



www.cdtdb.neuroinf.jp

Brain Transcriptome Database (BrainTx)

(formerly CDT-DB)

User's guide

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The BrainTx project, BrainTx platform committee

(April 1, 2020)



1. About BrainTx project

The Brain Transcriptome Database (BrainTx) project aims to create an integrated platform to visualize and analyze our original transcriptome data and publicly accessible transcriptome data related to the genetics that underlie the development, function, and dysfunction stages and states of the brain. BrainTx was developed from the Cerebellar Development Transcriptome Database (CDT-DB).

The BrainTx project is supported by Research Society for Neuroinformatics and NeuroTechnology (NINT), the ex-Neuroinformatics Unit, Integrative Computational Brain Science Collaboration Center, RIKEN Center for Brain Science (NIU, ICBSCC, RIKEN CBS) (formerly Neuroinformatics Japan Center, RIKEN Brain Science Institute; NIJC, RIKEN BSI) that is the Japan Node of the International Neuroinformatics Coordinating Facility (INCF), JST, JSPS and MEXT.

Detailed information

Please see "**About**" of tab menu for experimental data registered in the BrainTx.

Please see "**Help**" of tab menu for how to use the BrainTx.

Necessary conditions for using the BrainTx

BrainTx can be used with Web browsers.

Windows:

Windows 7/8/8.1/10: Google Chrome, Internet Explorer 7-11,
Microsoft Edge, Firefox 59 or higher

Macintosh:

Mac OSX 10.4 or higher: Google Chrome, Safari 11 or higher,
Firefox 59 or higher



2. BrainTx search

Top page



BrainTx v5.5

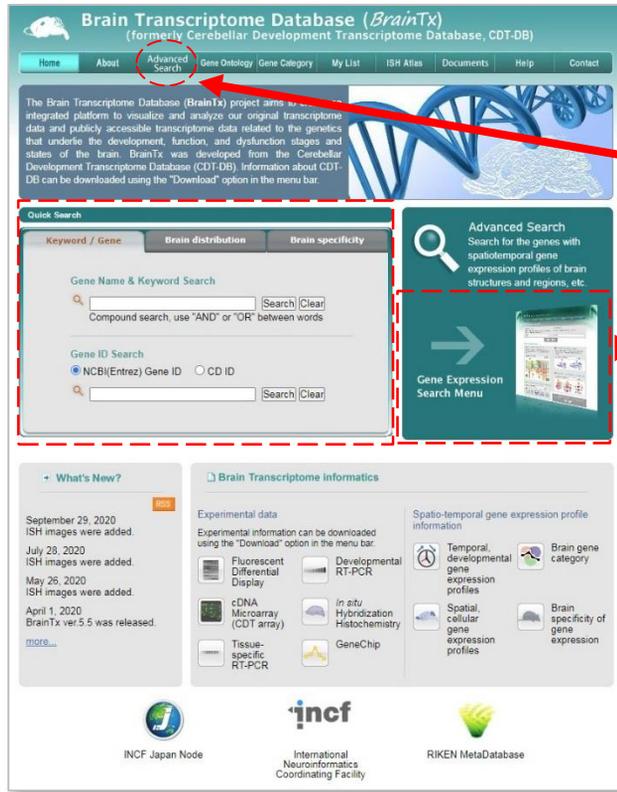
<http://www.cdtb.neuroinf.jp>

“Quick Search” tabs



Contents:

1. Keyword/Genes name/ID search
2. Brain distribution search
3. Brain specificity search



Click a “Advanced Search” tab or the square below to open the “Advanced Search page” (next page)

Contents

- Temporal information: developmental time series gene expression patterns (GeneChip, RT-PCR, custom array data)
- Spatial information: cellular/layer gene expression patterns (*in situ* hybridization brain histochemistry data)
- Brain distribution information: brain regional expression patterns (*in situ* hybridization brain histochemistry data)
- Brain specificity information: tissue distribution expression patterns (GeneChip, RT-PCR data)
- Gene category information: gene ontology and functional classification
- Relevant bioinformatics information: Hyperlinks to >30 websites → portal function

Number of the registered transcripts : about 46,000 transcripts (as of 2020.4.1)

Quick search menu

“Quick Search” on Top page

Select a search item by clicking “tab”

- Keyword/Gene tab
- Brain distribution tab
- Brain specificity tab

Advanced search menu

Gene Expression Search Menu containing “Brain subregional search”

(See next page)

Gene Search

- Gene Name & Keyword Search
- Gene ID Search

Expression Data Search

- Spatial expression search
- Temporal expression search
- Expression peak stage search
- Brain distribution search
- Brain specificity search

Advanced Search page

BrainTx v5.5 Advanced Search page

“All” Search Mode

Gene Search

Gene Name
& Keyword

Gene ID

Expression
Data Search

Visual
interface

Brain
distribution

Brain specificity
(Tissue distribution)

Two modes of Target genes:

1. All genes: Search from all genes registered in BrainTx.
2. Differentially expressed genes: Search from the genes differentially expressed during development in “All genes”.

“Detailed search”

Gene name & Keyword search

Enter gene name & symbol, protein structure & function, GO term (biological process, cellular component, molecular function)

Gene ID search

Enter NCBI Gene ID or CD ID (BrainTx ID)

Brain distribution search (Spatial data search)

Click the abbreviations of the brain regions at P7 or P21

Brain specificity search (Tissue distribution search)

Click the symbol icon on the tissue distribution diagram (brain specific, brain dominant, ubiquitous)

**BrainTx v5.5
Advanced
Search page**

Advanced Search page

Brain region "Cerebellum"

"Cerebellum" Search Mode

Gene Search

Gene name & Keyword

Gene ID

Expression Data Search

Cell/Layer types

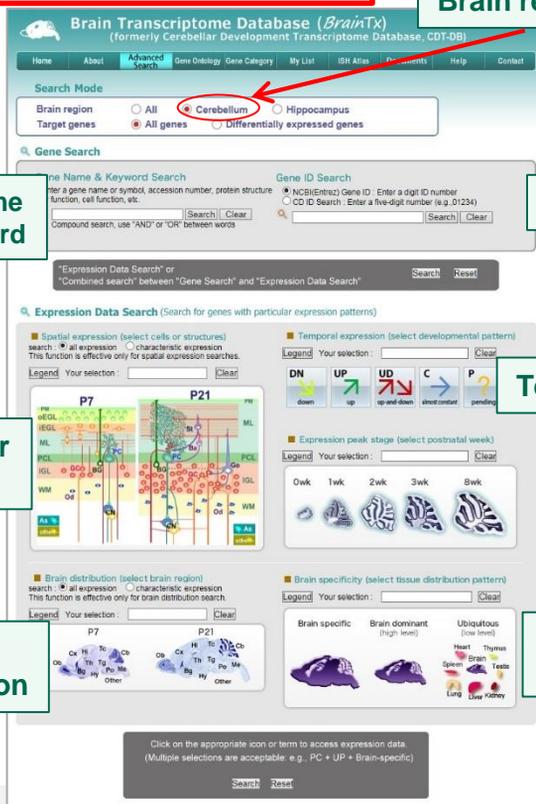
Temporal expression

Expression peak stage

Visual interface

Brain distribution

Brain specificity (Tissue distribution)



Two datasets:

1. **All genes:** Search from all genes registered in BrainTx.
2. **Differentially expressed genes:** Search from the genes differentially expressed during cerebellar development in "All genes".

"Detailed search"

Gene name & Keyword search

Enter gene name & symbol, protein structure & function, GO term (biological process, cellular component, molecular function)

Gene ID search

Enter NCBI Gene ID or CD ID (BrainTx ID)

Cell/Layer-type search (Spatial data search)

Click the abbreviations on the cerebellar cortex neurons or the layered structures at P7 or P21

Brain distribution search (Spatial data search)

Click the abbreviations of the brain regions at P7 or P21

Temporal expression pattern search (Temporal data search in cerebellum)

Click the symbol icon on the expression pattern diagram (down, up, up-and-down, constant, pending) in cerebellum

Expression peak stage search (Temporal data search in cerebellum)

Click the symbol icon on the expression peak stage diagram (0wk, 1wk, 2wks, 3wks, 8wk (adult)) in cerebellum

Brain specificity search (Tissue distribution search)

Click the symbol icon on the tissue distribution diagram (brain specific, brain dominant, ubiquitous)

BrainTx v5.5 Advanced Search page

Advanced Search page

Brain region "Hippocampus"

"Hippocampus" Search Mode

Gene Search

Gene name & Keyword

Gene ID

Expression Data Search

Subregion/
cell-types

Visual
interface

Brain
distribution

Brain specificity
(Tissue distribution)

Dataset:

1. **All genes:** Search from all genes registered in BrainTx.

"Detailed search"

Gene name & Keyword search

Enter gene name & symbol, protein structure & function, GO term (biological process, cellular component, molecular function)

Gene ID search

Enter NCBI Gene ID or CD ID (BrainTx ID)

Subregion/Cell-type search (Spatial data search)

Click the abbreviations on the hippocampal subregions or neurons at P7 or P21

Brain distribution search (Spatial data search)

Click the abbreviations of the brain regions at P7 or P21

Brain specificity search (Tissue distribution search)

Click the symbol icon on the tissue distribution diagram (brain specific, brain dominant, ubiquitous)



3. Database search results

Brain Transcriptome Database (BrainTx)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Home | About | Advanced Search | Gene Ontology | Gene Category | My List | ISH Atlas | Documents | Help | Contact

Search Results
Brain Region : Cerebellum
Target Genes : All genes
Input Search Terms : GC/P21

Item 1- 20 of 1508 Page 1 / 76 Next Last Show 20 Change

Add To MyList Check All Uncheck All Sort by : CD ID Print version

Result Download Select file size Normal size Download Show Graph GeneChip Graph CDT array Graph

	CD ID Accession No.	Gene Symbol	Gene Name	Gene Info	Links	Temporal	Spatial	Tissue	Category
<input type="checkbox"/> 1:	CD00003 NM_001081203	Sbno1	sno, strawberry notch homolog 1 (Drosophila)						
<input type="checkbox"/> 2:	CD00005 NM_013666	St8sia5	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 5						

1) Search target & queries; 2) Select pages; 3) Change number of genes displayed in a page; 4) Add checked genes to your list “My List”; 5) Check all genes; 6) Cancel all check; 7) Select download file size; 8) Sort by selected items and orders; 9) Print version; 10) Draw GeneChip graph; 11) Draw CDT array graph; 12) Check box; 13) Access to “Gene information” page; 14) Access to NCBI-Nucleotide website; 15) “Link” to other databases (see below); 16) Access to “Temporal info”; 17) Access to “Spatial info”; 18) Access to “Tissue info”; 19) Access to “Gene Category info”

Browsing and instruction of the search result page

Display and sort of the gene data column (2,3,8)

Search result page displays a list of hit genes. The gene list can be sorted by choosing the pull-down menus (CD ID, gene symbol, temporal, spatial, tissue and category). Number of genes displayed in a page can be changed.

Create “My List” (4,5,6,12)

Choose the genes of your interest and check the box. Then click “Add To MyList” button, it creates “My List” with a gene list the user selected (see, 4. “My List” page).

Download and print (7,9)

Select download file size (small or normal) and click “Download” button. Print version of the result page can be selected by clicking “Print version” button.

Gene information access (13,14)

Access to gene information page of the BrainTx or the NCBI-Nucleotide website.

“Links” to other databases (15)

Access to corresponding gene pages of NCBI-Gene, MGI, GEO, Allen Brain Atlas, GenePaint, ViBrism, BrainStars, BioGPS, Mouse Phenotype Database and RIKEN MetaDatabase.

Access to the expression data information (16,17,18,19)

To open expression data pages, click icons “Temporal”, “Spatial”, “Tissue”, “Category”.

“My Graph” - Create and analyze temporal expression profile graph (10,11)

Click “GeneChip Graph” and “CDT array Graph” button to automatically create an expression graph of hit genes, “My Graph”. Expression patterns can be analyzed.

BrainTx v5.5 Search Results



Search result page

Click icon to open each expression information page

- Gene information
- Links to other databases
- Temporal information
- Spatial information
- Tissue distribution
- Gene category

Brain Transcriptome Database (BrainTx)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Search Results
Brain Region : Cerebellum
Target Genes : All genes
Input Search Terms : GC/P21

Hit gene list

Item 1- 20 of 1508 Page 1 / 76 Show 20 Change

Sort by : CD ID **“Click”**

CD ID Accession No.	Gene Symbol	Gene Name	Gene Info	Links	Temporal	Spatial	Tissue	Category
CD00003 NM_001081203	Sbno1	sno, strawberry notch homolog 1 (Drosophila)						
CD00005 NM_013666	St8sia5	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 5						
CD00009 NM_016806	Hnmpa2b1	heterogeneous nuclear ribonucleoprotein A2/B1						
CD00010 NM_001205234	Nrxn2	neurexin II						
CD00011 NM_138391	Gfm1	G elongation factor, mitochondrial 1						
CD00014 NM_008972	Ptma	prothymosin alpha						
CD00015 NM_001128086	Anks1b	ankyrin repeat and sterile alpha motif domain containing 1B						
CD00018 NM_019505	Dgk1e	diacylglycerol kinase, epsilon						

Links icon

Spatial information icon

Gene Info Links Temporal Spatial Tissue Category

mouseover **“Links” icon to open “Link launcher”**

“Links” icon

Link launcher

mouseover **“Spatial” icon to open “dropdown menu of CD ID plus sub IDs”**

“Spatial” icon

click **“CD ID plus sub ID”** to open **“Spatial information page (ISH brain image page)”**

Links to NCBI-Gene, MGI, GEO, Allen Brain Atlas, GenePaint, ViBrism, BrainStars, BioGPS, Mouse Phenotype Database and RIKEN MetaDatabase

Links to other bioinformatics sites

Gene information page

Gene information

Example: ***Nlgn1 (neuroligin 1)***

Home

CD ID	CD00043	Gene ID in BrainTx	Links	Hyperlinks to other bioinformatics DB sites	
Gene Symbol	Nlgn1	Gene symbol & Gene name	General information	<ul style="list-style-type: none"> NCBI(Entrez)-Gene : 192167 MGI : 2179435 Ensembl : ENSMUSG00000063887 UniGene : Mm.316080 OMIM : 600568 GEO : Nlgn1 KEGG : Cell adhesion molecules (CAMs) 04514 	
Gene Name	neuroligin 1				
Alternative name(s)	neuroligin 1; neuroligin-1 6330415N05RIK, BB179718, NL1, mKIAA1070	Alternative gene names	Genome information	<ul style="list-style-type: none"> - Harvester - UCSC Mouse Genome Browser Gateway - Perlegen/NIEHS Mouse Genome Browser 	
Accession ID	NM_001163387 , NM_138666	Accession ID			
Gene Category	Cell adhesion and recognition-related genes Neurite growth and synapse formation-related genes	Gene category name	Functional genomics	<ul style="list-style-type: none"> - GeneNetwork - Mouse Phenome Database - BioGPS - STRING 	
Gene Ontology	<p>biological_process alpha-amino-3-hydroxy-5-methyl-4-isoxazole propionate receptor clustering, calcium-dependent cell-cell adhesion, cell adhesion, cell adhesion, establishment of protein localization, heterophilic cell-cell adhesion ... [Show All]</p> <p>cellular_component cell junction, cell surface, dendrite, excitatory synapse, integral to membrane ... [Show All]</p> <p>molecular_function cell adhesion molecule binding, neurexin family protein binding, protein dimerization activity, receptor activity</p>	Gene ontology terms			
Temporal expression	<p>Cerebellum CD00043.1 almost constant regulation</p> <p>CD00043.2 almost constant regulation</p>	Temporal expression information (developmental time series)	RIKEN databases	<ul style="list-style-type: none"> - RIKEN MetaDatabase - FANTOM - BioResource 	
Spatial expression (characteristic site)	<p>Cerebellum CD00043.1 P7 : Purkinje cell, granule cell, inner external germinal layer, internal granular layer, outer external germinal layer P21 : Purkinje cell, Purkinje cell layer, basket cell, internal granular layer, stellate cell</p> <p>Hippocampus CD00043.1 P7 : CA1, CA2, CA3, dentate gyrus P21 : CA1, CA2, CA3, dentate gyrus</p>	Spatial expression information (region, subregion, cell, layer)			
Brain distribution (characteristic site)	<p>CD00043.1 P7 : basal ganglia, cerebellum, cerebral cortex, hippocampus, hypothalamus, olfactory bulb, pons, tectum, tegmentum, thalamus P21 : basal ganglia, cerebellum, cerebral cortex, hippocampus, hypothalamus, olfactory bulb, pons, tectum, tegmentum, thalamus</p>		ex-INCF Japan Node databases	<ul style="list-style-type: none"> - ViBrism - Cerebellar Platform - Mouse Phenotype Database 	
Brain specificity	<p>CD00043.1 P21 : Brain specific</p> <p>CD00043.2 Ubiquitous</p>	Brain specificity information (tissue distribution)			
Experimental data	Temporal Spatial Tissue Category	Link icon to each information page (containing experimental data)	Nervous system	<ul style="list-style-type: none"> - BrainStars - SynDB - Mouse Neuronal Expression Database - Molecular Brain Mouse Brain Transcriptome 	
References	<p>(PubMed IDs searched for cerebellar development, etc. and cited in NCBI Nucleotide)</p> <ul style="list-style-type: none"> 14769026 Structural characterization of recombinant soluble rat neuroligin 1: mapping of secondary structure and glycosylation by mass spectrometry. 14522992 Characterization of the interaction of a recombinant soluble neuroligin-1 with neurexin-1beta. 7736595 Neuroligin 1: a splice site-specific ligand for beta-neurexins. 21267068 A high-resolution anatomical atlas of the transcriptome in the mouse embryo 20534458 Essential cooperation of N-cadherin and neuroligin-1 in the transsynaptic control of vesicle accumulation <p>Show all (13) references (detailed information)</p>	Literature (PudMed ID)			Reference information
			Cellular expression (ISH) information	<ul style="list-style-type: none"> - Allen Brain Atlas - GenePaint - BGEM 	
			Probe	<p>CD00043.1 CDT EST : BP426298 Affymetrix : 1437160_at (MG 430 2.0 Array)</p> <p>CD00043.2 CDT EST : Affymetrix : 1421648_at (MG 430 2.0 Array)</p>	Probe information (CDT EST & Affymetrix GeneChip)

Hyperlinks on gene information page

General information

NCBI-Gene; NCBI Nucleotide; UniGene; OMIM; GEO; MGI; Ensembl; KEGG; Gene Ontology

Genome information

Harvester; UCSC Mouse Genome Browser Gateway; Perlegen/NIEHS Mouse Genome Browser

Functional genomics

GeneNetwork; Mouse Phenome Database; BioGPS; STRING

RIKEN databases

RIKEN MetaDatabase; FANTOM; BioResource

ex-INCF Japan Node (NIU) databases

ViBrism; Cerebellar Platform; Mouse Phenotype Database

Nervous system

BrainStars; SynDB; Mouse Neuronal Expression Database; Molecular Brain Mouse Brain Transcriptome

Reference information

GoPubMed; iHOP; PubMed

Cellular expression (ISH) information

Allen Brain Atlas; GenePaint; BGEM

Probe information

GenBank; Affymetrix

We gratefully appreciate these databases

BrainTx also functions as a portal site for the relevant bioinformatics websites.

The BrainTx includes easy links to relevant bioinformatics database sites. Thus, one can easily access additional information about BrainTx genes through these hyperlinks.



5. Temporal expression data search

Temporal information page

BrainTx v5.5 Temporal Info

Developmental time series
expression information

Three different experiment data

Example:

Pvalb (parvalbumin)
"up-regulated"

Temporal information

CD01266
Gene symbol : Pvalb
Description : parvalbumin
Strain : RT: ICR, GC: C57BL/6J, MA: ICR

Current data: CD01266.1
Other data links: CD01266.2 CD01266.3

Temporal expression pattern of this gene

Expression: up regulation

RT-PCR

Gel image

Experimental condition

5'-primer	CGCTGGAGACAAGGATGG
3'-primer	CCGAGGCCATAGAGGAT
Denature	95 °C 30 sec
Renature	60 °C 30 sec
Extension	72 °C 30 sec
Cycle No.	25

Experimental condition

1	E18
2	P0
3	P3
4	P7
5	P12
6	P15
7	P21
8	P56

Choose a suitable scale of the Y-axis

GeneChip

Graph

Max signal value (Select Y-axis range): 10000

Graph

Stage	Relative value (%)	Signal Value
E18	2.0	105.37
P7	14.0	742.03
P14	91.1	4815.07
P21	100.0	5286.07
P56	99.5	5260.63

Numerical data

Stage	Relative value (%)	Signal value
E18	2.0	105.37
P7	14.0	742.03
P14	91.1	4815.07
P21	100.0	5286.07
P56	99.5	5260.63
Peak		P21

Chip information

Experimental condition	1417653_at
Affymetrix Probe ID	MG 430 2.0 Array
Array Info	
Signal range	Max: 9176.00 Min: 0.10

CDT array

Graph

Signal value (Select Y-axis range): 2.5

Graph

Stage	Relative value (%)	Signal Value
E18	15.8	0.19
P0	14.2	0.17
P3	19.0	0.23
P7	31.0	0.38
P12	90.4	1.10
P15	90.3	1.09
P21	100.0	1.21
P56	90.6	1.10

Numerical data

Stage	Relative value (%)	Signal value
E18	15.8	0.19
P0	14.2	0.17
P3	19.0	0.23
P7	31.0	0.38
P12	90.4	1.10
P15	90.3	1.09
P21	100.0	1.21
P56	90.6	1.10
Peak		P21

Experimental condition

Signal range	Max: 19.15 Min: 0.00
--------------	----------------------

Developmental time series gene expression data search



RT-PCR experiment data

It provides the electrophoresis gel images with eight stages on E18, P0, P3, P7, P12, P15, P21 and P56. Also, the primer sequences and the experimental condition are stated.



GeneChip experiment data

It provides the graph and the table data (the relative and the absolute signal values) of the five stages on E18, P7, P14, P21 and P56, obtained by the Affymetrix GeneChip analysis. The probe information and the supplementary information are hyperlinked to a webpage of the Affymetrix probe information page.



Custom CDT array experiment data

Custom CDT array is the microarray which consists of approximately 2000 of the cerebellar development-related genes (identified by fluorescent differential display analyses) spotted on the glass plates. It provides the graph and the table data (the relative and the absolute signal values) of eight stages on E18, P0, P3, P7, P12, P15, P21 and P56.



6. Spatial cellular expression data search

Spatial information page

BrainTx v5.5
Spatial Info

Brain Transcriptome Database (*BrainTx*)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

[Spatial information](#) **Spatial expression data information** [Home](#)

CD01266
NM_013645

Gene Symbol : Pvalb
Gene Name : parvalbumin
Strain : ICR

mouse strain analyzed

Current data: CD01266.1
Other data links: CD01266.2 CD01266.3

Ex: Pvalb

In situ hybridization **ISH brain histochemistry**

P7 P21

P7 **P21**

Click to open a "Detailed viewer" window Click to open a "Detailed viewer" window

Extra Data

P7 / Cerebellum P7 / Thalamus P21 / Cerebellum

ISH histochemistry of sagittal brain sections at P7 and P21 are compiled. Click a brain image at P7 or P21 to open a "**Detailed viewer (BrainTx Brain Viewer)**" window (see next page).

Extra Data: Extra ISH images are provided if characteristic ISH patterns appear in brain regions. Click an image to open a new window containing a magnified image.

Detailed viewer (BrainTx Brain Viewer)

BrainTx v5.5
Image viewer

Spatial information (Detailed view) Ex: *Pvalb*

CD ID	CD01266 (CD01266.1)
Gene Symbol	Pvalb
Stage	P21

Image control
Tool bar

Image mode

Direction of
movement

Magnification
slide bar

Loupe icon

Hand tool

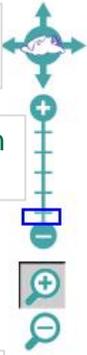


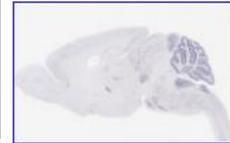
Image mode

Color mode

Grayscale mode

Inverted mode

Position



Tool bar on the left is used to operate a brain image in a view window: move up/down and left/right, magnify by moving the slider bar or by using the loupe icon (+/-, magnification/reduction), move by hand icon.

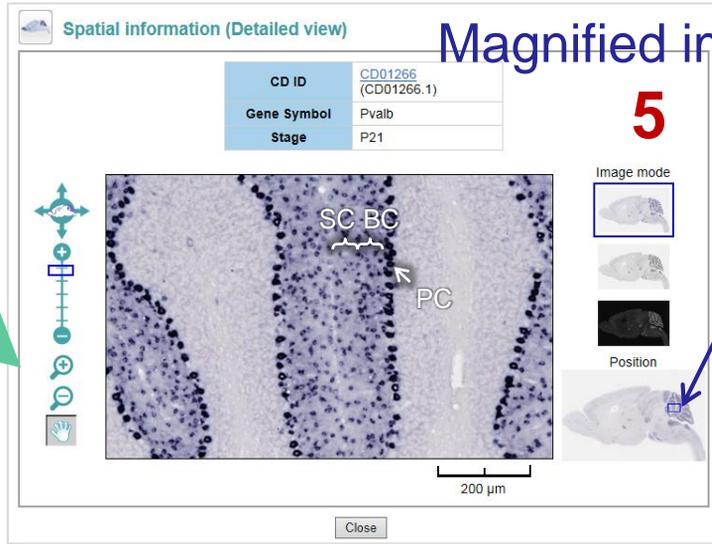
Scale bar: Scale bar of magnified brain images is indicated.

Analysis of expression
at cell levels

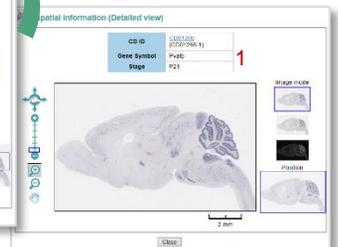
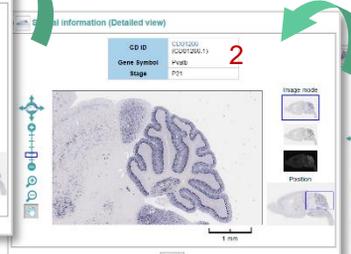
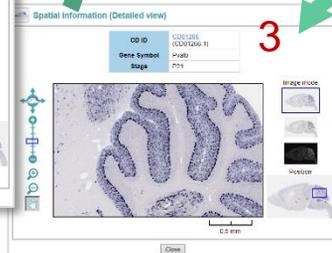
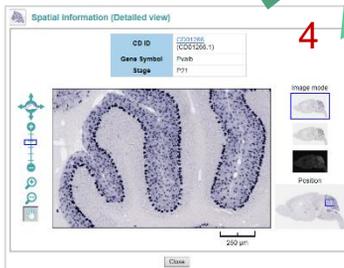
Ex: *Pvalb*

is observed in
"SC, stellate cell"
"BC, basket cell"
"PC, Purkinje cell"

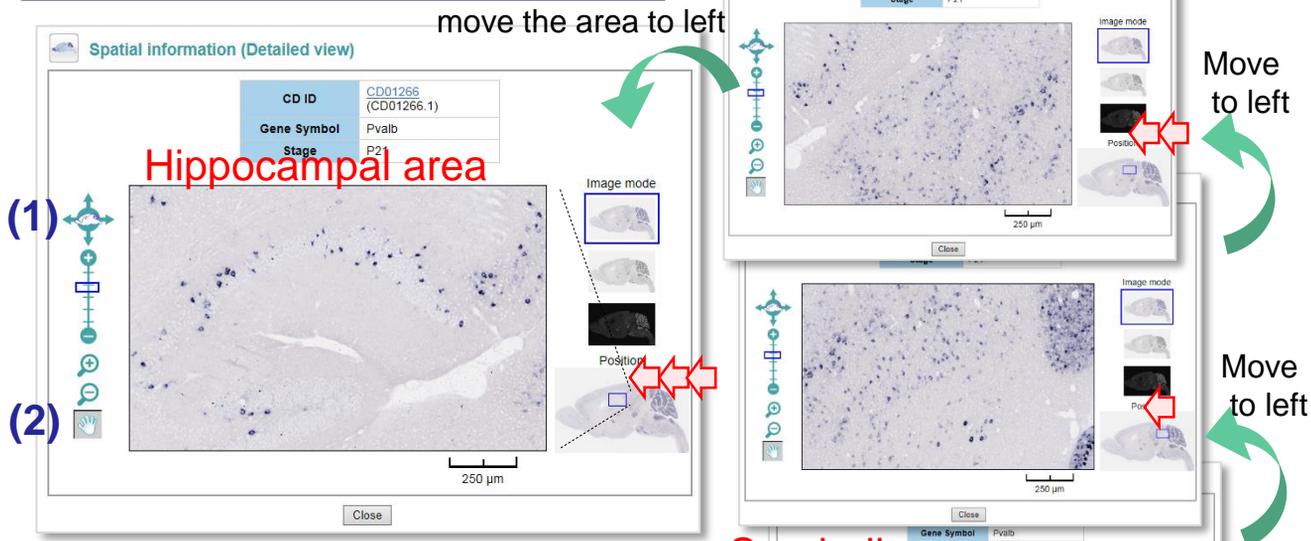
Magnified image



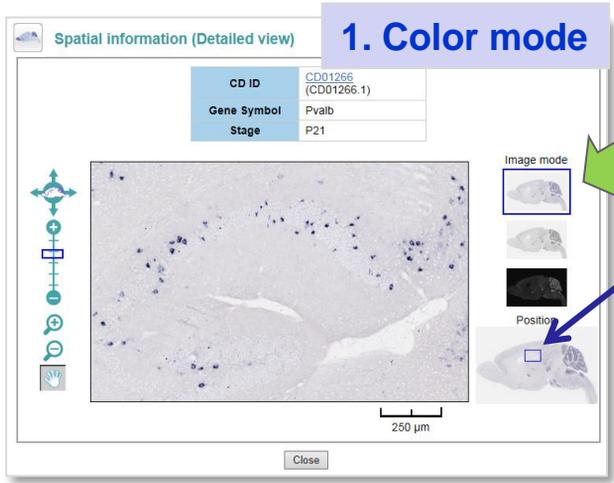
Display area



Move & display magnified views of various brain areas



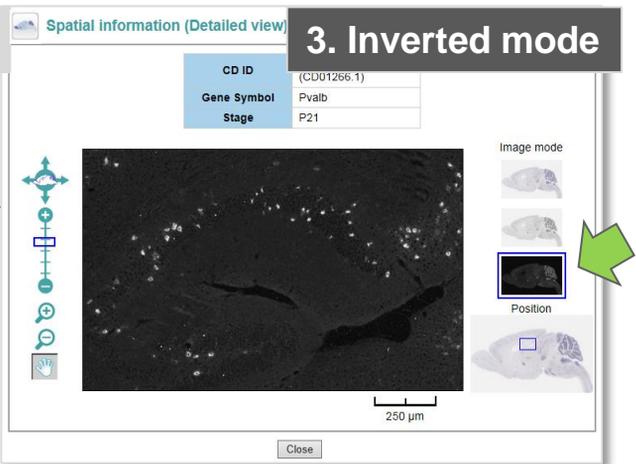
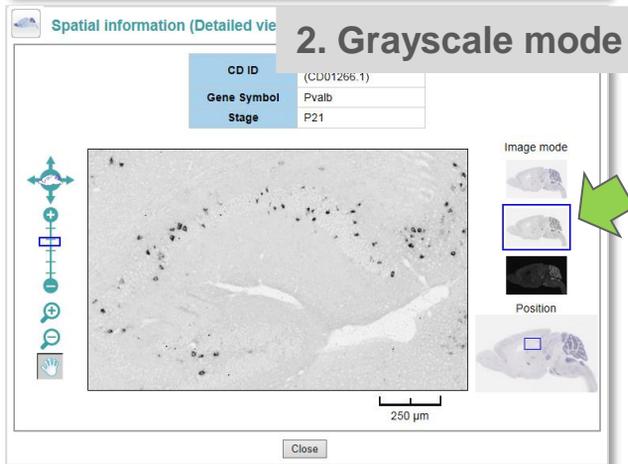
Display area: A frame is the brain area showing in a view window, and can freely be moved by clicking (movement direction, (1)) or dragging (hand icon, (2)).



Ex: Pvalb (parvalbumin)
"Expression in hippocampal inhibitory neuron"

Image mode

Image mode: A display image can be chosen from three modes:
 1. Color, 2. Grayscale and 3. Inverted modes.



7. Tissue distribution expression data search

**BrainTx v5.5
Tissue Info**

Tissue information page

Tissue distribution expression information

Tissue information (Brain specificity)

Gene symbol : Pvalb
Description : parvalbumin
Strain : RT: ICR, GC: C57BL/6J

Current data: CD01266.1
Other data links: CD01266.2 CD01266.3

Tissue distribution pattern of this gene

Expression : Brain dominant

RT-PCR (Tissue distribution)

Gel image

Experimental condition

Developmental stage	P21	
5-primer	CGCTGGAGACAAGGATGG	
3-primer	CCGAGGGCCATAGAGGAT	
Temperature & Time	Denature	95 °C 30 sec
	Renature	60 °C 30 sec
	Extension	72 °C 30 sec
Cycle No.	25	

1 Brain
2 Thymus
3 Lung
4 Heart
5 Liver
6 Spleen
7 Kidney
8 Testis

GeneChip

Max signal value (Select Y-axis range): 1000

Relative Value (%) (P7, P21)

Signal intensity

	Br	Th	Lu	He	Li	Sp	Ki	Te
Relative value (%)	P7: 100.0	25.4	6.6	13.5	7.1	9.3	22.9	7.5
	P21: 100.0	1.7	2.8	0.8	0.3	0.5	8.9	0.6
Signal value	P7: 170.15	43.18	11.26	22.97	12.08	15.85	38.89	12.80
	P21: 1929.60	31.99	53.71	15.80	6.40	10.51	171.33	12.49

Chip data

Affymetrix Probe ID	1417653_at
Array Info	MG-430A 2.0 Array
Signal range	Max: 9845.40 Min: 0.70

Experimental condition

Choose a suitable scale of the Y-axis

RT-PCR and GeneChip analyses of eight different tissues

Example:
Pvalb (parvalbumin)
"brain dominant"

Numerical data

Gene expression patterns in eight different tissues (brain, thymus, lung, heart, liver, spleen, kidney, and testis)

1. Tissue specific RT-PCR



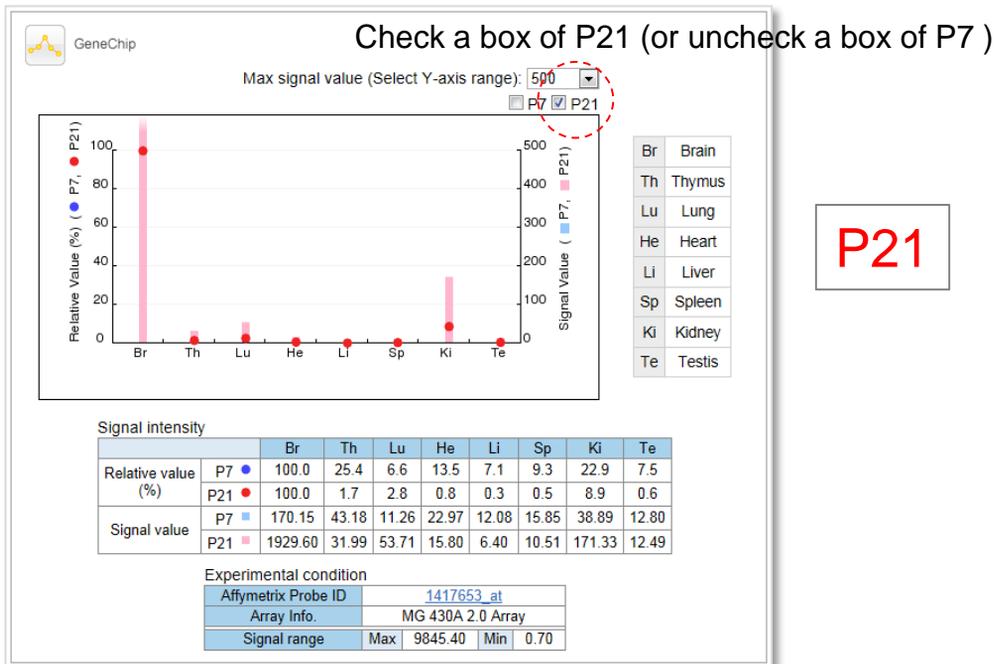
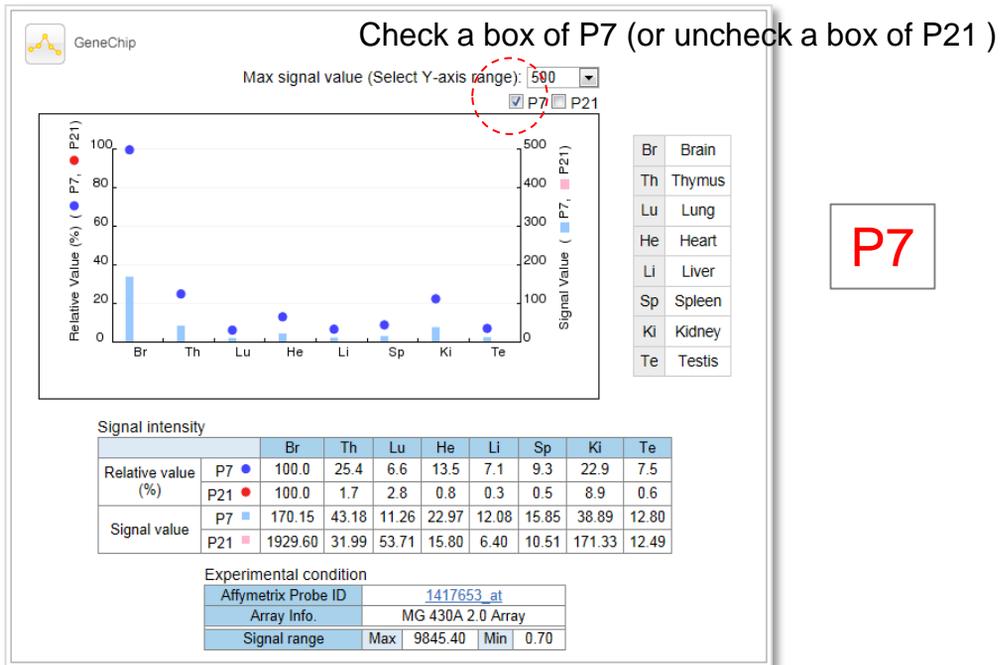
A representative agarose gel banding pattern of RT-PCR analysis to show brain specificity or dominance of gene expression among eight different mouse tissues at either P7 or P21.

2. GeneChip



A graph and table indicate normalized signal and relative values of gene expression in eight different tissues of P7 and P21 mice (C57BL/6J). The maximum signal values of right y-axis can be adjustable by selecting from 10000, 5000, 1000, 500 and 100. Experimental conditions, Affymetrix Probe ID, GeneChip array name and signal range (maximum and minimum values) are indicated.

GeneChip graph of tissue-specific expression



To indicate a GeneChip graph of tissue-specific expression at a stage of P7 or P21, check a box of either P7 or P21 and it will be displayed.



8. Gene Ontology search

Gene search based on Gene Ontology (GO) terms

BrainTx v5.5
Gene Ontology search

Brain Transcriptome Database (BrainTx)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Home About Advanced Search **Gene Ontology** Gene Category My List ISH Atlas Documents Help Contact

Browse the genes annotated to Gene Ontology (GO) terms [Gene Ontology \(GO\)](#) [How to use \(search examples\)](#)

1 **GO Tree Browser:** select parent term to display child GO terms (number of annotated genes)
GO terms in light gray color (ex. carbon utilization) contain no annotated genes (in both parent and child terms) so far.

GO term tree:

- biological_process(6603 genes) **• Biological process**
- cellular_component(5782 genes) **• Cellular component**
- molecular_function(6968 genes) **• Molecular function**

2 **GO Term Search:** enter query (genes, terms, etc.) to search for genes annotated to particular GO terms

Gene name/symbol GO term (exact match)
Gene Ontology Search: NCBI(Entrez) Gene ID CD ID

Query:

(e.g., gene, synapse, axon, glomerulus, migration, depolarization, etc.)

Gene ontology search can browse the registered genes of BrainTx by definition terms of the Gene Ontology (GO).



Gene Ontology Consortium
<http://www.geneontology.org>



The OBO Foundry (The Open Biological and Biomedical Ontology Foundry)
<http://www.obofoundry.org>

BrainTx (CD) genes can be searched for Gene Ontology (GO) terms.

1. GO Tree Browser (GO hierarchy search)

Click a GO term. CD genes classified into the selected term are shown in the hierarchical tree of GO (the biological process, cellular component and molecular function) (see next page)

2. GO Tree Search (GO term search)

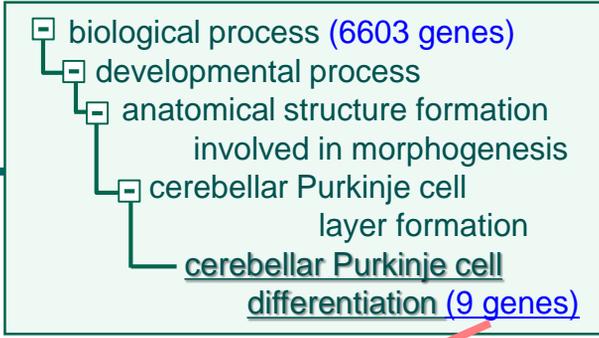
CD genes can be searched by gene name/symbol, GO terms, Entrez (NCBI)-Gene ID, or CD ID. Hit genes are shown in the GO hierarchical tree, so that a correlation among hit genes is estimated.

GO Tree Browser (GO hierarchy search)

GO Tree Browser: select parent term to display child GO terms (number of annotated genes)

- biological_process (6603 genes)
 - biological adhesion
 - biological regulation
 - carbohydrate utilization (1 gene)
 - carbon utilization
 - cell killing
 - cell proliferation (157 genes)
 - cellular component organization or biogenesis
 - cellular process (32 genes)
 - death (9 genes)
 - developmental process (2 genes)
 - abscission
 - age-dependent behavioral decline
 - age-dependent general metabolic decline
 - aging (22 genes)
 - anatomical structure arrangement (1 gene)
 - anatomical structure development (13 genes)
 - anatomical structure formation involved in morphogenesis (21 genes)
 - adenohypophysis formation
 - adrenal cortex formation (1 gene)
 - aerenchyma formation
 - angiogenesis (158 genes)
 - anterior neural plate formation
 - beak formation
 - blastocyst formation (6 genes)
 - blood microparticle formation
 - bract formation
 - cardiac chamber formation (1 gene)
 - cellular component assembly involved in morphogenesis
 - cellularization
 - central nervous system formation
 - cephalic furrow formation
 - cerebellar cortex formation (1 gene)
 - cerebellar granular layer formation
 - cerebellar molecular layer formation
 - cerebellar Purkinje cell layer formation
 - candelabrum cell differentiation
 - cerebellar Purkinje cell differentiation (9 genes)** ← "Click"
 - cerebellum formation (1 gene)
 - conidium formation

Example :
 "cerebellar Purkinje cell differentiation"
 includes 9 related genes, registered in
 the BrainTx.



Click GO terms to show a hierarchical tree

Ex: **Lhx1**
 LIM homeobox protein 1

A list of 9 hit genes

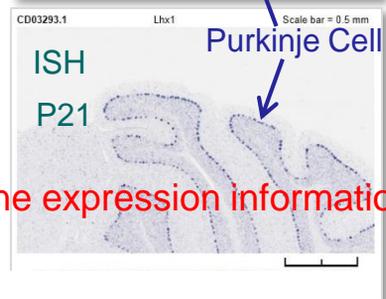
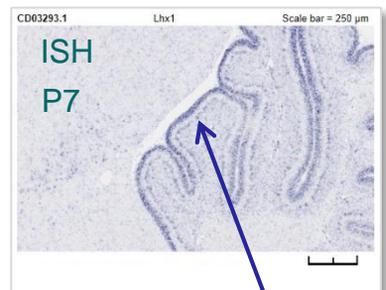
Search Results
 Brain Region : All
 Target Genes : All genes
 Input Search Terms : cerebellar Purkinje cell differentiation

Item 1-9 of 9 Page 1 / 1 Show 20 Change

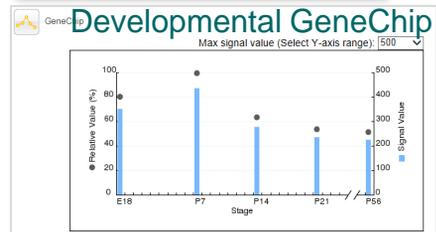
Add To MyList Check All Uncheck All Sort by: CD ID Print version

Result Download Select file size Normal size Download Show Graph GeneChip_Graph CDT_array_Graph

CD ID Accession No.	Gene Symbol	Gene Name	Gene Info	Links	Temporal	Spatial	Tissue	Category
1: CD01495 NM_001036684	Atp2b2	ATPase, Ca ⁺⁺ transporting, plasma membrane 2						
2: CD03116 NM_001252059	Cacna1a	calcium channel, voltage-dependent, P/Q type, alpha 1A subunit						
3: CD03293 NM_008498	Lhx1	LIM homeobox protein 1						
4: CD03310 NM_013646	Rora	RAR-related orphan receptor alpha						
5: CD04696 NM_001048008	Agtbbp1	ATP/GTP binding protein 1						
6: CD08733 NM_009125	Atxn2	ataxin 2						
7: CD10163 NM_001109757	Atp7a	ATPase, Cu ⁺⁺ transporting, alpha polypeptide						
8: CD13141 NM_00113408	Ldb1	LIM domain binding 1						
9: CD17884 NM_008499	Lhx5	LIM homeobox protein 5						



Gene expression information



GO term: cerebellar Purkinje cell differentiation

GO Tree Search (GO term search)

BrainTx v5.5 Gene Ontology search

Select "GO term"

GO Tree Search: enter query (genes, terms, etc.) to search for genes annotated to particular GO terms

Gene Ontology Search: Gene name/symbol GO term (exact match)
 Entrez Gene ID CD ID

Query:
(e.g., gene, synapse, axon, glomerulus, migration, depolarization, etc.)

"spine" search result

Enter a GO term
example: "spine"

Click "Search"

biological_process

[acid secretion \(3 genes\)](#)
[actin cytoskeleton organization \(102 genes\)](#)
[actin cytoskeleton reorganization \(32 genes\)](#)
[actin filament bundle assembly \(21 genes\)](#)
[actin filament organization \(36 genes\)](#)

[\[...Show all\]](#)

cellular_component

[A band \(9 genes\)](#)
[acetylcholine-gated channel complex \(15 genes\)](#)
[acrosomal vesicle \(51 genes\)](#)
[actin cap \(3 genes\)](#)
[actin cytoskeleton \(136 genes\)](#)

[\[...Show all\]](#)

molecular_function

[14-3-3 protein binding \(14 genes\)](#)
[A-type \(transient outward\) potassium channel activity \(2 genes\)](#)
[A2A adenosine receptor binding \(2 genes\)](#)
[acetylcholine binding \(13 genes\)](#)
[acetylcholine receptor activator activity \(1 gene\)](#)

[\[...Show all\]](#)

Click to show
all GO terms
related to
"spine"

Click each GO term

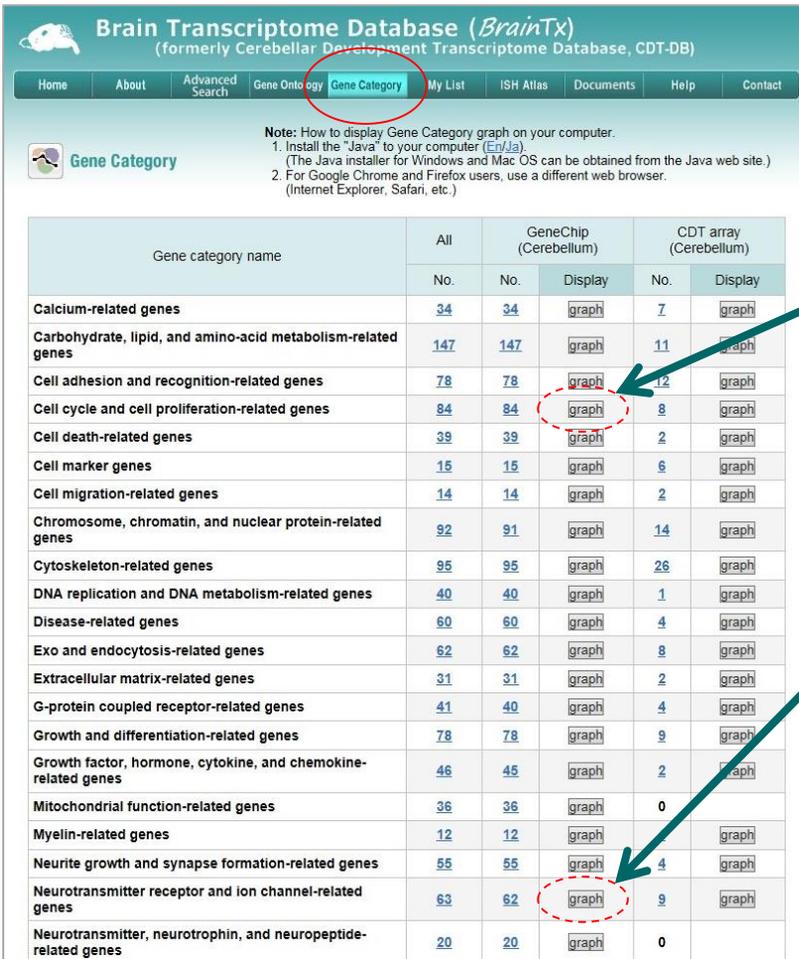
Gene list page



Gene information & Gene expression data

Number of genes related to "spine" in the BrainTx can be mined.

By query a GO term, you can mine and display a list of the related GO terms with number of BrainTx genes related to the terms. Then, click the term to open and display a gene list page, which provides gene information and gene expression data.



Note: How to display Gene Category graph on your computer.
 1. Install the "Java" to your computer ([En/Java](#)).
 (The Java installer for Windows and Mac OS can be obtained from the Java web site.)
 2. For Google Chrome and Firefox users, use a different web browser.
 (Internet Explorer, Safari, etc.)

Gene category name	All	GeneChip (Cerebellum)		CDT array (Cerebellum)	
	No.	No.	Display	No.	Display
Calcium-related genes	34	34	graph	7	graph
Carbohydrate, lipid, and amino-acid metabolism-related genes	147	147	graph	11	graph
Cell adhesion and recognition-related genes	78	78	graph	12	graph
Cell cycle and cell proliferation-related genes	84	84	graph	8	graph
Cell death-related genes	39	39	graph	2	graph
Cell marker genes	15	15	graph	6	graph
Cell migration-related genes	14	14	graph	2	graph
Chromosome, chromatin, and nuclear protein-related genes	92	91	graph	14	graph
Cytoskeleton-related genes	95	95	graph	26	graph
DNA replication and DNA metabolism-related genes	40	40	graph	1	graph
Disease-related genes	60	60	graph	4	graph
Exo and endocytosis-related genes	62	62	graph	8	graph
Extracellular matrix-related genes	31	31	graph	2	graph
G-protein coupled receptor-related genes	41	40	graph	4	graph
Growth and differentiation-related genes	78	78	graph	9	graph
Growth factor, hormone, cytokine, and chemokine-related genes	46	45	graph	2	graph
Mitochondrial function-related genes	36	36	graph	0	graph
Myelin-related genes	12	12	graph		graph
Neurite growth and synapse formation-related genes	55	55	graph	4	graph
Neurotransmitter receptor and ion channel-related genes	63	62	graph	9	graph
Neurotransmitter, neurotrophin, and neuropeptide-related genes	20	20	graph	0	graph

Gene category information

Click "graph" to show temporal expression graph of each gene category

Cell cycle and cell proliferation-related genes

Examples

Neurotransmitter receptor and ion channel-related genes

The BrainTx genes are clustered based on their functions and properties.

Gene Category (Gene Functional Cluster)

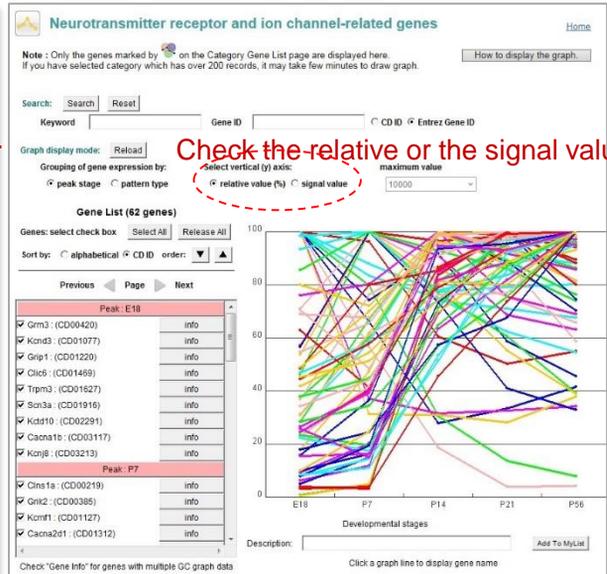
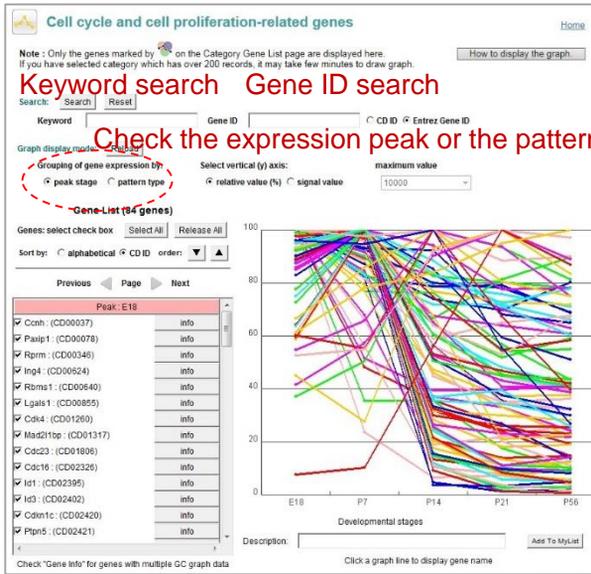
BrainTx genes are categorized into 34 gene clusters, basically by their functional properties. Temporal expression profiles (plots of GeneChip and CDT array data) of genes registered in each gene category can be displayed graphically by press "graph" button (see next page).

Gene Category – 34 clusters

1. Calcium;
2. Carbohydrate, lipid & amino-acid metabolism;
3. Cell adhesion & recognition;
4. Cell cycle & cell proliferation;
5. Cell death;
6. Cell marker;
7. Cell migration;
8. Chromosome, chromatin, and nuclear protein;
9. Cytoskeleton;
10. DNA replication & DNA metabolism;
11. Disease;
12. Exo and endocytosis;
13. Extracellular matrix;
14. G-protein coupled receptor;
15. Growth and differentiation;
16. Growth factor, hormone, cytokine, & chemokine;
17. Mitochondrial function;
18. Myelin;
19. Neurite growth & synapse formation;
20. Neurotransmitter receptor & ion channel;
21. Neurotransmitter, neurotrophin, & neuropeptide;
22. Protein kinase;
23. Protein modification & metabolism;
24. Protein phosphatase;
25. Protein transport;
26. RNA-binding protein;
27. Signal transduction;
28. Small GTPase signaling;
29. Splicing & mRNA processing;
30. Transcription & RNA metabolism;
31. Transcription regulation (transcription factor);
32. Translation;
33. Transporter & pump;
34. Unclassified

Display the temporal expression patterns of functional clustered genes

BrainTx v5.5 Gene Category Graph & analysis tool



Ex: Cell cycle and cell proliferation-related gene cluster: mostly "down-regulated"

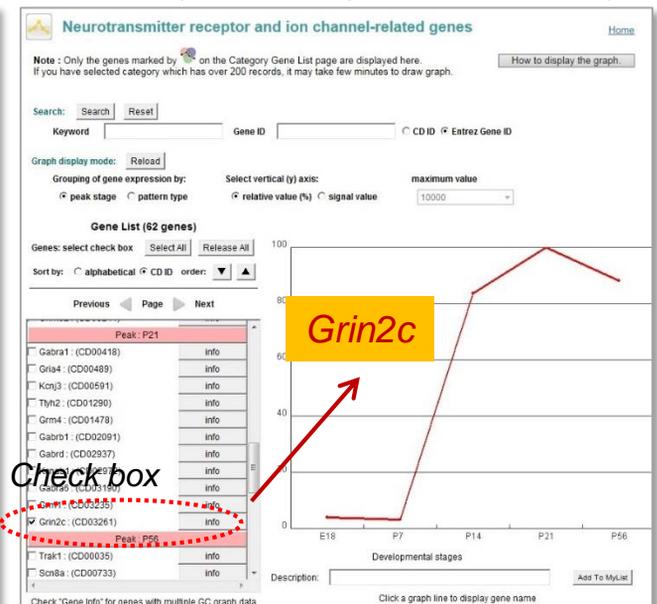
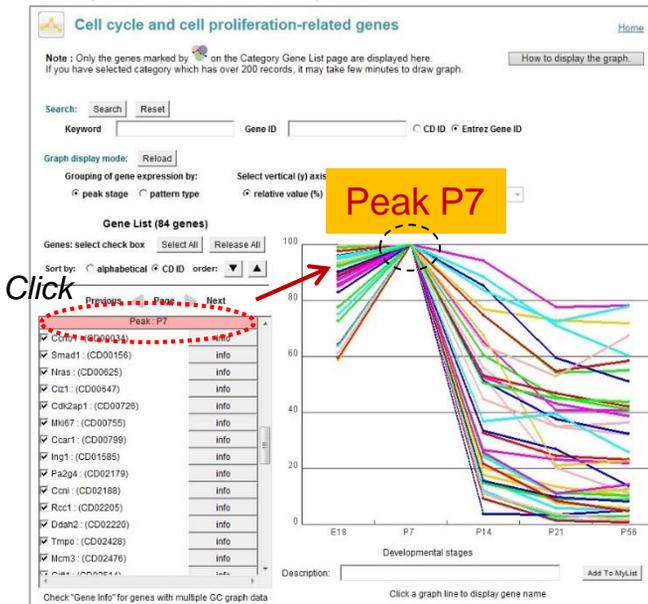
Ex: Neurotransmitter receptor and ion channel-related gene cluster: mostly "up-regulated"

Graph analysis: Gene & Keyword/ID search, Expression peak/pattern display, Signal/relative value display, Create My List, etc.

Display examples

1) Graph display of genes with expression peak in the first postnatal week

2) Graph display of selected gene: *Grin2c* (NMDA receptor NR2C subunit).



Cell cycle and cell proliferation-related gene cluster

Neurotransmitter receptor and ion channel-related gene cluster



10. My List – creating a gene list

Create a gene list using the “My List” tool

**BrainTx v5.5
My List**

Brain Transcriptome Database (BrainTx)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Home | About | Advanced Search | Gene Ontology | Gene Category | My List | ISH Atlas | Documents | Help | Contact

Search Results
Brain Region : Cerebellum
Target Genes : All genes

Search result page

Click “Add To MyList” button (1)

Click to create “My Graph” (4)

Check box to select genes (5)

Check All (2) | Uncheck All (3)

Sort by : CD ID

Result Download | Download | Show Graph | GeneChip Graph (4) | CDT array Graph (4)

	CD ID Accession No.	Gene Symbol	Gene Name	Gene Info	Links	Temporal	Spatial	Tissue	Category
(5) <input checked="" type="checkbox"/>	CD00003 NM 001081203	Sbno1	sno, strawberry notch homolog 1 (Drosophila)						
<input checked="" type="checkbox"/>	CD00005 NM 013666	St8sia5	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 5						
<input checked="" type="checkbox"/>	CD00009 NM 016806	Hnrnpa2b1	heterogeneous nuclear ribonucleoprotein A2/B1						
<input type="checkbox"/>	CD00010 NM 001205234	Nrxn2	neurexin II						
<input type="checkbox"/>	CD00011 NM 138591	Gfm1	G elongation factor, mitochondrial 1						
<input type="checkbox"/>	CD00014 NM 008972	Ptma	prothymosin alpha						

Using the “My List” tool can create one’s own gene list.

*My List is useful for browsing and analysis of your gene(s) of interest.

Creating a gene list with “My List”

Select genes and check the box (5) with , and click “Add To MyList” button (1).

Then, your gene list will be created in “My List” page (See the next page).

From different search results, you can repeatedly add your genes to your gene list in “My List” page. “Check All” button (2) and “Uncheck All” button (3) are optional.

Creating a temporal expression graph with “My Graph”

Click “GeneChip Graph” or “CDT array Graph” button (4). Temporal expression profile graph window will be created. The graph is useful for analyzing expression patterns of gene(s) of your interest (See the next page).

Analysis of expression patterns in 'My List' page

Brain Transcriptome Database (*BrainTx*)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Home About Advanced Search Gene Ontology Gene Category **My List** ISH Atlas Documents Help Contact

My List

Item 1- 3 of 3 Page 1 / 1 Show 20 Change

Check All Uncheck All SearchResults Sort by: CD ID Print version

Delete DeleteAll Result Download Select file size Normal size Download Show My Graph GeneChip Graph CDT array Graph

	CD ID Accession No.	Gene Symbol	Gene Name	Gene Info	Links	(1)	Spatial	Tissue	Category
<input type="checkbox"/> 1:	CD00003 NM_001081203	Sbn01	sno, strawberry notch homolog 1 (Drosophila)						
<input type="checkbox"/> 2:	CD00005 NM_013666	St8sia5	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 5						
<input type="checkbox"/> 3:	CD00009 NM_016806	Hnrnpa2b1	heterogeneous nuclear ribonucleoprotein A2/B1						

Check All Uncheck All SearchResults Sort by: CD ID Print version

Item 1- 3 of 3 Page 1 / 1 Show 20 Change

(1) ISH image page:
Expression images in the brain

(2) My Graph page:
Expression graph of genes in a list

Brain Transcriptome Database (*BrainTx*)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Spatial information Home

CD00003
NM_001081203
Gene Symbol: Sbn01
Gene Name: sno, strawberry notch homolog 1 (Drosophila)
Strain: ICR

Current data: CD00003.1
Other data links: CD00003.2 CD00003.3 CD00003.4 CD00003.5 CD00003.6

In situ hybridization

P7 P21

Click to open a "Detailed viewer" window Click to open a "Detailed viewer" window

My Graph

Note: Only the genes marked by on the Category Gene List page are displayed here. If you have selected category which has over 200 records, it may take few minutes to draw graph.

Search: Search Reset
Keyword: Gene ID CD ID Entrez Gene ID

Graph display mode: Reload
Grouping of gene expression by: peak stage pattern type
Select vertical (y) axis: relative value (%) signal value maximum value 10000

Gene List (3 genes)
Genes: select check box Select All Release All
Sort by: alphabetical CD ID order

Previous Page Next

Gene	Peak
<input checked="" type="checkbox"/> Hnrnpa2b1 (CD00009)	Peak: E18
<input checked="" type="checkbox"/> Sbn01 (CD00003)	Peak: P7
<input checked="" type="checkbox"/> St8sia5 (CD00005)	Peak: P14
	Peak: P21
	Peak: P56

100
80
60
40
20
0

E18 P7 P14 P21 P56
Developmental stages

Description: Add To MyList

Brain Transcriptome Database (*BrainTx*)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

[Home](#) | [About](#) | [Advanced Search](#) | [Gene Ontology](#) | [Gene Category](#) | [My List](#) | [ISH Atlas](#) | [Documents](#) | [Help](#) | [Contact](#)

ISH Atlas

Select: "[Gene Expression Brain Atlas](#)", or "[Appendix: Developing Mouse Brain Atlas](#)."

(1) Gene Expression Brain Atlas (ISH)

Subregion/cell-type	CD ID	Gene Symbol
P7-PC/ P21-PC	CD00012	Car8
P7-WM_Od/ P21-WM_Od	CD00473	Mbp
P7-PC/ P21-St_Ba_PC	CD01266	Pvalb
P7-PCL_WM/ P21-St_Ba_PC_Go	CD01364	Abat
P7-EGL_IGL/ P21-GC	CD02071	Neurod1
P7-IGL_UBC_LC/ P21-GC_UBC_LC	CD03122	Calb2
P7-IGL/ P21-St_Ba_GC	CD03129	Cnr1
P7-oEGL	CD03167	Prkx
P7-PC/ P21-PC	CD03168	Sst
P7-PC_Go_WM/ P21-St_Ba_PC_Go	CD03191	Gad2
P7-Ba_PC_Go_WM/ P21-St_Ba_PC_Go	CD03192	Gad1
P7-WM_BG_As/ P21-WM_BG_As	CD03195	Gfap
P7-BG/ P21-BG	CD03197	Slc1a3
P7-PC/ P21-PC	CD03218	Pcp2
P7-oEGL	CD03233	Atoh1
P7-WM_Od/ P21-WM_Od	CD03236	Mobp
P7-IGL_IGL/ P21-GC	CD03345	Zic1

[Abbreviation](#)

Fig. 1. Cerebellar cell-type-specific ISH sample images (click to magnify).

List of the genes having characteristic expression patterns

The ISH Atlas is composed of two atlases of developing mouse brains, with small collections of data on representative ISH staining (1) and histochemical staining (2) for easy reference.

(2) Appendix: Developing Mouse Brain Atlas (CV, LFB, IHC, etc.)

Staining	Stage
CV	E18 P7 P21
LFB	P21
IHC-Calb1	P14 P21
IHC-Calretinin	P14 P21
IHC-GFAP	P14 P21
IHC-Cupidin	P14
IHC-Homer3	P14 P21
IHC-MBP	P21

[Abbreviation](#)

Fig. 2. Mouse brains at P0, P7, and P21 (click to magnify).

(1) [Gene Expression Brain Atlas](#): ISH staining patterns of cell marker genes. Click on subregion/cell type to see the ISH page, and CD ID to open the gene information page.

(2) [Developing Mouse Brain Atlas](#): Histochemical (cresyl violet and luxol fast blue) and immunohistochemical (specific antibodies) staining patterns of developing mouse brains. Click on stage to open the staining page.



12. Documents – Download file

Brain Transcriptome Database (*BrainTx*)
(formerly Cerebellar Development Transcriptome Database, CDT-DB)

Home About Advanced Search Gene Ontology Gene Category My List ISH Atlas **Documents** Help Contact

Download *User's Guide, etc.*

File name	Description	Date
BrainTx_Users_Guide_ver5.5.pdf	BrainTx ver.5.5 Users Guide	2020-04-24
Experimental_Information.pdf	Experimental Information	2015-04-01
Information_on_CDT-DB.pdf	Information on CDT-DB	2015-04-01

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Updated: April 1, 2020. Ver.5.5

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- 1) Furuichi, T., Shiraishi-Yamaguchi, Y., Sato, A., Sadakata, T., Huang, J., Shinoda, Y., Hayashi, K., Mishima, Y., Tomomura, M., Nishibe, H., and Yoshikawa, F. (2011) Systematizing and cloning of genes involved in the cerebellar cortex circuit development. **Neurochem Res.** 36:1241-1252
- 2) Sato, A., Sekine, Y., Saruta, C., Nishibe, H., Morita, N., Sato, Y., Sadakata, T., Shinoda, Y., Kojima, T., and Furuichi, T. (2008) Cerebellar development transcriptome (BrainTx): profiling of spatio-temporal gene expression during the postnatal development of mouse cerebellum. **Neural Networks** 21:1056-1069.
- 3) Sato, A., Morita, N., Sadakata, T., Yoshikawa, F., Shiraishi-Yamaguchi, Y., Huang, JH., Shoji, S., Tomomura, M., Sato, Y., Suga, E., Sekine, Y., Kitamura, A., Shibata, Y., Furuichi, T. (2004) Deciphering the genetic blueprint of cerebellar development by the gene expression profiling informatics. **Neural information processing. Lecture Notes in Computer Science** 3316:880-884. Springer-Verlag, Berlin, Heidelberg, Germany. DOI: 10.1007/978-3-540-30499-9_135
- 4) Kagami, Y., and Furuichi, T. (2001) Investigation of differentially expressed genes during the development of mouse cerebellum. **Brain Research Gene Expression Patterns** 1:39-59.

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