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0102076>)
 GO:0016702 : oxidoreductase activity, acting on single donors with incorporation of molecular oxygen, incorporation of two atoms of oxygen
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016702>)

GO - Biological Process
 GO:0055114 : oxidation-reduction process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0055114>)
 GO:0001523 : retinoid metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0001523>)
 GO:0016121 : carotene catabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016121>)
 GO:0042574 : retinal metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0042574>)
 GO:0016119 : carotene metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016119>)
 GO:0016116 : carotenoid metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016116>)
 GO:0051881 : regulation of mitochondrial membrane potential
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0051881>)
 GO:2000377 : regulation of reactive oxygen species metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:2000377>)
 GO:0042573 : retinoic acid metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0042573>)
 GO:0016122 : xanthophyll metabolic process
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0016122>)

GO - Cellular Component
 GO:0005739 : mitochondrion (<https://www.ebi.ac.uk/QuickGO/term/GO:0005739>)
 GO:0005622 : intracellular (<https://www.ebi.ac.uk/QuickGO/term/GO:0005622>)
 GO:0005759 : mitochondrial matrix (<https://www.ebi.ac.uk/QuickGO/term/GO:0005759>)

Unknown (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=~Unknown~#gephebase-summary-title>)
 Cis-regulatory (<https://www.gephebase.org/search-criteria?/and+Molecular Type=~Cis-regulatory~#gephebase-summary-title>)
 Unknown (<https://www.gephebase.org/search-criteria?/and+Aberration Type=~Unknown~#gephebase-summary-title>)

Presumptive Null
 Molecular Type
 Aberration Type

Not identified
 Linkage Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=~Linkage Mapping~#gephebase-summary-title>)

Molecular Details of the Mutation
 Experimental Evidence

Identification of the yellow skin gene reveals a hybrid origin of the domestic chicken. (2008) (<https://pubmed.ncbi.nlm.nih.gov/18454198>)
 Eriksson J; Larson G; Gunnarsson U; Bed'hom B; Tixier-Boichard M; Str mstedt L; Wright D; Jungerius A; Vereijken A; Randi E; Jensen P; Andersson L

Main Reference
 Authors
 Abstract
 Yellow skin is an abundant phenotype among domestic chickens and is caused by a recessive allele (W*Y) that allows deposition of yellow carotenoids in the skin. Here we show that yellow skin is

caused by one or more cis-acting and tissue-specific regulatory mutation(s) that inhibit expression of BCDO2 (beta-carotene dioxygenase 2) in skin. Our data imply that carotenoids are taken up from the circulation in both genotypes but are degraded by BCDO2 in skin from animals carrying the white skin allele (W^W). Surprisingly, our results demonstrate that yellow skin does not originate from the red junglefowl (*Gallus gallus*), the presumed sole wild ancestor of the domestic chicken, but most likely from the closely related grey junglefowl (*Gallus sonneratii*). This is the first conclusive evidence for a hybrid origin of the domestic chicken, and it has important implications for our views of the domestication process.

Additional References

The Domestic BCO2 Allele Buffers Low-Carotenoid Diets in Chickens: Possible Fitness Increase Through Species Hybridization. (2019) (<https://pubmed.ncbi.nlm.nih.gov/31160321>)

RELATED GEPHE

1 (BCMO1) (<https://www.gephebase.org/search-criteria?/or+Taxon+ID=~9031^/and+Trait=Carotenoid+content/or+Taxon+ID=~9033^/and+Trait=Carotenoid+content/and+groupHaplotypes=true#gephebase-summary-title>)

Related Genes

No matches found.

Related Haplotypes

EXTERNAL LINKS

COMMENTS

@Introgression ; the mutation in BCO2 appeared first in the wild species *Gallus sonneratii* and then introgressed into a domesticated strain of chicken and gave the yellow skin phenotype.