

## GEPHE SUMMARY

opsin - (SWS1) ( <a (sws1)^#gephebase-summary-title"="" +opsin+"-="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^opsin - (SWS1)^#gephebase-summary-title</a> )		Gephebase Gene	GP00000756	GepheID
Published	Entry Status	Martin		Main curator

## PHENOTYPIC CHANGE

Physiology ( <a +physiology^#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait+Category=">https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title</a> )		Trait Category		
Color vision ( <a +color+vision^#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait=^Color vision^#gephebase-summary-title</a> )		Trait		
Other cetaceans	Trait State in Taxon A			
Mysticetes	Trait State in Taxon B			
Taxon A	Ancestral State			
Intergeneric or Higher ( <a +intergeneric+or+higher^#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intergeneric or Higher^#gephebase-summary-title</a> )		Taxonomic Status		
	Taxon A		Taxon B	
Cetacea	Latin Name	Mysticeti	Latin Name	
( <a +cetacea^#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Cetacea^#gephebase-summary-title</a> )	Common Name	( <a +mysticeti^#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Mysticeti^#gephebase-summary-title</a> )	Common Name	
whales	Synonyms	baleen whales	Synonyms	
whales; cetaceans; whale; whales, dolphins, and porpoises	Rank	baleen whales	Rank	
order	Lineage	suborder	Lineage	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Cetartiodactyla	Parent	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Cetartiodactyla; Cetacea	Parent	
Cetartiodactyla (whales, hippos, ruminants, pigs, camels etc.) - (Rank: no rank) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=91561">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=91561</a> )	NCBI Taxonomy ID	Cetacea (whales) - (Rank: order) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9721">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9721</a> )	NCBI Taxonomy ID	
9721		9761		
( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9721">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9721</a> )	is Taxon A an Intraspecies?	( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9761">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9761</a> )	is Taxon B an Intraspecies?	
No		No		

## GENOTYPIC CHANGE

OPN1SW	Generic Gene Name	P03999 ( <a href="http://www.uniprot.org/uniprot/P03999">http://www.uniprot.org/uniprot/P03999</a> )	UniProtKB Homo sapiens
BCP; BOP; CBT	Synonyms	0	GenebankID or UniProtKB
9606.ENSPO0000249389	String		
( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000249389">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000249389</a> )	Sequence Similarities		
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.	GO - Molecular Function		
GO:0038023 : signaling receptor activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0038023">https://www.ebi.ac.uk/QuickGO/term/GO:0038023</a> )			
GO:0008020 : G protein-coupled photoreceptor activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0008020">https://www.ebi.ac.uk/QuickGO/term/GO:0008020</a> )	GO - Biological Process		
GO:0007165 : signal transduction ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0007165">https://www.ebi.ac.uk/QuickGO/term/GO:0007165</a> )			
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>)

Presumptive Null

Yes ([https://www.gephebase.org/search-criteria?/and+Presumptive Null=~Yes^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Presumptive+Null=~Yes^#gephebase-summary-title))

Molecular Type

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

Aberration Type

Deletion ([https://www.gephebase.org/search-criteria?/and+Aberration Type=~Deletion^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Aberration+Type=~Deletion^#gephebase-summary-title))

Deletion Size

1-9 bp

Molecular Details of the Mutation

4bp frameshift deletion in exon 1 of SWS1 that results in a premature stop codon

Experimental Evidence

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

Main Reference

Rod monochromacy and the coevolution of cetacean retinal opsins. (2013) (<https://pubmed.ncbi.nlm.nih.gov/23637615>)

Authors

Meredith RW; Gatesy J; Emerling CA; York VM; Springer MS

Abstract

Cetaceans have a long history of commitment to a fully aquatic lifestyle that extends back to the Eocene. Extant species have evolved a spectacular array of adaptations in conjunction with their deployment into a diverse array of aquatic habitats. Sensory systems are among those that have experienced radical transformations in the evolutionary history of this clade. In the case of vision, previous studies have demonstrated important changes in the genes encoding rod opsin (RH1), short-wavelength sensitive opsin 1 (SWS1), and long-wavelength sensitive opsin (LWS) in selected cetaceans, but have not examined the full complement of opsin genes across the complete range of cetacean families. Here, we report protein-coding sequences for RH1 and both color opsin genes (SWS1, LWS) from representatives of all extant cetacean families. We examine competing hypotheses pertaining to the timing of blue shifts in RH1 relative to SWS1 inactivation in the early history of Cetacea, and we test the hypothesis that some cetaceans are rod monochromats. Molecular evolutionary analyses contradict the "coastal" hypothesis, wherein SWS1 was pseudogenized in the common ancestor of Cetacea, and instead suggest that RH1 was blue-shifted in the common ancestor of Cetacea before SWS1 was independently knocked out in baleen whales (Mysticeti) and in toothed whales (Odontoceti). Further, molecular evidence implies that LWS was inactivated convergently on at least five occasions in Cetacea: (1) Balaenidae (bowhead and right whales), (2) Balaenopteroidea (rorquals plus gray whale), (3) Mesoplodon bidens (Sowerby's beaked whale), (4) Physeter macrocephalus (giant sperm whale), and (5) Kogia breviceps (pygmy sperm whale). All of these cetaceans are known to dive to depths of at least 100 m where the underwater light field is dim and dominated by blue light. The knockout of both SWS1 and LWS in multiple cetacean lineages renders these taxa rod monochromats, a condition previously unknown among mammalian species.

Additional References

## RELATED GEPHE

Related Genes

2 (opsin - rhodopsin (LWS), opsin - rhodopsin1 (RH1)) ([https://www.gephebase.org/search-criteria?/or+Taxon ID=~9721^/and+Trait=Color vision/or+Taxon ID=~9761^/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon+ID=~9721^/and+Trait=Color+vision/or+Taxon+ID=~9761^/and+Trait=Color+vision/and+groupHaplotypes=true#gephebase-summary-title))

Related Haplotypes

1 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=~opsin - \(SWS1\)^/and+Taxon ID=~9721^/or+Gene Gephebase=~opsin - \(SWS1\)^/and+Taxon ID=~9761^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=~opsin-(SWS1)^/and+Taxon+ID=~9721^/or+Gene+Gephebase=~opsin-(SWS1)^/and+Taxon+ID=~9761^#gephebase-summary-title))

## EXTERNAL LINKS

## COMMENTS

