

GEPHE SUMMARY

Gephebase Gene		GepheID
opsin - (SWS1) (<a (sws1)""="" +opsin+"-="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">#gephebase-summary-title)	GP00000761	
	Entry Status	Courtier
Published		Main curator

PHENOTYPIC CHANGE

Trait Category			
Physiology (<a +physiology"="" href="https://www.gephebase.org/search-criteria?/and+Trait+Category=">#gephebase-summary-title)		Trait	
Color vision (UV-shift) (<a +color+vision+(uv-shift)""="" href="https://www.gephebase.org/search-criteria?/and+Trait=">#gephebase-summary-title)			
Trait State in Taxon A			
Other birds		Trait State in Taxon B	
Rhea americana			
Ancestral State			
Taxon A		Taxonomic Status	
Intergeneric or Higher (<a +intergeneric+or+higher"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">#gephebase-summary-title)			
Taxon A		Taxon B	
Latin Name		Latin Name	
Aves (<a +aves"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">#gephebase-summary-title)		Rhea americana (<a +rhea+americana"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">#gephebase-summary-title)	
Common Name		Common Name	
birds		greater rhea	
Synonyms		Synonyms	
avian; birds		greater rhea; common rhea	
Rank		Rank	
class		species	
Lineage		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		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; Palaeognathae; Rheiformes; Rheidae; Rhea	
Parent		Parent	
Coelurosauria () - (Rank: no rank) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 436492)		Rhea () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8796)	
NCBI Taxonomy ID		NCBI Taxonomy ID	
8782 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8782)		8797 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8797)	
is Taxon A an Intraspecies?		is Taxon B an Intraspecies?	
No		No	

GENOTYPIC CHANGE

Generic Gene Name		UniProtKB Homo sapiens
OPN1SW		P03999 (http://www.uniprot.org/uniprot/P03999)
Synonyms		GenebankID or UniProtKB
BCP; BOP; CBT		AAP23986 (https://www.ncbi.nlm.nih.gov/nuccore/AAP23986)
String		
9606.ENSPP00000249389 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=9606.ENSPP00000249389)		
Sequence Similarities		
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.		
GO - Molecular Function		
GO:0038023 : signaling receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0038023)		
GO:0008020 : G protein-coupled photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008020)		
GO - Biological Process		
GO:0007165 : signal transduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007165)		

GO:0007186 : G protein-coupled receptor signaling pathway
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007186>)
GO:0001523 : retinoid metabolic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001523>)
GO:0018298 : protein-chromophore linkage
(<https://www.ebi.ac.uk/QuickGO/term/GO:0018298>)
GO:0007601 : visual perception (<https://www.ebi.ac.uk/QuickGO/term/GO:0007601>)
GO:0071482 : cellular response to light stimulus
(<https://www.ebi.ac.uk/QuickGO/term/GO:0071482>)
GO:0007602 : phototransduction (<https://www.ebi.ac.uk/QuickGO/term/GO:0007602>)
GO - Cellular Component

GO:0005887 : integral component of plasma membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)
GO:0001750 : photoreceptor outer segment
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001750>)
GO:0097381 : photoreceptor disc membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0097381>)

Mutation #1

Presumptive Null

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title>)

Molecular Type

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title>)

Aberration Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title>)

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

S86F and S90C - both have phenotypic effect

Experimental Evidence

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title>)

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ser	Phe	86

Main Reference

Complex distribution of avian color vision systems revealed by sequencing the SWS1 opsin from total DNA. (2003) (<https://pubmed.ncbi.nlm.nih.gov/12716987>)

Authors

Odeen A; Hastad O

Abstract

To gain insights into the evolution and ecology of visually acute animals such as birds, biologists often need to understand how these animals perceive colors. This poses a problem, since the human eye is of a different design than that of most other animals. The standard solution is to examine the spectral sensitivity properties of animal retinas through microspectrophotometry-a procedure that is rather complicated and therefore only has allowed examinations of a limited number of species to date. We have developed a faster and simpler molecular method, which can be used to estimate the color sensitivities of a bird by sequencing a part of the gene coding for the ultraviolet or violet absorbing opsin in the avian retina. With our method, there is no need to sacrifice the animal, and it thereby facilitates large screenings, including rare and endangered species beyond the reach of microspectrophotometry. Color vision in birds may be categorized into two classes: one with a short-wavelength sensitivity biased toward violet (VS) and the other biased toward ultraviolet (UVS). Using our method on 45 species from 35 families, we demonstrate that the distribution of avian color vision is more complex than has previously been shown. Our data support VS as the ancestral state in birds and show that UVS has evolved independently at least four times. We found species with the UVS type of color vision in the orders Psittaciformes and Passeriformes, in agreement with previous findings. However, species within the families Corvidae and Tyrannidae did not share this character with other passeriforms. We also found UVS type species within the Laridae and Struthionidae families. Raptors (Accipitridae and Falconidae) are of the violet type, giving them a vision system different from their passeriform prey. Intriguing effects on the evolution of color signals can be expected from interactions between predators and prey. Such interactions may explain the presence of UVS in Laridae and Passeriformes.

Additional References

The molecular evolution of avian ultraviolet- and violet-sensitive visual pigments. (2007) (<https://pubmed.ncbi.nlm.nih.gov/17556758>)
Retinal photoreceptors of paleognathous birds: the ostrich (Struthio camelus) and rhea (Rhea americana). (2001) (<https://pubmed.ncbi.nlm.nih.gov/11163611>)

Mutation #2

Presumptive Null

No (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title>)

Molecular Type

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=^Coding^#gephebase-summary-title>)

Aberration Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=^SNP^#gephebase-summary-title>)

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

S86F and S90C - both have phenotypic effect

Experimental Evidence

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title>)

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ser	Cys	90

Main Reference

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Authors

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Abstract

To gain insights into the evolution and ecology of visually acute animals such as birds, biologists often need to understand how these animals perceive colors. This poses a problem, since the human eye is of a different design than that of most other animals. The standard solution is to examine the spectral sensitivity properties of animal retinas through microspectrophotometry-a procedure that is rather complicated and therefore only has allowed examinations of a limited number of species to date. We have developed a faster and simpler molecular method, which can be used to estimate the color sensitivities of a bird by sequencing a part of the gene coding for the ultraviolet or violet absorbing opsin in the avian retina. With our method, there is no need to sacrifice the animal, and it thereby facilitates large screenings, including rare and endangered species beyond the reach of microspectrophotometry. Color vision in birds may be categorized into two classes: one with a short-wavelength sensitivity biased toward violet (VS) and the other biased toward ultraviolet (UVS). Using our method on 45 species from 35 families, we demonstrate that the distribution of avian color vision is more complex than has previously been shown. Our data support VS as the ancestral state in birds and show that UVS has evolved independently at least four times. We found species with the UVS type of color vision in the orders Psittaciformes and Passeriformes, in agreement with previous findings. However, species within the families Corvidae and Tyrannidae did not share this character with other passeriforms. We also found UVS type species within the Laridae and Struthionidae families. Raptors (Accipitridae and Falconidae) are of the violet type, giving them a vision system different from their passeriform prey. Intriguing effects on the evolution of color signals can be expected from interactions between predators and prey. Such interactions may explain the presence of UVS in Laridae and Passeriformes.

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RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

5 ([https://www.gephebase.org/search-criteria?/or+Gene+Gephebase="+opsin+\(SWS1\)~/and+Taxon+ID="+8782~/or+Gene+Gephebase="+opsin+\(SWS1\)~/and+Taxon+ID="+8797#+gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=))

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect