Module 4: Function and Expression
ii. How can I find gene expression data?

Aims

- Introduce gene expression data at ZFIN
- Suggest starting points for various queries
- Discuss morpholino curation at ZFIN

Introduction

ZFIN displays three kinds of gene expression data:

- annotated images that have been directly submitted to ZFIN by researchers
- annotated data from the current literature, figures and legends are included when copyright permissions are available.
- an index of gene expression data from older publications

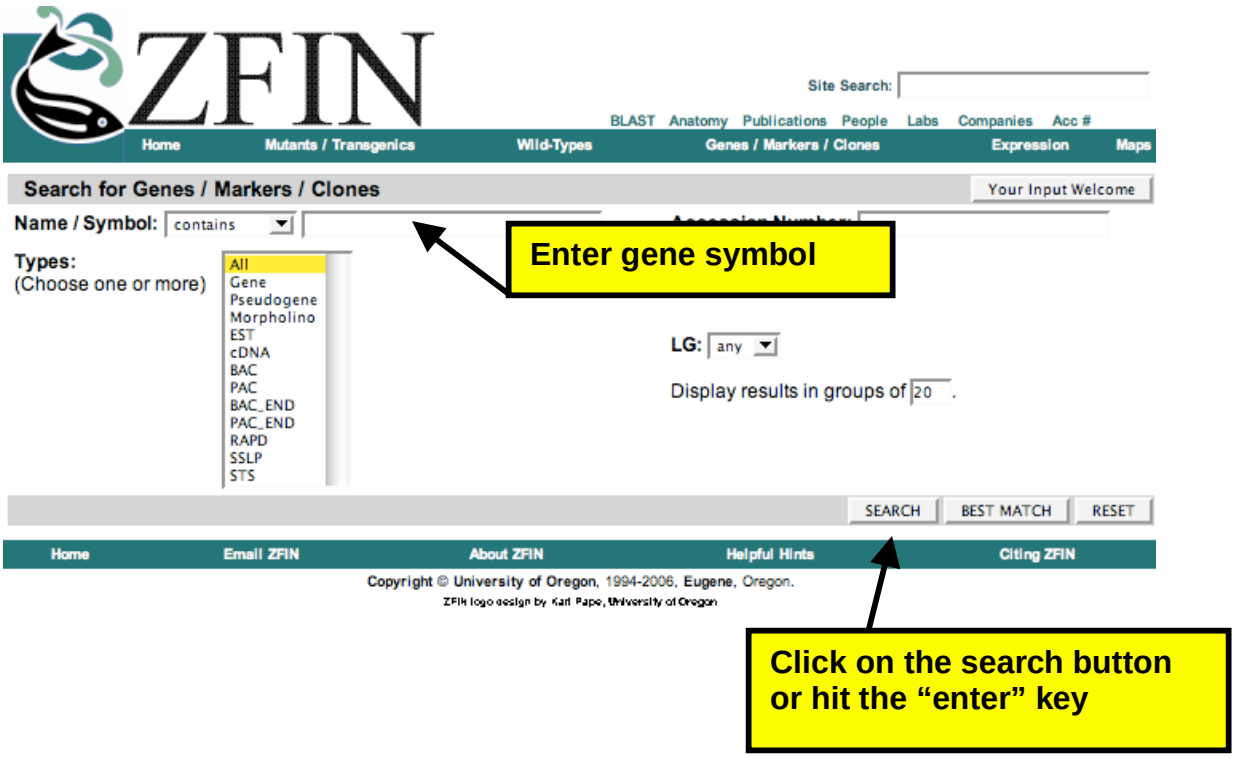
ZFIN began to include published figures in 2004. We are currently able to add figures from older publications only on an ad hoc basis. A more complete incorporation of figures from the older literature is a long-term goal.
The zebrafish anatomical dictionary, http://zfin.org/cgi-bin/webdriver?MIval=aa-anatdict.apg&mode=search, plays a central role in our curation of gene expression data.

Finding gene expression data

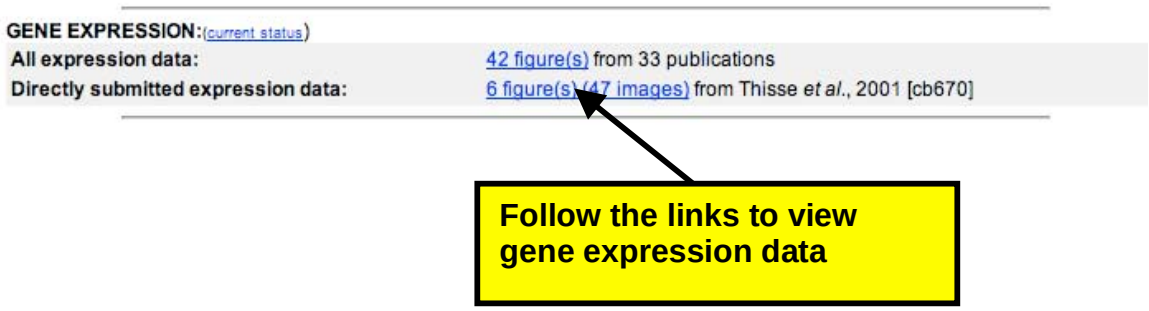
There are three methods for finding gene expression data in ZFIN.

1. Gene Expression data may be found by following the links provided on a gene page.

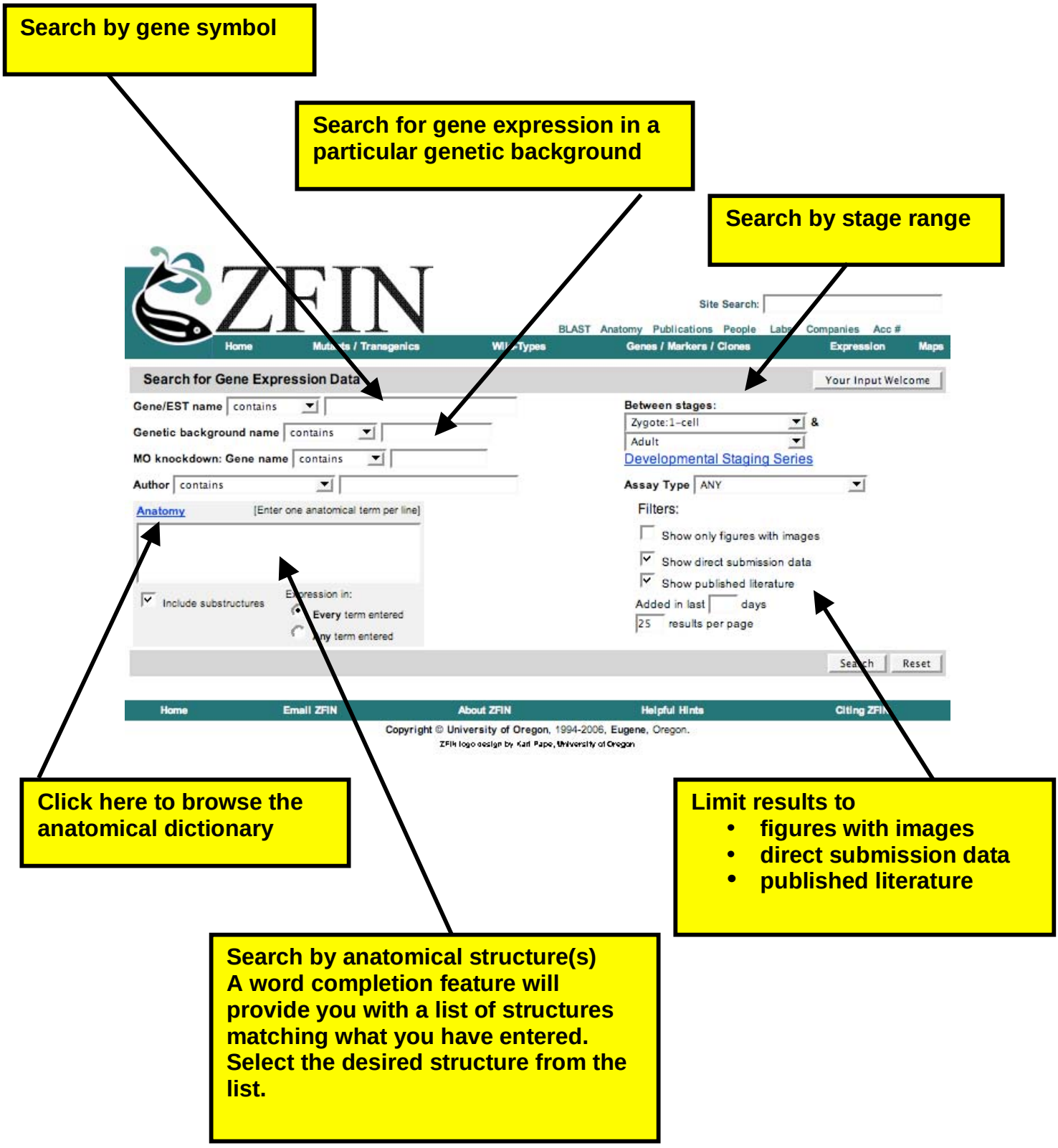
Locate this information using our Genes/Markers/Clones query form, http://zfin.org/cgi-bin/webdriver?MIval=aa-newmrkrselect.apg. Search by specifying your gene of interest.



Scroll to the **Gene Expression** section of the gene page.



2. Gene expression data may also be found using the ZFIN expression query form.



A portion of the return results for a *bmp2b* gene expression search is shown below.

Search matched on current symbol: **bmp2b**

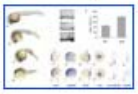
Modify Search

Your Input Welcome

Expression Pattern Search Results for *bmp2b*

(42 figure(s) with expression from 33 publication(s))

[Show only figures with images]

Publication (current status)	Data		Background(s)	Stage Range	Anatomy
Dutta *et al.*, 2005	Fig. 2		WT	Bud to 1-4 somites	non neural ectoderm
Ghiselli *et al.*, 2005	Fig. 3		AB	50%-epiboly to 5-9 somites	
	Fig. 4		AB	Shield to Prim-5	tail
Holzschuh *et al.*, 2005	Fig. 5		*cas*^{ta56}, WT	26+ somites to Prim-25	pharyngeal pouch
Leung *et al.*, 2005	Fig. 7		WT	Prim-5	
Londin *et al.*, 2005	Fig. 5		TL	Sphere to Shield	embryo
	Fig. 7		TL	Sphere to Shield	
Lyman Gingerich *et al.*, 2005	Fig. 2		AB, *hec*^{t2808}	Sphere to 75%-epiboly	ectoderm
Norton *et al.*, 2005	Fig. 3		*dae*^{tbvbo}, WT	Prim-5 to Prim-25	pectoral fin, pectoral fin bud

Click here to view the publication abstract

Click on the figure number or thumbnail to view expression data

Click on the Fig.5 link of the Eivers et al. publication for figure image, legend and annotations.

Click here to view all expression data from this publication

ZFIN ID: ZDB-FIG-050509-2

Dutta *et al.*, 2005 - pitx3 defines an equivalence domain for lens and anterior pituitary placode. Development 132(7):1579-1590

Your Input Welcome

ADDITIONAL FIGURES

Genes : *bmp2b*, *ctslb*, *dlx3b*, *eya1*, *foxb1.2*, *pax6a*, *pitx3*, *shha*, *zic1*
Genetic Background : WT
Anatomical Terms: ectoderm, neural plate, neuroectoderm, non neural ectoderm, polster, prechordal plate
Stage Range : Bud to 1-4 somites

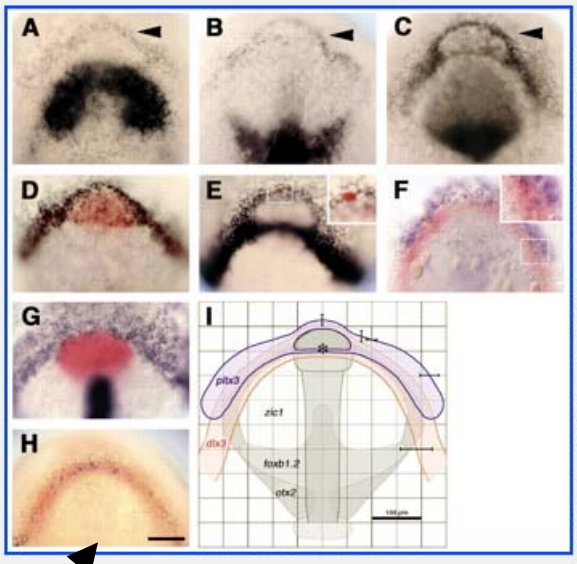


Fig. 2 *pitx3* and *dlx3b* form overlapping expression domains at the anterior neural plate border. (A-D) Embryos labeled with probes for *pitx3* (arrowheads) and (A) *zic1*, (B) *foxb1.2*; (C) *pax6a* or (D) *hgg1* (red). (E) Anterior neural plate border cells express *dlx3b*. (E, inset) Single cell injected with fluorescein-dextran, labeled for lineage tracer (red). (F-H) A subset of cells co-expresses: (F) *pitx3* (blue) and *dlx3b* (red); (G) *bmp2b* (blue, non-neural ectoderm), *shh* (blue, neural plate midline) and *hgg1* (red, polster); (H) *dlx3b* (red) and *eya1* (black). (I) Sketch of anterior neural plate gene expression domains (*pitx3*, blue, *n*=12; *dlx3b*, red, *n*=15; *zic1*, *foxb1.2*, *otx2*, grey) (Varga et al., 1999) to predict location of *pitx3*-expressing cells in live unlabeled embryos. Averaged gene expression domains; bars indicate standard deviations from the mean, relative to neural plate midline and center of polster (asterisk). All panels at bud stage, except C, which is at the one-somite stage. Dorsal views of prospective head region, ventral towards the top. Scale bars: 100 µm.

Click here to view a larger image

Continue to scroll down this page. You will find a tabular summary of the expression data discussed in this figure. This table is always available, even when we do not have privileges to display the figure's image and legend.

Gene expression details

Gene	Fish	Stage	Anatomy	Assay
bmp2b	WT	Bud	non neural ectoderm	ISH
ctslb	WT	Bud	polster	ISH
dlx3b	WT	Bud	non neural ectoderm	ISH
eya1	WT	Bud	ectoderm	ISH
foxb1.2	WT	Bud	neuroectoderm	ISH
pax6a	WT	1-4 somites	neuroectoderm	ISH
pitx3	WT	Bud	ectoderm	ISH
		1-4 somites	ectoderm	ISH
shha	WT	Bud	neural plate	ISH
		Bud	prechordal plate	ISH
zic1	WT	Bud	neural plate	ISH

Acknowledgments:
ZFIN wishes to thank the journal Development for permission to reproduce figures from this article. Please note that this material may be protected by copyright.

The gene expression query form can also be used to locate expression patterns from studies using knockdown reagents.

A search for *gata1* targeted knockdowns returns the following:

Expression Pattern Search Results
(17 genes with expression)

Modify Search
Your Input Welcome

Gene	Expression Data (current status)	Stage Range	Matching Text
alas2	1 figure(s) from Galloway *et al.*, 2005	20-25 somites	MO symbol: **gata1**
cahz	1 figure(s) from Galloway *et al.*, 2005	20-25 somites	MO symbol: **gata1**
cmyb	1 figure(s) from Galloway *et al.*, 2005	20-25 somites	MO symbol: **gata1**
gata1	2 figure(s) from 2 publications	20-25 somites	MO symbol: **gata1**
glcci1	1 figure(s) from Galloway *et al.*, 2005	10-13 somites to 26+ somites	MO symbol: **gata1**
hbae1	1 figure(s) from Rhodes *et al.*, 2005	Prim-15	MO symbol: **gata1**
hbbe1	3 figure(s) from Galloway *et al.*, 2005	20-25 somites to Prim-5	MO symbol: **gata1**
kiaa0650l	1 figure(s) from Galloway *et al.*, 2005	10-13 somites to 26+ somites	MO symbol: **gata1**
klf4	1 figure(s) from Galloway *et al.*, 2005	10-13 somites to 20-25 somites	MO symbol: **gata1**
krcp	1 figure(s) from Galloway *et al.*, 2005	10-13 somites	MO symbol: **gata1**
lcp1	3 figure(s) from 2 publications	Prim-5 to Day 4	MO symbol: **gata1**
lmo2	1 figure(s) from Rhodes *et al.*, 2005	26+ somites	MO symbol: **gata1**
mpx	3 figure(s) from 2 publications	26+ somites to Day 4	MO symbol: **gata1**
runx1	2 figure(s) from 2 publications	20-25 somites to 26+ somites	MO symbol: **gata1**
spi1	3 figure(s) from 2 publications	14-19 somites to Prim-5	MO symbol: **gata1**
tal1	1 figure(s) from Rhodes *et al.*, 2005	26+ somites	MO symbol: **gata1**
znfn1a1	1 figure(s) from Galloway *et al.*, 2005	20-25 somites	MO symbol: **gata1**

Click here to view expression data

Fig. 1 ZFIN is incorporating published figure images and captions as part of an ongoing project. Figures from some publications have not yet been curated, or are not available for display because of copyright restrictions.

Gene expression details

Gene	Fish	Stage	Qualifier	Anatomy	Assay
cmyb	TU, MO:gata2	20-25 somites		intermediate cell mass of mesoderm	ISH
	TU, MO:gata1	20-25 somites		intermediate cell mass of mesoderm	ISH
	TU, MO:gata1,gata2	20-25 somites		intermediate cell mass of mesoderm	ISH
	TU	20-25 somites		intermediate cell mass of mesoderm	ISH
hbbe1	TU, MO:gata1	Prim-5		intermediate cell mass of mesoderm	ISH
	TU	Prim-5		intermediate cell mass of mesoderm	ISH
lcp1	TU, MO:gata2	Prim-5		intermediate cell mass of mesoderm	ISH
		Prim-5		unspecified	ISH
	TU, MO:gata1	Prim-5		intermediate cell mass of mesoderm	ISH
		Prim-5		unspecified	ISH
	TU, MO:gata1,gata2	Prim-5		intermediate cell mass of mesoderm	ISH
		Prim-5		unspecified	ISH
	TU	Prim-5		intermediate cell mass of mesoderm	ISH
		Prim-5		unspecified	ISH
mpx	TU, MO:gata2	26+ somites	*Not detected*	intermediate cell mass of mesoderm	ISH
		26+ somites		unspecified	ISH
	TU, MO:gata1	26+ somites		intermediate cell mass of mesoderm	ISH
		26+ somites		unspecified	ISH
	TU, MO:gata1,gata2	26+ somites		intermediate cell mass of mesoderm	ISH
		26+ somites		unspecified	ISH
	TU	26+ somites	*Not detected*	intermediate cell mass of mesoderm	ISH
		26+ somites		unspecified	ISH

Click here to view morpholino details

ZFIN

Site Search:

BLAST Anatomy Publications People Labs Companies Acc #

Home Mutants / Transgenics Wild-Types Genes / Markers / Clones Expression Maps

ZFIN ID: ZDB-MRPHLNO-050208-10

Morpholino Name: MO1-gata1

Your Input Welcome

Previous Names: MO(T)-gata1 (1) ; gata1 MO (1) ; Gata1 morpholino (1)

Sequence: 5' - CTGCAAGTGTAGTATTGAAGATGTC - 3' BLAST IT

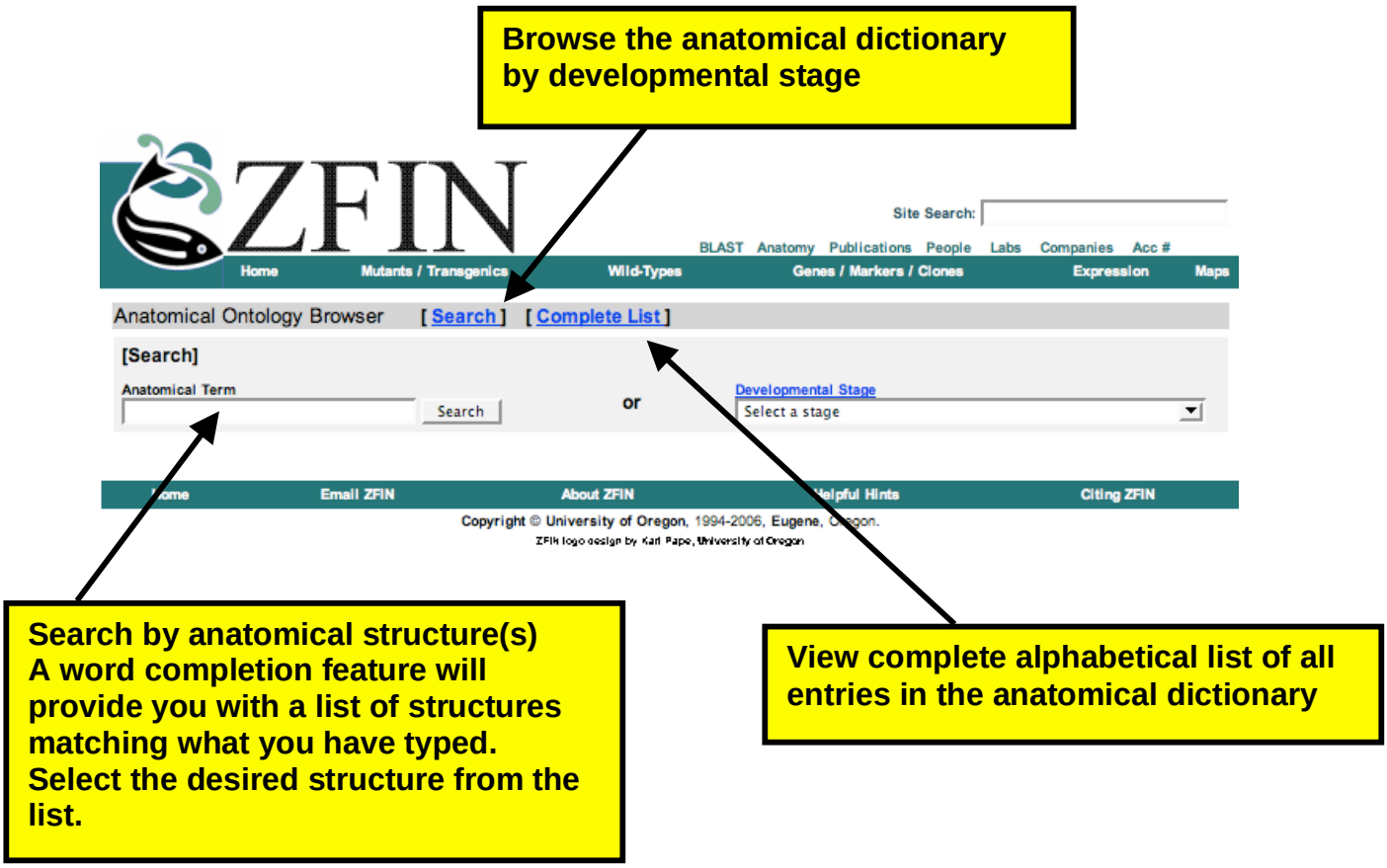
(Although ZFIN verifies reagent sequence data, we recommend that you conduct independent sequence analysis before ordering any reagent.)

Target Gene: gata1 (1)

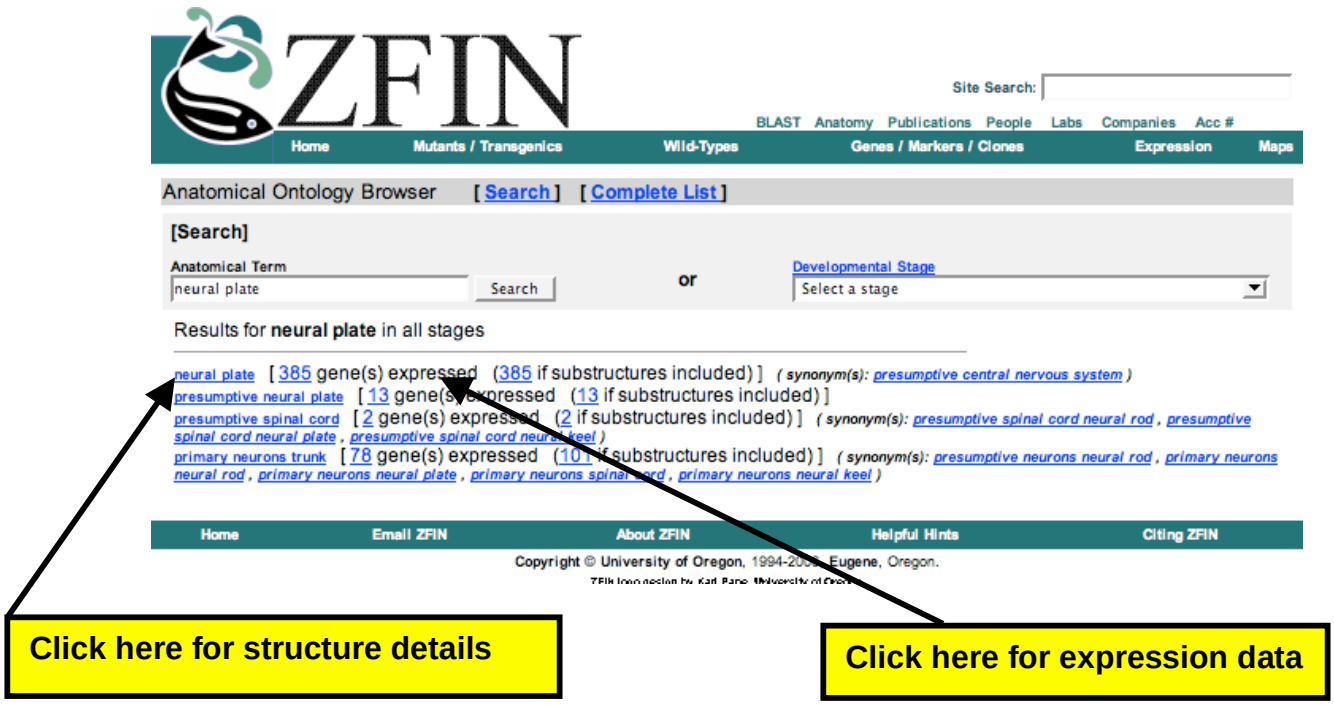
Note: A translation blocking morpholino targeting *gata1*.
This morpholino sequence was reported with an additional nucleotide in Rhodes et al. 2005 and is correct as displayed here confirmed by author.

CITATIONS (3)

3. Gene expression data may also be found by browsing the anatomical dictionary, http://zfin.org/cgi-bin/webdriver?MIval=aa-anatdict.apg&mode=search



A search for **neural plate** returns the following list:



Looking at the **neural plate** anatomy page, http://zfin.org/cgi-bin/webdriver?MIval=aa-anatomy_item.apg&OID=ZDB-ANAT-010921-5060, notice synonyms and a definition for neural plate, the stages in which the neural plate is present, links to genes expressed in the neural plate, related structures and a list of publications with neural plate in their abstract.

Exercises

- How can you find expression patterns for your marker in early wildtype development to determine if the observed change is due to misexpression or a delay in development?
- Can you find any knockdown studies for a gene you are studying?
- Use the gene expression query form to find expression data for an anatomical structure during a specified developmental stage range.