

ZFIN exercises

1. You are interested in cerebellum development. Go to the ZFIN homepage, choose “search anatomy” and search for “cerebellum.” From which structure does the cerebellum develop? What is the cerebellum part of? What parts does it have?

The screenshot shows the ZFIN website interface. At the top, there is a navigation bar with the ZFIN logo and a search box. Below the navigation bar, there are tabs for 'Research', 'General Information', and 'ZIRC'. The main content area displays the entry for 'cerebellum'. It includes the ZFIN ID (ZDB-ANAT-010921-522) and OBO ID (ZFA:0000100). The name is 'cerebellum' and the definition is 'Brain structure derived from the anterior hindbrain, and perhaps including posterior midbrain. The cerebellum plays a role in somatic motor function, the control of muscle tone, and balance.' Below the definition, there are sections for 'Appears at' (Segmentation: 26+ somites (22.0h-24.0h)) and 'Evident until' (Adult). The 'Relationships' section lists: develops from: upper rhombic lip; is part of: hindbrain; has parts: commissura cerebelli, corpus cerebelli, valvula cerebelli, vestibulolateralis lobe; is a type of: multi-tissue structure. There are checkboxes for EXPRESSION and PHENOTYPE. A link for 'Search for publications with 'cerebellum' in abstract' is provided. The footer contains a disclaimer and copyright information for the University of Oregon, 1994-2009.

Name: cerebellum Search:

Definition: Brain structure derived from the anterior hindbrain, and perhaps including posterior midbrain. The cerebellum plays a role in somatic motor function, the control of muscle tone, and balance.

Appears at	Evident until
Segmentation: 26+ somites (22.0h-24.0h)	Adult

Relationships ([about](#))

develops from: [upper rhombic lip](#)

is part of: [hindbrain](#)

has parts: [commissura cerebelli](#) [corpus cerebelli](#) [valvula cerebelli](#) [vestibulolateralis lobe](#)

is a type of: [multi-tissue structure](#)

EXPRESSION

PHENOTYPE

[Search for publications with 'cerebellum' in abstract](#)

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ZFIN logo design by Karl Page, University of Oregon

2. Open the expression section of the “cerebellum” anatomy page. Which genes have the most figures with gene expression in the cerebellum? Which probes are recommended to label the cerebellum? Which antibodies label the cerebellum?

EXPRESSION

Genes with Most Figures

Gene	Figures
roraa	5 figures from 2 publications
sox3	5 figures from 2 publications
mdkb	4 figures from 2 publications
sox11a	4 figures from 2 publications
ppp1r7	4 figures from Rauch et al., 2003

Show all [280 genes](#), [414 figures](#) (including substructures [321 genes](#))

In Situ Probes: [Recommended](#) by [Thisse lab](#)

Gene	Probe	Figures
adcyp1b	MGC:101522	1 figure from Thisse et al., 2004
atoh2b	MGC:92543	1 figure from Thisse et al., 2004
atp1a3a	cb705	2 figures from Thisse et al., 2001
casz1	eu580	2 figures from Thisse et al., 2005
epha4a	eu671	3 figures from Thisse et al., 2005

Show all [25 probes](#)

Antibodies

Antibody	Gene	Figures
Ab1-gabra1	gabra1	1 figure from Delgado et al., 2008
Ab3-dag1	dag1	1 figure from Moore et al., 2008
Ab1-s100		1 figure from Germanà et al., 2008
Ab1-dag1	dag1	1 figure from Moore et al., 2008
Ab2-dag1	dag1	1 figure from Moore et al., 2008

Show all [7 antibodies](#) (including substructures [9 antibodies](#))

- Open the phenotype section of the “cerebellum” anatomy page. Which mutants have cerebellum phenotypes? Which morpholinos affect the cerebellum? Are there any morpholino/mutant combinations which cause a cerebellum phenotype?

☐ PHENOTYPE

Mutant and Transgenic Lines

Genotype (Background)	Affected Genes	Phenotype	Figures
apc^{zf134/zf134}	apc	abnormal	text only from Paridaen et al., 2009
Df(LG01:lef1,msxb)x8/x8		physical object quality	2 figures from McFarland et al., 2008
fgf8a^{ti282a/ti282a}	fgf8a	morphology	1 figure from Jászai et al., 2003
pax2a^{b593/b593}	pax2a	malformed	1 figure from Erickson et al., 2007
pax2a^{tb21/tb21}	pax2a	absent	2 figures from 2 publications

Show all [15 genotypes](#). (including substructures [16 genotypes](#).)

Morpholino Experiments in Wild-type Fish

Target Genes	Morpholinos	Genotype	Phenotype	Figures
ppm1e	MO1-ppm1e	wild type (unspecified)	apoptotic	1 figure from Nimura et al., 2007
rps3	MO1-rps3	AB	absent	1 figure from Uechi et al., 2006
rps3a	MO1-rps3a	AB	absent	1 figure from Uechi et al., 2006
rps4x	MO1-rps4x	AB	absent	1 figure from Uechi et al., 2006
rps8	MO1-rps8	AB	absent	1 figure from Uechi et al., 2006

Show all [21 experiments](#)

Morpholino Experiments in Mutant and Transgenic Fish

Target Genes	Morpholinos	Genotype	Phenotype	Figures
pbx2, pbx4	MO2-pbx2, MO1-pbx2, MO3-pbx4, MO2-pbx4	pbx4^{b557/b557}	malformed	1 figure from Erickson et al., 2007
disc1	MO1-disc1	Tg(olig2:EGFP)vu12	[eurydendroid cell]: present in fewer numbers in organism	1 figure from Wood et al., 2009
nrg1	MO1-nrg1	Tg(olig2:EGFP)vu12	[eurydendroid cell]: present in fewer numbers in organism	1 figure from Wood et al., 2009

- Click on the “Ab1-gabra1” antibody. What is the host organism? From which species is the immunogen from? What gene(s) does it detect? Which structures does it label? Where can you get this antibody?

Site Search:

ZFIN Research General Information ZIRC

[Home](#) [Genes / Markers / Clones](#) [Expression](#) [Antibodies](#) [BLAST](#) [Mutants / Tg](#) [Anatomy](#) [Maps](#) [Publications](#)

ZFIN ID: ZDB-ATB-090219-5 Your Input Welcome

Antibody Name: **Ab1-gabra1**

Alias: anti-GABA(A) R-alpha 1 (1) , anti-gamma-aminobutyric acid A receptor, alpha 1 (1) , sc-7348 (1)

Host Organism: Goat

Immunogen Organism: Human

Isotype: IgG

Type: polyclonal

Assays: Immunohistochemistry , Western blot

Antigen Genes: [gabra1](#) (1)

NOTES: None Submitted

ANATOMICAL LABELING

Anatomy : Substructure	Stage	Assay	Gene	Data
cerebellum	Adult	WB	gabra1	1 figure from Delgado <i>et al.</i> , 2008
cranial ganglion	Adult	IHC	gabra1	2 figures from Delgado <i>et al.</i> , 2008
granular layer corpus cerebelli	Adult	IHC	gabra1	1 figure from Delgado <i>et al.</i> , 2008
granular layer valvula cerebelli	Adult	IHC	gabra1	1 figure from Delgado <i>et al.</i> , 2008
medial caudal lobe	Adult	IHC	gabra1	1 figure from Delgado <i>et al.</i> , 2008

[Show all](#) 7 labeled structures

SOURCE:
[Santa Cruz Biotechnology, Inc.](#)

CITATIONS (2)

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 ZFIN logo design by Karl Pape, University of Oregon

5. Go to the home page and “search antibodies” that label cerebellum. Can you find Ab1-gabra1?
6. Go to the home page “search gene expression” for cerebellum. Hover over the figures in the gallery. Click on the gene or figure link to go to the gene or figure pages respectively. What happens if you search for “cerebellum” and for “pax” at the same time?

ZFIN Site Search:

Research General Information ZIRC

Home Genes / Markers / Clones Expression Antibodies BLAST Mutants / Tg Anatomy Maps Publications

[Modify Search](#)
Your Input Welcome

Figure Gallery (1175 images) ← 1 / 118 →

Expression Pattern Search Results
(328 genes with expression)

Gene	Expression Data (current status)	Stage Range
acss1	1 figure(s) from Thisse et al., 2001	Prim-15 to Prim-25
adcyp1b	1 figure(s) from Thisse et al., 2004	High-pec to Long-pec
adh5	1 figure(s) from Cañestro et al., 2003	128-cell to Pec-fin
adka	1 figure(s) from Thisse et al., 2001	Prim-15 to Prim-25
adra2a	2 figure(s) from Ampatzis et al., 2008	Adult
adra2da	1 figure(s) from Ruuskanen et al., 2005	Adult
ahcy	3 figure(s) from Thisse et al., 2001	20-25 somites to Long-pec
ahi1	1 figure(s) from Doering et al., 2008	Prim-25 to Day 5
ahr2	1 figure(s) from Andreasen et al., 2002	5-9 somites to Day 4
alcam	3 figure(s) from 3 publications	75%-epiboly to Long-pec
aldh1a2	1 figure(s) from Grandel et al., 2002	30%-epiboly to Long-pec
aldoc	2 figure(s) from 2 publications	Day 5 to Days 30-44
alp	2 figure(s) from Thisse et al., 2004	20-25 somites to Prim-25
amotl2	2 figure(s) from Thisse et al., 2001	Prim-15 to Long-pec
amt2	1 figure(s) from Andreasen et al., 2002	5-9 somites to Day 4
atic	2 figure(s) from Thisse et al., 2001	20-25 somites to Prim-25
atoh1a	6 figure(s) from 4 publications	Prim-5 to Protruding-mouth
atoh2b	1 figure(s) from Thisse et al., 2004	High-pec to Long-pec
atp1a3a	2 figure(s) from Thisse et al., 2001	Prim-15 to Long-pec
atp1b2a	2 figure(s) from 2 publications	Prim-15 to Day 5
atp1b3a	1 figure(s) from Thisse et al., 2001	Prim-15 to Prim-25
atp1b3b	1 figure(s) from Rauch et al., 2003	Day 5

- Go to the “search for mutant/transgenic lines” search on the home page and search for mutants that affect “cerebellum”. Click on the 15 figures link for *fgf8a^{ti2282a/ti282a}*. This is a summary of figures for this genotype. Click on Fig. 1 from [Jászai et al., 2003](#). Which genes are expressed in this figure? Which genotypes are shown?

Site Search:

[Research](#) [General Information](#) [ZIRC](#)
[Home](#) [Genes / Markers / Clones](#) [Expression](#) [Antibodies](#) [BLAST](#) [Mutants / Tg](#) [Anatomy](#) [Maps](#) [Publications](#)

[Modify Search](#)
Your Input Welcome

Mutant / Transgenic Lines Search Results (16 records found)

Genotype(Background)	Phenotype	Allele	Parental Zygosity	Type	Affected Gene(s)	LG
apc^{zf134/zf134}	5 figure(s)	zf134	♀ +/- ♂ +/-	point mutation	apc	10 Details
Df(LG01:lef1.msxb)x8/x8	4 figure(s)		♀ +/- ♂ +/-	deficiency		1 Details
fgf8^{ti282a/ti282a}	15 figure(s)	ti282a	♀ +/- ♂ +/-	point mutation	fgf8a	13, 23 Details
Gt(T2kSAG:EGFP-HRAS_G12V)io1/io1	3 figure(s)			transgenic insertion		
pax2^{b593/b593}	1 figure(s)	b593		unknown	pax2a	13 Details
pax2^{tb21/tb21}	5 figure(s)	tb21	♀ +/- ♂ +/-	point mutation	pax2a	13 Details
pax2^{th44/th44}	4 figure(s)	th44	♀ +/- ♂ +/-	point mutation	pax2a	13 Details
pax2^{tm243a/tm243a}	3 figure(s)	tm243a	♀ +/- ♂ +/-	point mutation	pax2a	13 Details
pax2^{tu29a/tu29a}	15 figure(s)	tu29a	♀ +/- ♂ +/-	point mutation	pax2a	13 Details
pax2^{ty22b/ty22b}	4 figure(s)	ty22b	♀ +/- ♂ +/-	point mutation	pax2a	13 Details
pax2^{ty31a/ty31a}	5 figure(s)	ty31a	♀ +/- ♂ +/-	point mutation	pax2a	13 Details
pbx4^{b557/b557}	2 figure(s)	b557		point mutation	pbx4	3 Details
smo^{b641/b641}	8 figure(s)	b641	♀ +/- ♂ +/-	point mutation	smo	22, 4 Details
Tg(dusp6:EGFP)pt10:mgo^{pt11/pt11}	1 figure(s)			transgenic insertion		
		pt11	♀ +/- ♂ +/-	unknown	mgo	13 Details
Tg(hsp70l:dkk1-GFP)w32/w32	2 figure(s)			transgenic insertion		

8. Search genes/markers/clones for “hox”. How many genes with hox in the name or abbreviation are there? How many have mutants? How many morpholinos? Click on the list of genes, and choose *hoxa2b*.

Site Search:

Gene Search Results (57 records.) Your Input Welcome

Show genes with mutant(s)

Symbol - name	Expression	Phenotype	Map	Matching Text
hoxa1a -homeo box A1a	10 figures		LG: 19 Details	Current symbol: hoxa1a
hoxa2b -homeo box A2b	29 figures	1 figure	LG: 16 , 6 Details View Map: Merged Individual Panels	Current symbol: hoxa2b
hoxa3a -homeo box A3a	12 figures		LG: 19 Details	Current symbol: hoxa3a
hoxa4a -homeo box A4a	9 figures		LG: 19 Details View Map: Merged Individual Panels	Current symbol: hoxa4a
hoxa5a -homeo box A5a	6 figures		LG: 19 Details View Map: Merged Individual Panels	Current symbol: hoxa5a
hoxa9a -homeo box A9a	16 figures		LG: 19 Details View Map: Merged Individual Panels	Current symbol: hoxa9a
hoxa9b -homeo box A9b	4 figures		LG: 16 , 6 Details	Current symbol: hoxa9b
hoxa10b -homeo box A10b	3 figures		LG: 16 , 6 Details	Current symbol: hoxa10b
hoxa11a -homeo box A11a	3 figures		LG: 19 Details	Current symbol: hoxa11a
hoxa11b -homeo box A11b	10 figures		LG: 16 Details View Map: Merged Individual Panels	Current symbol: hoxa11b
hoxa13a -homeo box A13a	4 figures		LG: 19 Details	Current symbol: hoxa13a
hoxa13b -homeo box A13b	10 figures		LG: 16 Details View Map: Merged Individual Panels	Current symbol: hoxa13b
hoxb1a -homeo box B1a	42 figures	3 figures	LG: 3 Details View Map: Merged Individual Panels	Current symbol: hoxb1a
hoxb1b -homeo box B1b	37 figures		LG: 12 Details View Map: Merged	Current symbol: hoxb1b

9. This is the *hoxa2b* gene page. What is a previous name of *hoxa2b*? How many figures show expression of this gene? How many knockdown reagents(morpholinos) are there to this gene? How many Gene Ontology terms are annotated to this gene? Which genomic clones contain this gene? Which clones does this gene encode? What is the RNA refseq for this gene? Unigene? Can you identify links to this gene at Entrez, VEGA or Ensembl? Does this gene have any orthologs in other species?

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ZFIN ID: ZDB-GENE-990415-98

Gene Name: *homeo box A2b* Your Input Welcome
Gene Symbol: *hoxa2b*
Previous Names: [hoxa2](#), [Z-75](#), [etlD309949.16\(1\)](#)
Keywords and Sequence Similarities: [homeo box \(1\)](#)

GENE EXPRESSION: [\(current status\)](#)

All expression data: [29 figure\(s\)](#) from 21 publications

Directly submitted expression data: [6 figure\(s\) \(16 images\)](#) from [Thisse et al., 2005 \[eu715\]](#)

Wild Type Stages, Structures: [Segmentation:1-4 somites](#) (10.33h-11.66h) to [Lawal:Protruding-mouth](#) (72.00h-96.00h, 3.5mm)
[hindbrain](#), [hindbrain neural plate](#) ... [\(all 23\)](#) ▶

Curated microarray expression: [GEO \(1\)](#)

MUTANTS AND TARGETED KNOCKDOWNS:

Phenotype: [\(current status\)](#)

Data: [1 figure\(s\)](#) from [Miller et al., 2004](#)

Observed in: [pharyngeal arch 2](#)

Knockdown reagent: [MO1-hoxa2b \(2\)](#)

GENE PRODUCTS:

Gene Ontology

Ontology	GO Term
Molecular Function	DNA binding (more)
Biological Process	multicellular organismal development (more)
Cellular Component	nucleus

[All GO Terms \(9\)](#)

Protein Families, Domains and Sites:

- [InterPro:IPR001356 \(1\)](#)
- [InterPro:IPR001827 \(1\)](#)
- [InterPro:IPR012287 \(1\)](#)
- [InterPro:IPR017970 \(1\)](#)
- [PROSITE:PS00027 \(1\)](#)
- [PROSITE:PS00032 \(1\)](#)
- [PROSITE:PS50071 \(1\)](#)
- [Pfam:PF00046 \(1\)](#)

10. Select the ZFIN blast from the BLAST tools on the NM_131106 sequence. Choose ZFIN RNA/cDNA sequences and click BLAST. How many hits come back with a probability of 0? How many different genes are returned? Do any of them have expression, gene ontology or phenotype data?

SEQUENCE INFORMATION:

Type	Accession #	Length	Analysis
RNA:	RefSeq:NM_131106 (1)	1797 bp	ZFIN BLAST
Genomic:	GenBank:CR392024 (1)	183486 bp	- Select Tool - ZFIN BLAST NCBI BLAST Ensembl UCSC BLAT
Polypeptide:	UniProtKB:B3DG99 (1)	363 aa	
Sequence Clusters:	UniGene:82597 (1)		

[All Sequence Information \(25\)](#)

Site Search:

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BLAST Your Input Welcome

Choose program and database:

Program: Database:

===== Nucleotide Db =====

- GenBank Zebrafish (no ESTs,GSS,HTGs)
- RefSeq Zebrafish mRNA
- ZFIN GenBank Sequences
- ZFIN RNA/cDNA Sequences**
- ZFIN Genes with Expression
- ZFIN Morpholino Sequences
- ZFIN MicroRNA Sequences
- ZFIN Vega Transcripts

Query sequence (maximum of 50,000 letters) :

FASTA or free-text format:

Set subsequence: From To

Search for short, nearly exact matches

Sequence ID: (one or multiple delimited by ",")

Sequence Type:

Upload a free-text file:

Options:

Expect: Word Size: Matrix:

Filter options for DNA Queries: Low complexity Poly-A's filter

Filter options for Protein Queries:

SEG - filter low compositional complexity regions

XNU - filter short-periodicity repeats

Format:

Show: Graphical Overview *limit of the first 50 alignments*

Answers:

1. The cerebellum develops from the upper rhombic lip, is part of the hindbrain, and has parts commissura cerebelli, corpus cerebelli, valvula cerebelli and vestibulolateralis lobe.
2. Genes with most figures: *roar*, *sox3*, *mdkb*, *sox11a* and *ppp1r7*. in situ probes: *adcyap1b*, *atoh2b*, *atp1a3a*, *casz1* and *epha4a*. antibodies: Ab1-gabra1, Ab3-dag1, Ab1-s100, Ab1-dag1 and Ab2-dag1. Additional genes, probes and antibodies are available in their respective links.
3. Mutations in *apc*, *fgf8a* and *pax2a* cause cerebellum phenotypes. Morpholinos targeting *ppm1e*, *rps3*, *rps3a*, *rps4x* and *rps8* cause cerebellum phenotypes. *pbx2* and *pbx4* morpholinos in *pbx4^{b557}* mutants cause cerebellum phenotypes, as do *disc1* or *nrg1* morpholinos in *Tg(olig2:EGFP)vu12*.
4. Ab1-gabra1 is goat antibody against a human protein which labels the gabra1 gene product in zebrafish. The structures labeled are: the cerebellum, cranial ganglia, granular layer of corpus cerebelli and valvula cerebelli, and the medial caudal lobe. This antibody is available from Santa Cruz Biotechnology.

5. Ab1-gabra1 is fourth in the list of results.
6. There are 328 genes with expression in cerebellum. This might seem like a lot, but you have included substructures, which means the expression could be in any part of the cerebellum. Searching for “cerebellum” with “pax” in the gene/EST name box returns 4 genes.
7. Genes expressed are pax8, sall1a, and spry4. Fish shown are *fgf8a*^{ti2282a/ti282a} and also *fgf8a*^{ti2282a/ti282a} in a PTU environment.
8. 57 genes, 3 with mutants, and 18 morpholinos.
9. *hoxa2*, Z-75 and etID309949.16 are all previous names of *hoxa2b*. 29 figures show expression of *hoxa2b*. There is one morpholino to *hoxa2b*, MO1-hoxa2b. There are 9 GO terms annotated to *hoxa2b*, all of which are inferred from electronic annotation (not manually curated). DKEY-45E15 and BUSM1-31B14 both contain *hoxa2b*. *hoxa2b* encodes eu715, MGC:193940 and MGC:193947 cDNAs and ESTs. The RNA refseq ID is NM_131106. Links to one Entrez gene page, two VEGA genes and one Ensembl gene are available. *hoxa2b* is orthologous to human *HOXA2* and mouse *Hoxa2*.
10. 6 hits with a probability of 0, and all results are in the *hoxb2a* gene, which has expression and gene ontology annotations, but not phenotype.