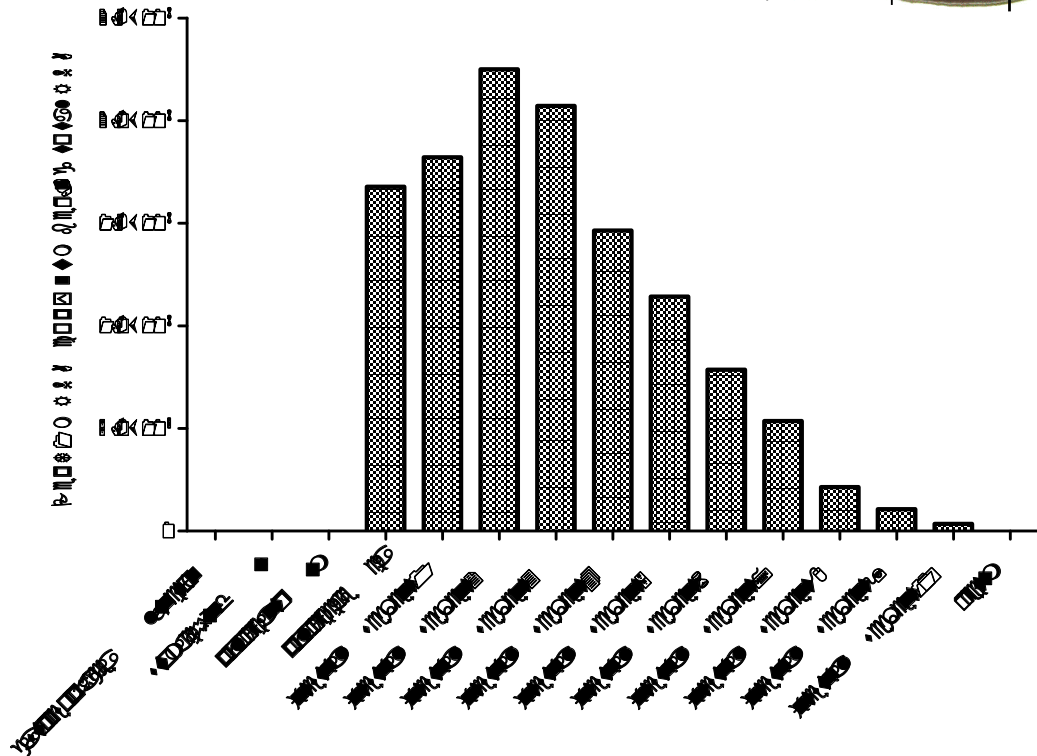
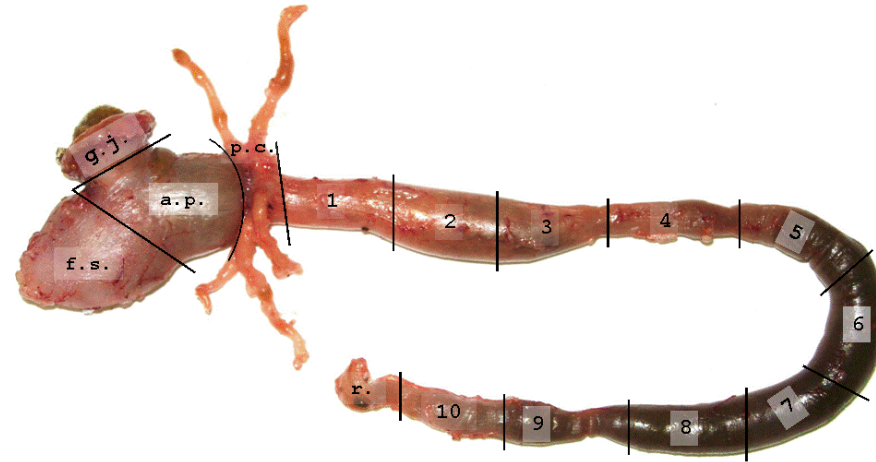


Spatial distribution of pept1 mRNA in the digestive tract (real time quantitative PCR)

Terova et al., Aquaculture 294:288 (2009)

European sea bass

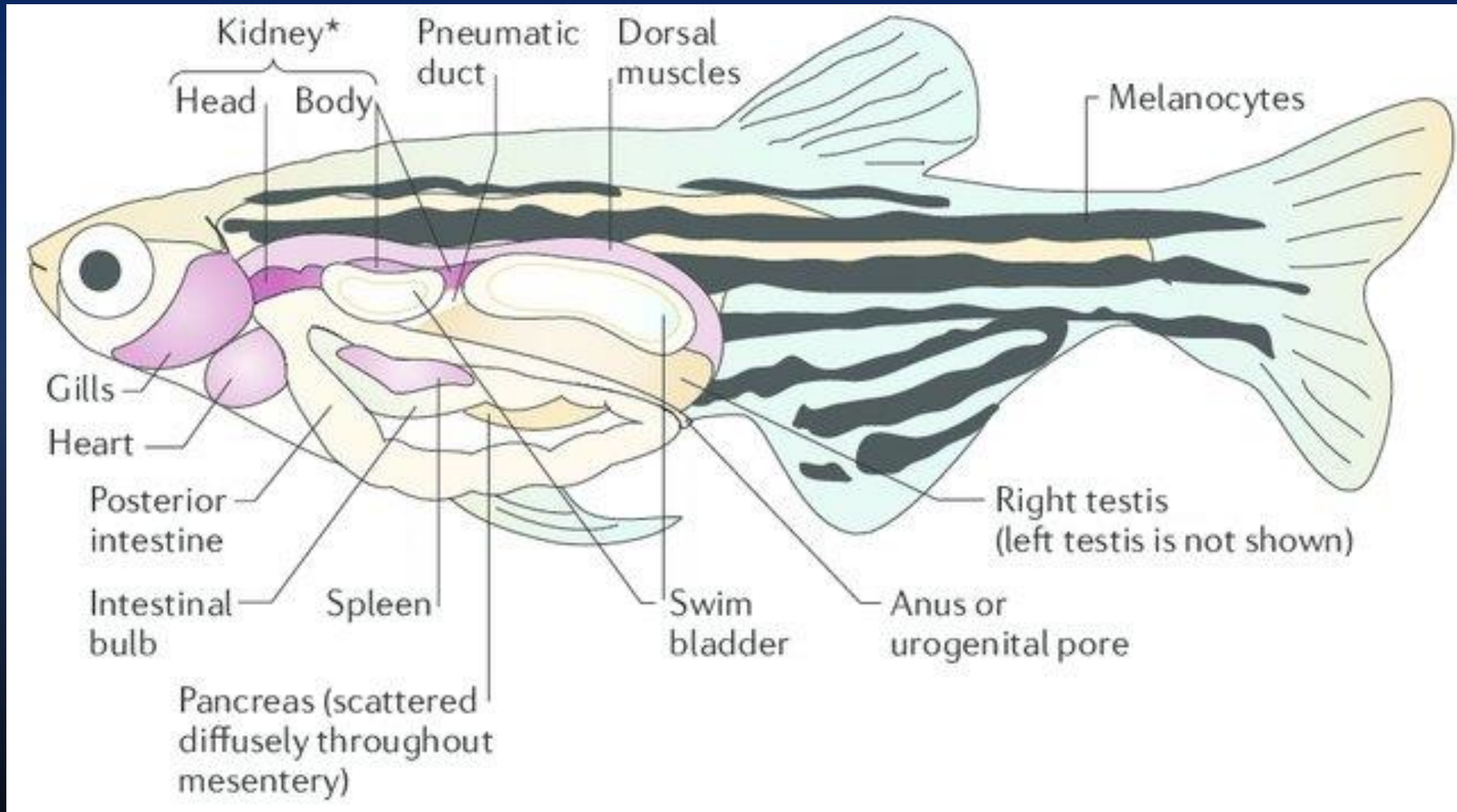


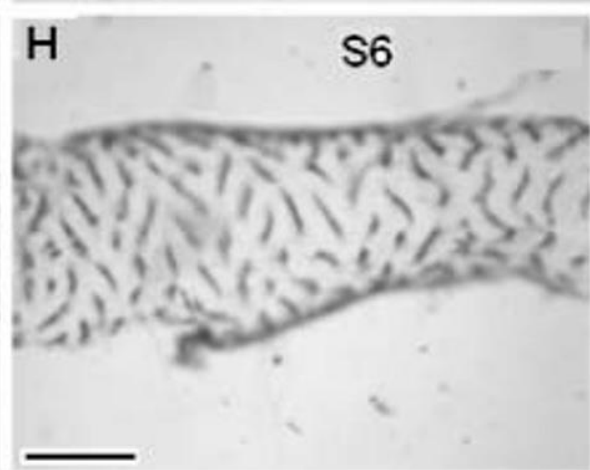
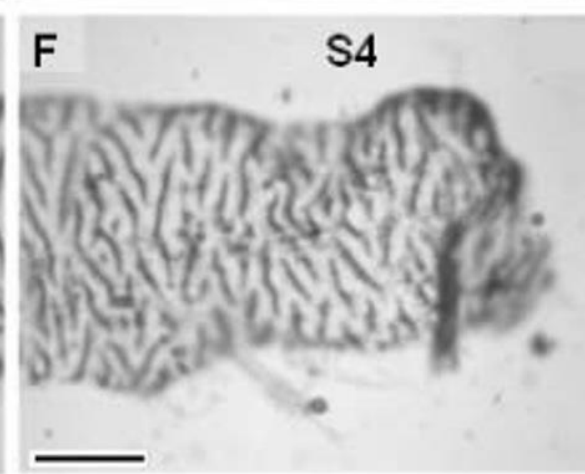
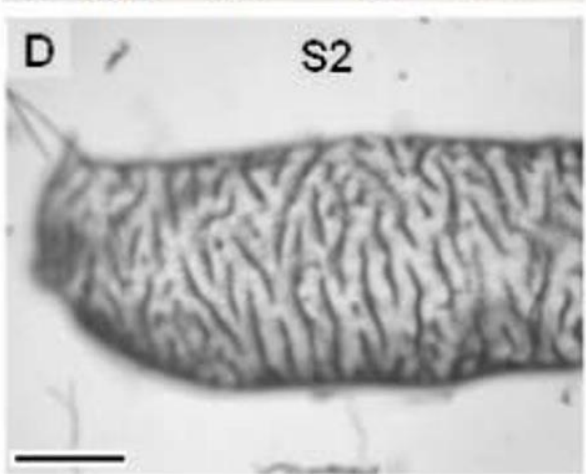
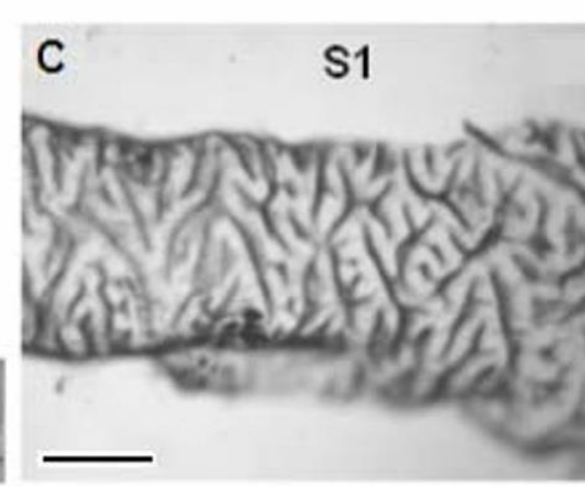
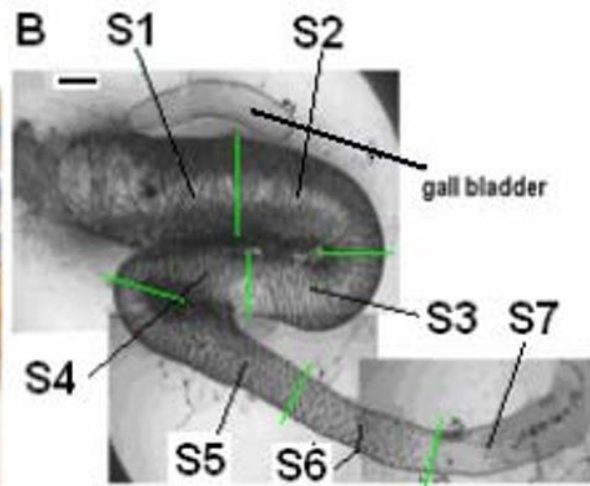
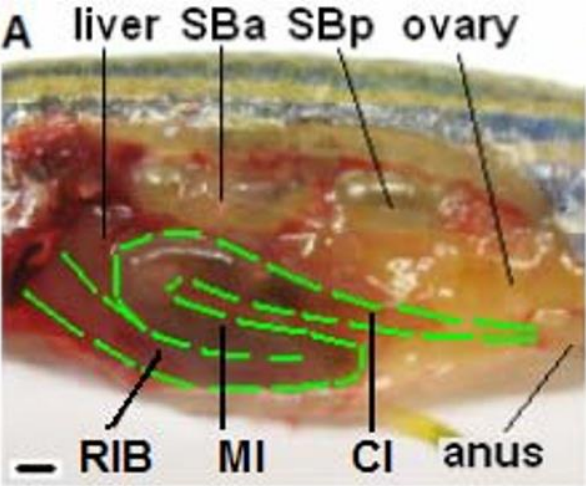
Conclusions (2)

- zebrafish *pept1* is highly expressed in the proximal intestine starting day 4 post-fertilisation, before functional maturation of the gut, first feeding and complete yolk resorption
- **cloning of Pept1-type transporters from other teleost fish is done or underway**
- *pept1* is a marker for teleost fish gut regionalization, differentiation and morphogenesis

**SLCs in zebrafish gut
(a cluster analysis on transcriptomics data)**

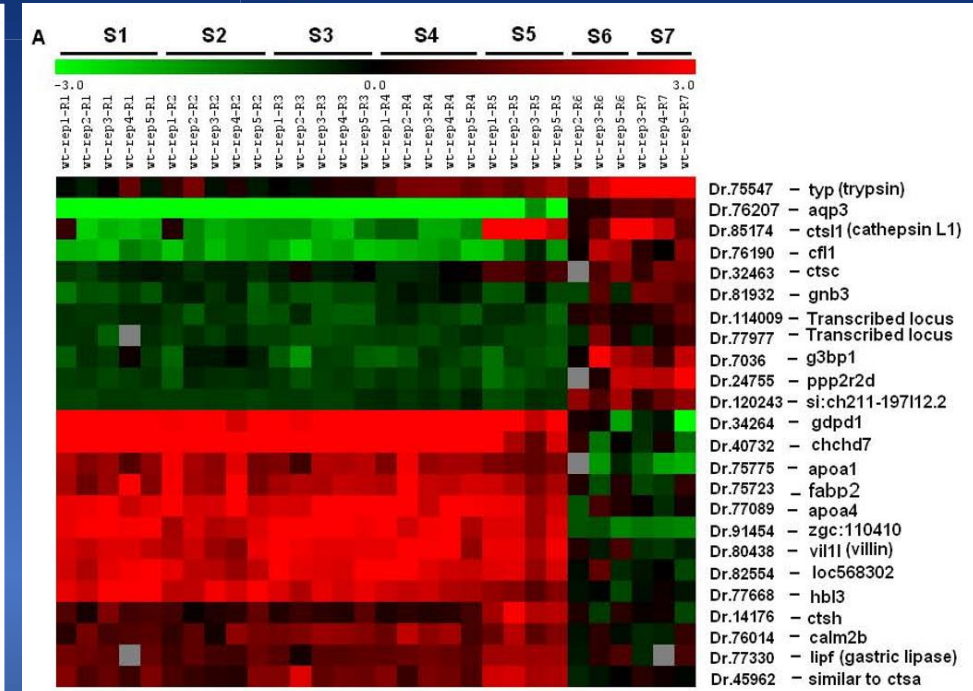
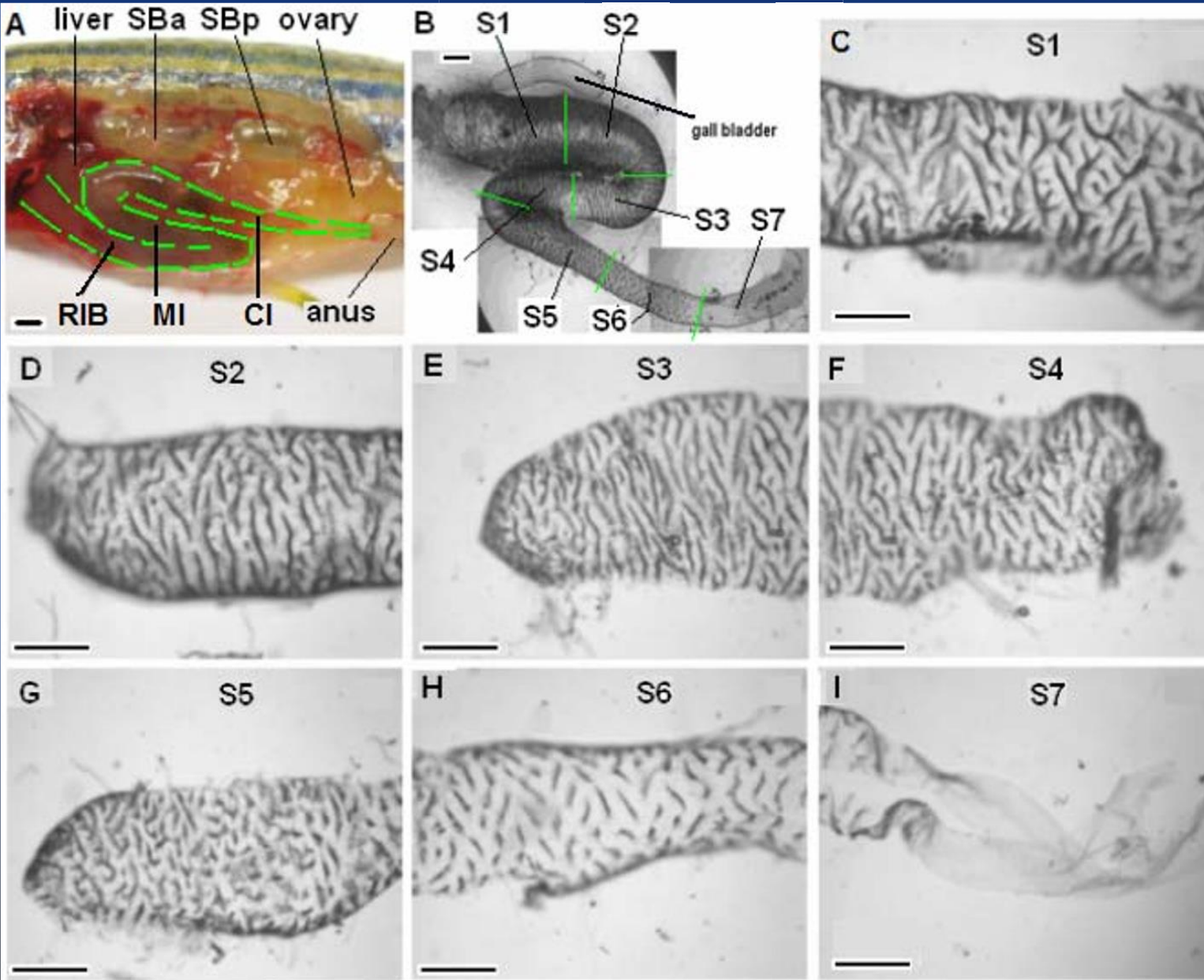
The adult zebrafish gut



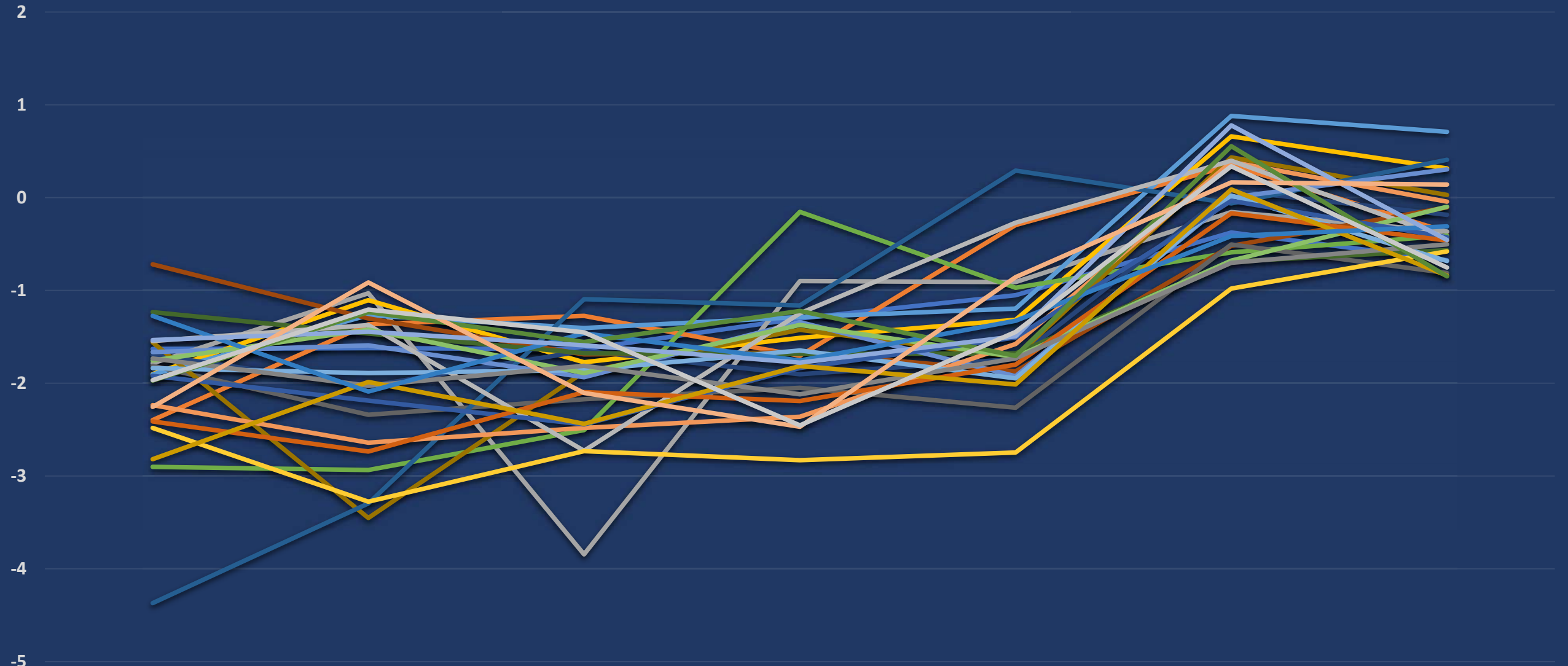


The adult zebrafish gut

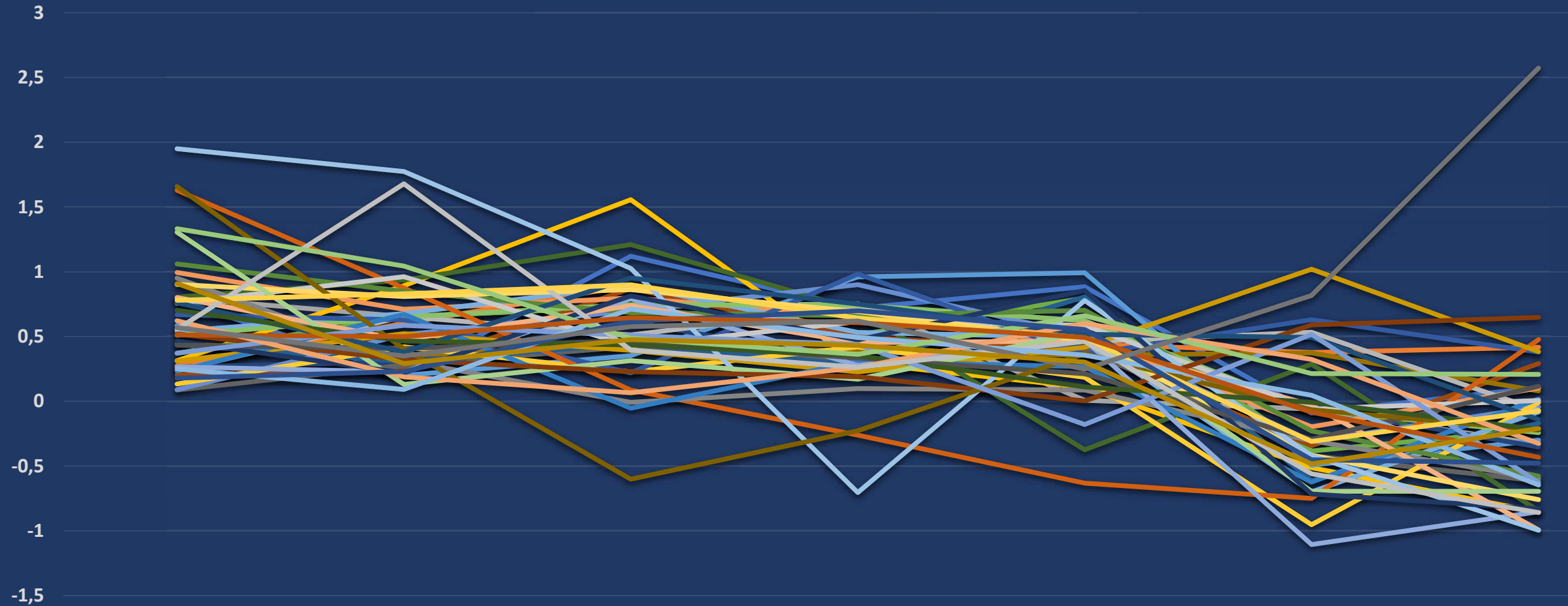
Morphological and molecular evidence for functional organization along the rostro-caudal axis of the adult zebrafish gut



Solute carriers - cluster 1

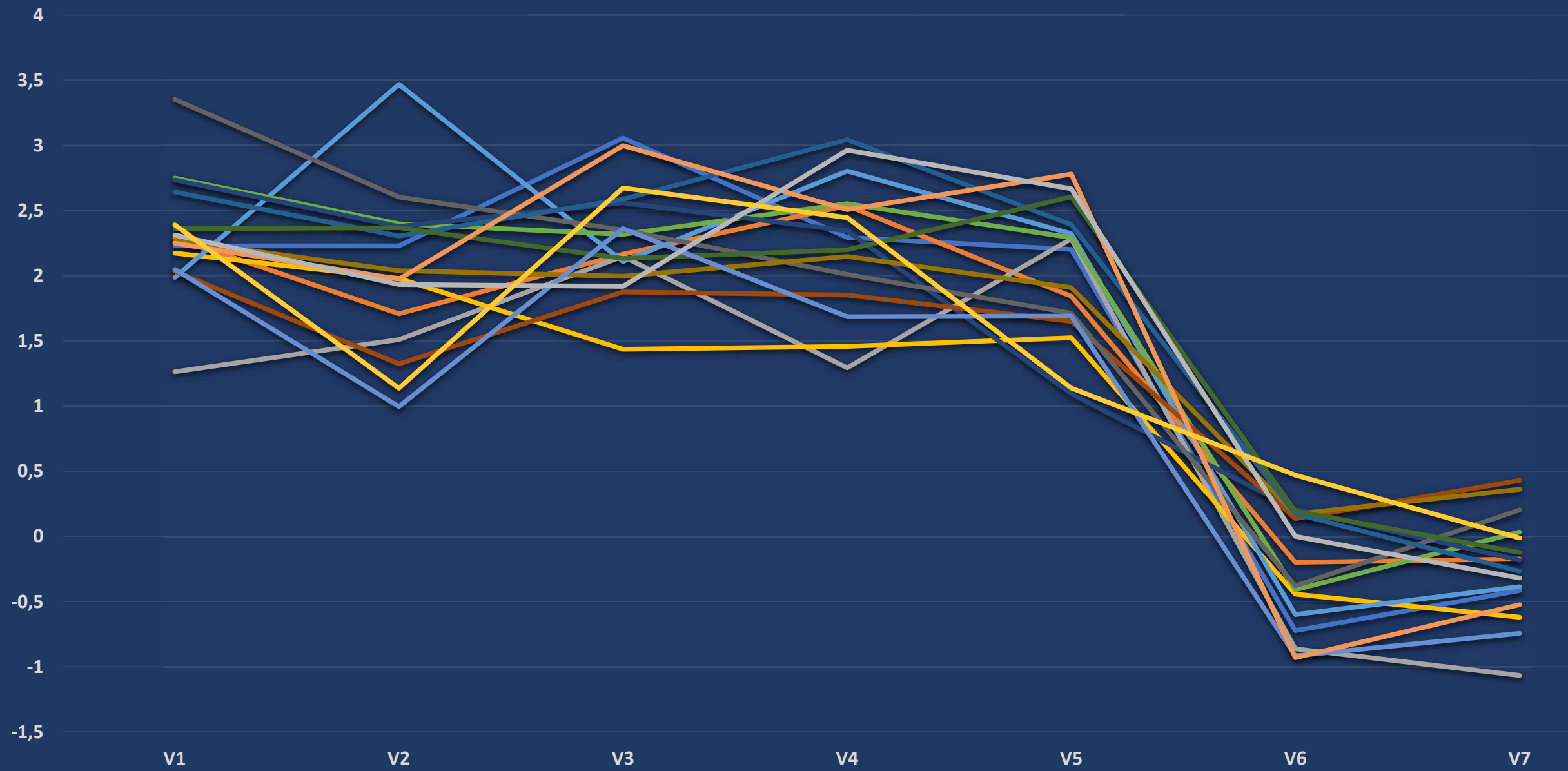


Solute carriers - cluster 2



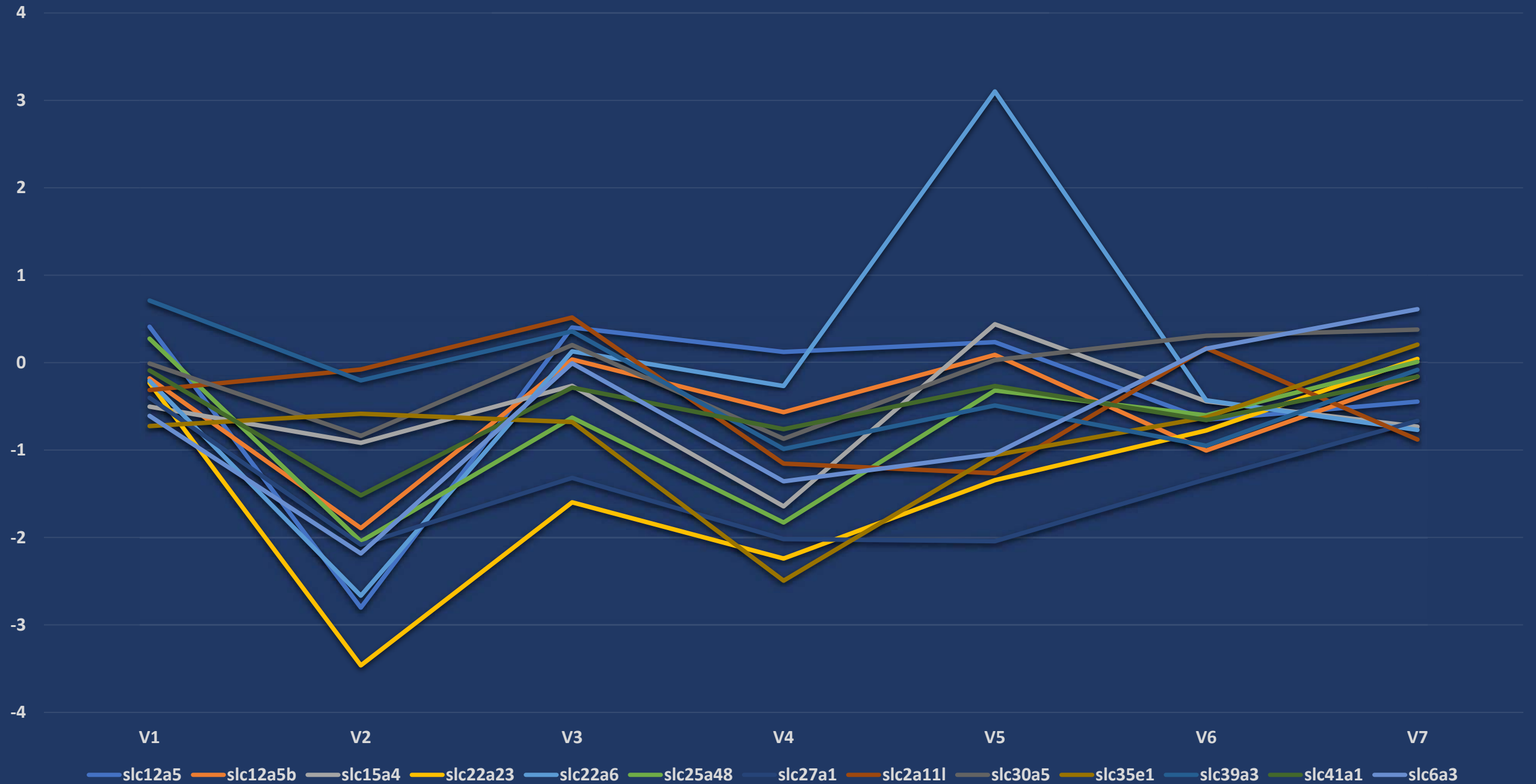
| V1 | V2 | V3 | V4 | V5 | V6 | V7 |
|-----------|----------|----------|-----------------|--------------|-----------|----------|
| slc13a2 | slc17a5 | slc20a1 | slc21a9.slco2b1 | slc22a6l.oat | slc24a3 | slc25a11 |
| slc25a16 | slc25a18 | slc25a22 | slc25a25b | slc25a27 | slc25a36b | slc25a3l |
| slc25a44b | slc25a5 | slc29a1a | slc2a5 | slc2a9l2 | slc32a1 | slc33a1 |
| slc35a4 | slc35a5 | slc35b1 | slc35b4 | slc35c2 | slc35d2 | slc35e2b |
| slc37a1 | slc38a4 | slc38a8 | slc42a2.rhbg | slc4a4b | slc52a2 | slc5a2 |
| slc6a13 | slc7a2 | slc7a3 | slc9a3r2 | slco1d1 | | |

Solute carriers - cluster 3

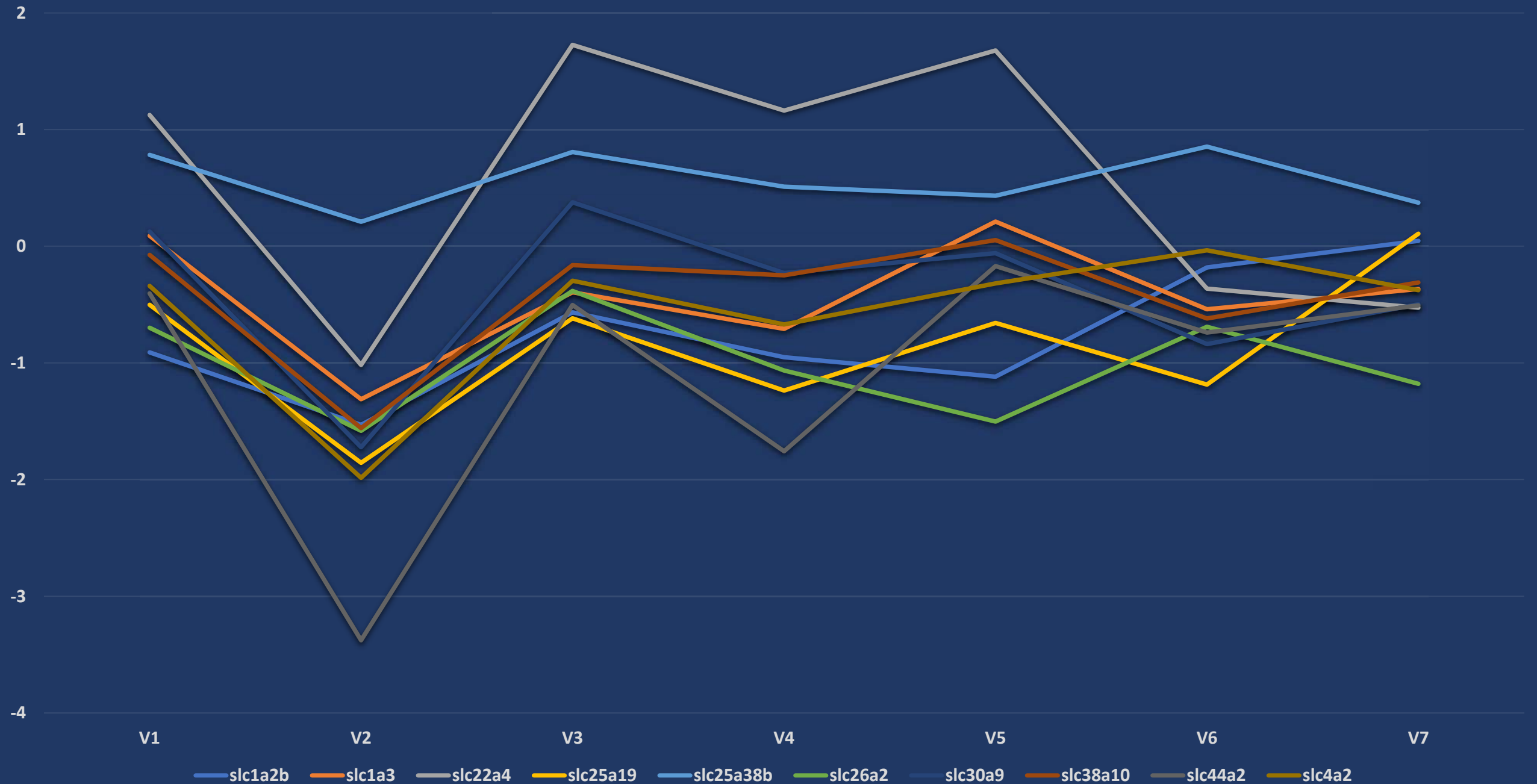


slc10a3 slc16a9a slc16a9b slc19a1 slc26a1 slc31a1 slc34a2a slc34a2b
slc35d1b slc37a4a slc39a5 slc40a1 slc46a3 slc47a1 slc4a4a slc5a6b

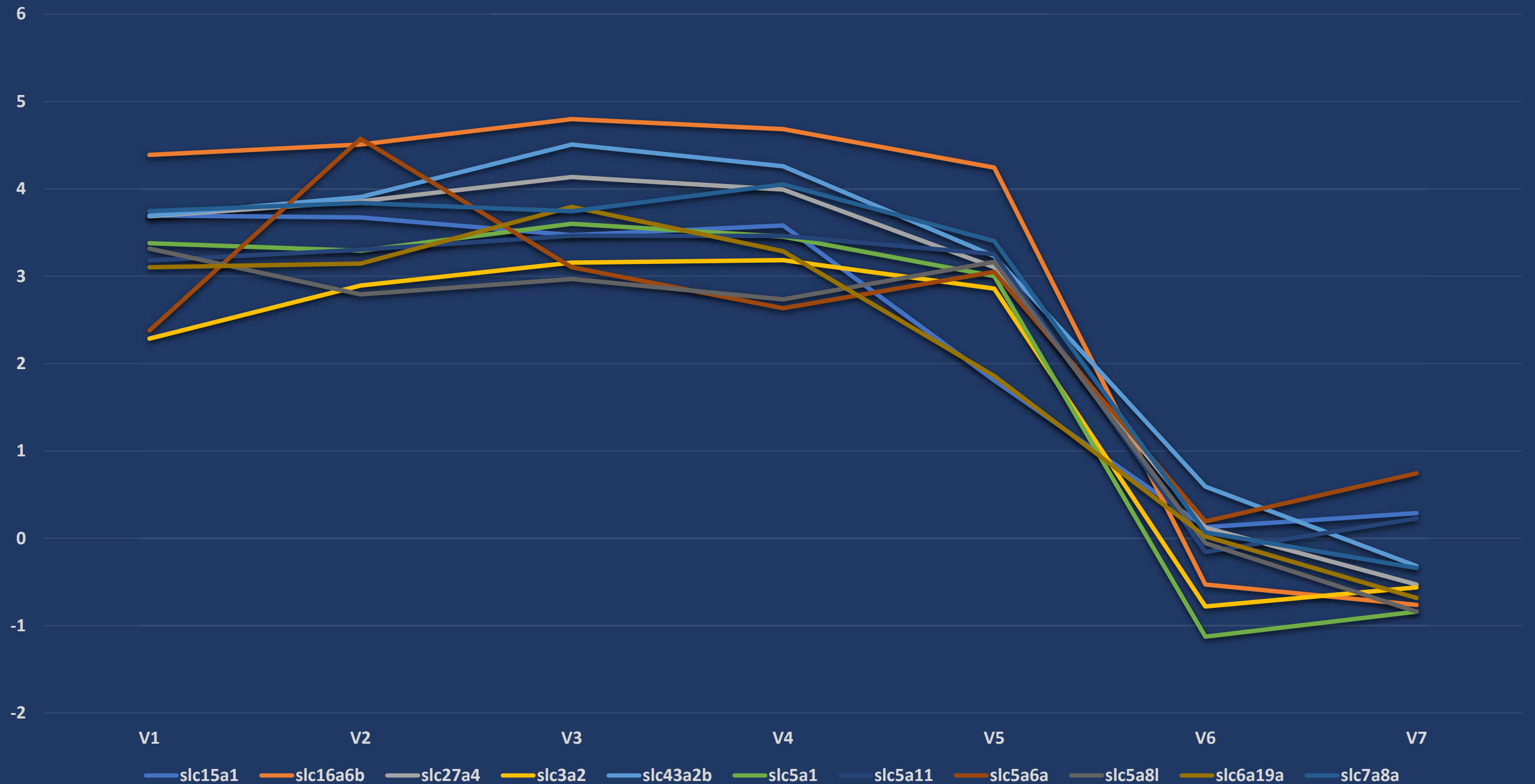
Solute carriers - cluster 4



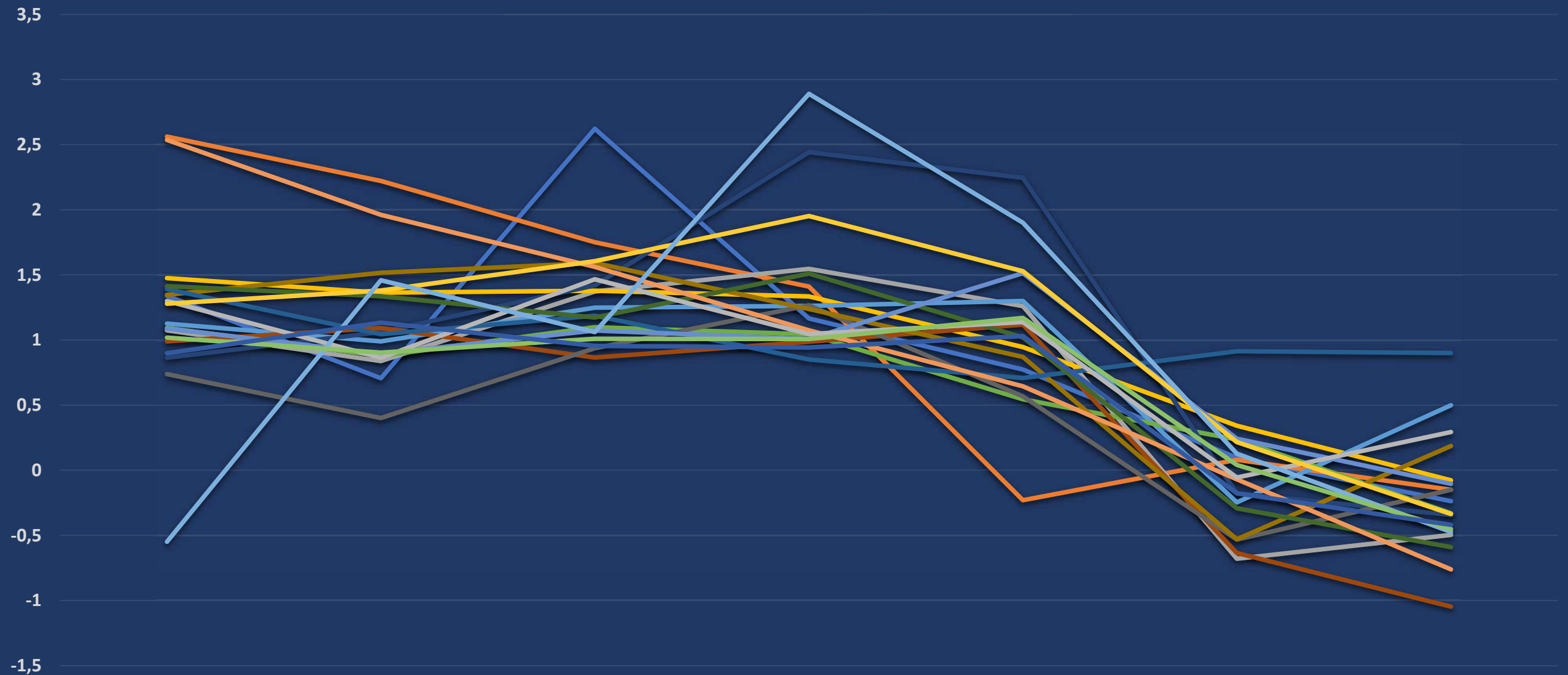
Solute carriers - cluster 5



Solute carriers - cluster 6



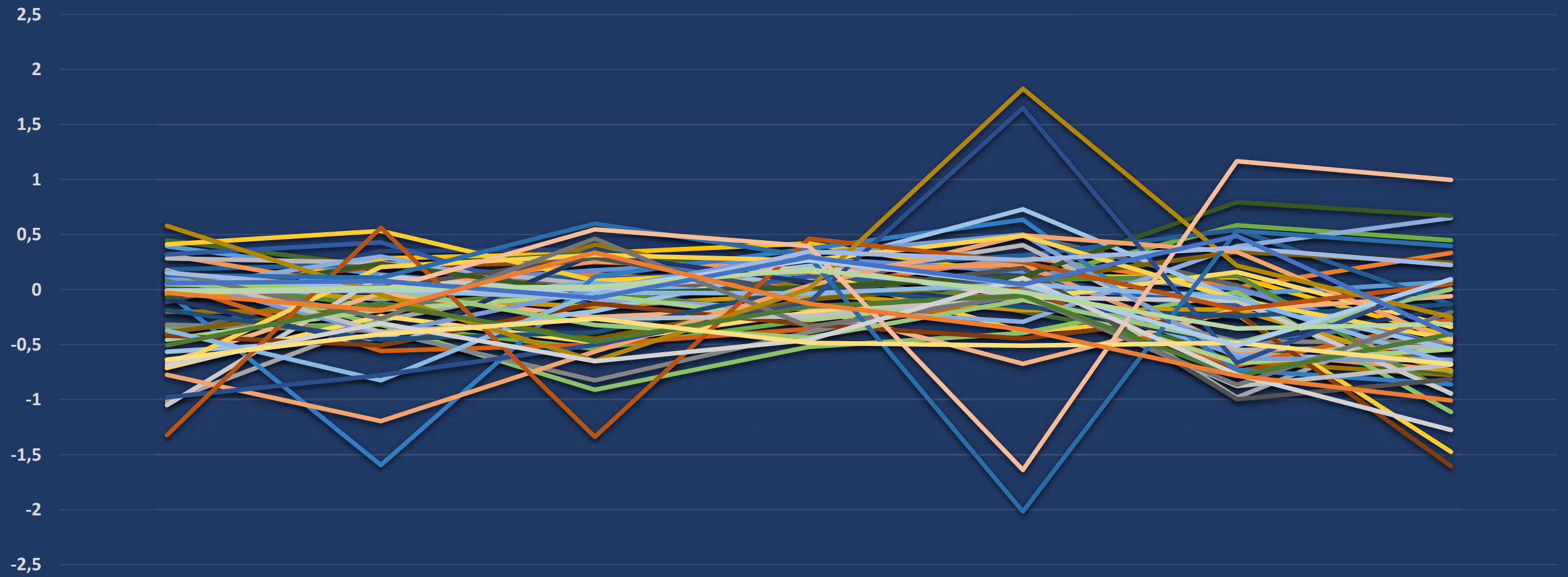
Solute carriers - cluster 7



V1 V2 V3 V4 V5 V6 V7

- slc11a2
- slc13a1
- slc13a5a
- slc16a1
- slc17a6l
- slc18b1
- slc1a4
- slc25a10
- slc25a20
- slc25a3
- slc25a34
- slc27a2
- slc30a4
- slc35a3
- slc44a5b
- slc49a2b.flvcr2b
- slc7a9l
- slc9a6a
- slco3a1

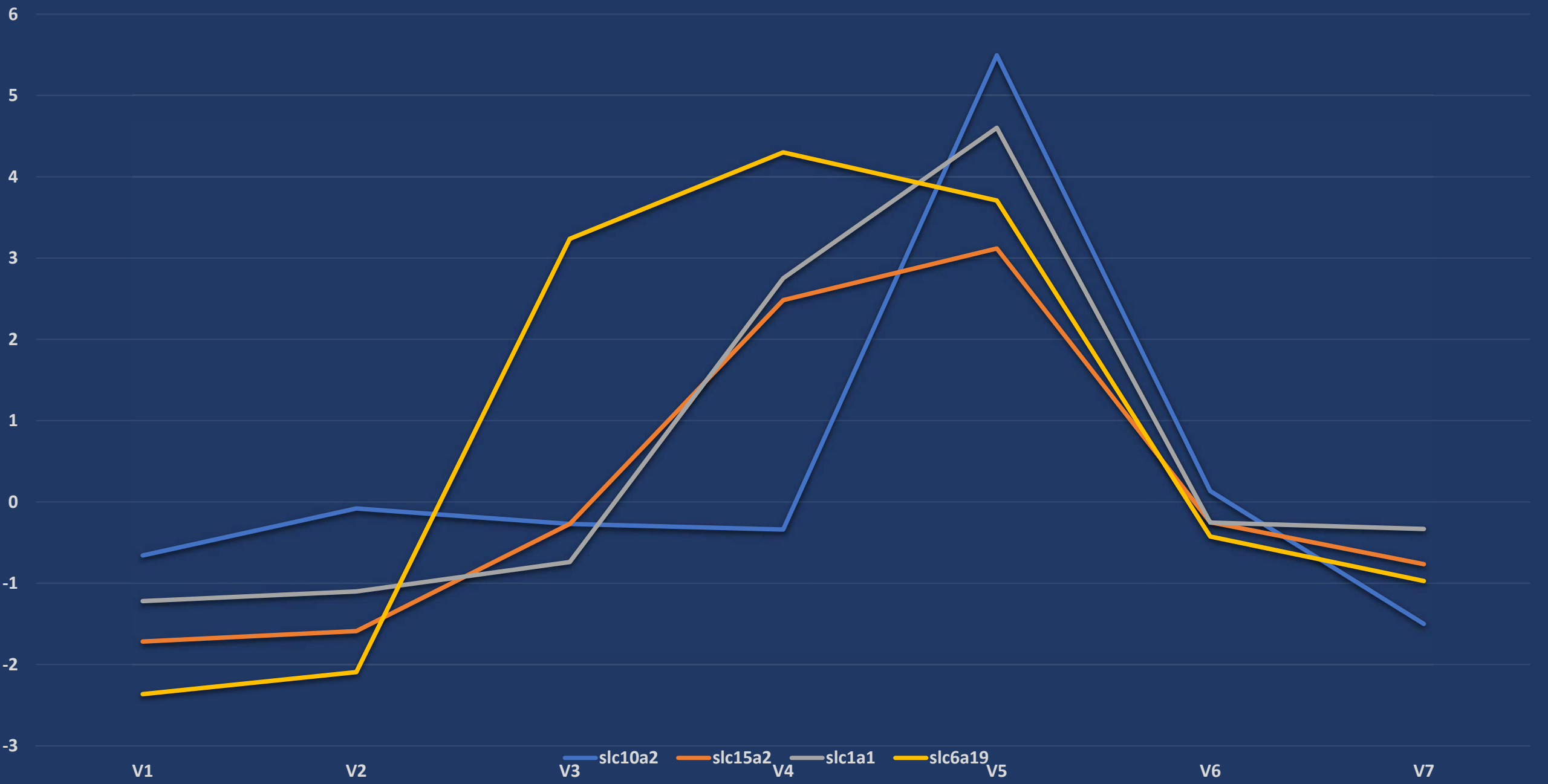
Solute carriers - cluster 8



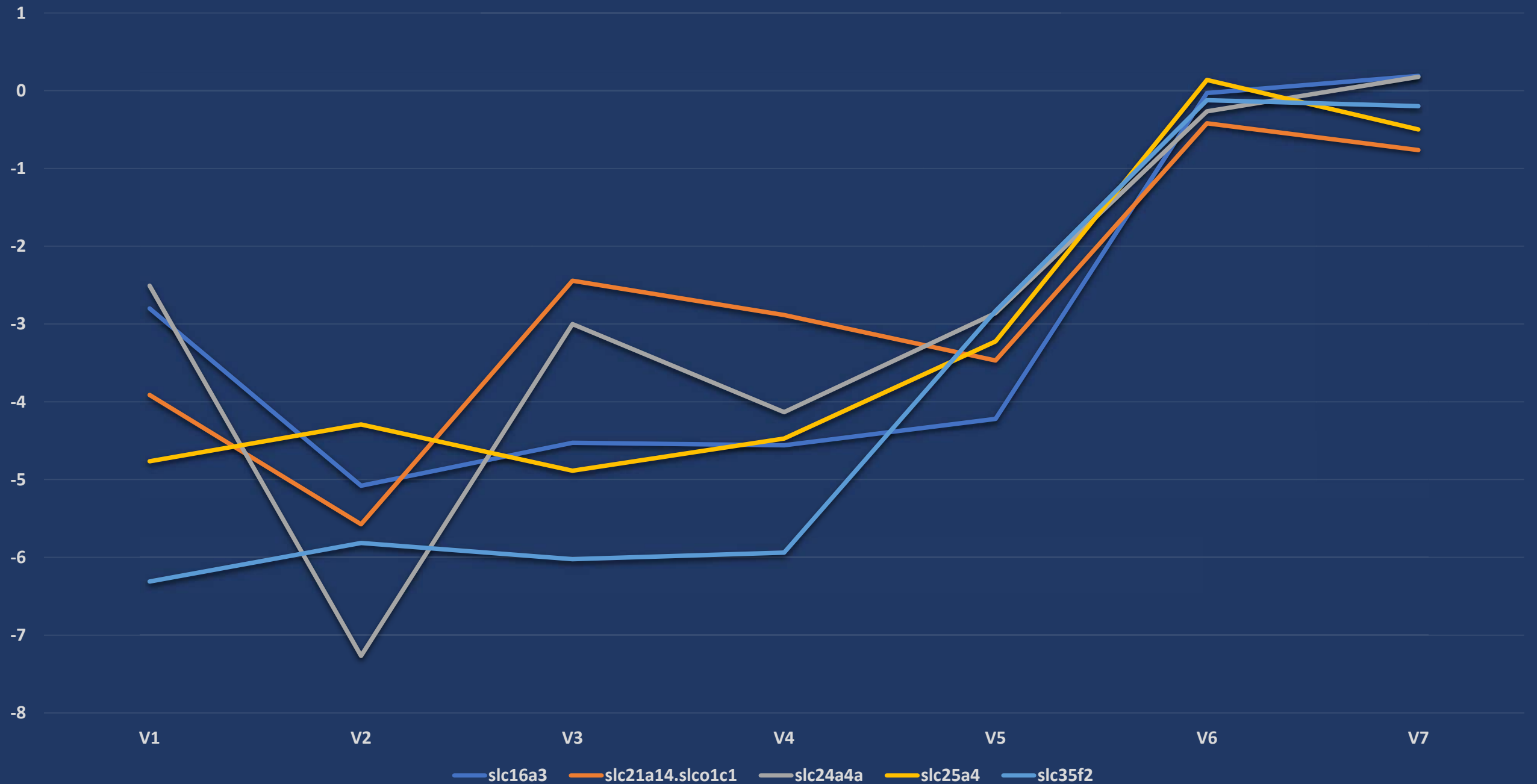
V1 V2 V3 V4 V5 V6 V7

- | | | | | | | | | | |
|------------|------------|------------|-------------|------------|-------------|------------|-------------|-------------|-------------|
| — slc10a4 | — slc10a7 | — slc13a4 | — slc16a2 | — slc16a4 | — slc17a9b | — slc18a3a | — slc18a3b | — slc22a13l | — slc22a20 |
| — slc22a8l | — slc25a1 | — slc25a17 | — slc25a1b | — slc25a24 | — slc25a25 | — slc25a28 | — slc25a32a | — slc25a32b | — slc25a36a |
| — slc25a37 | — slc25a40 | — slc25a43 | — slc25a44a | — slc25a46 | — slc25a51a | — slc26a10 | — slc26a11 | — slc26a5 | — slc2a11b |
| — slc2a14 | — slc30a6 | — slc30a7 | — slc35b2 | — slc35e4 | — slc35g2b | — slc38a2 | — slc38a3 | — slc38a3l | — slc39a1 |
| — slc39a10 | — slc39a7 | — slc44a4 | — slc45a2 | — slc48a1a | — slc51a | — slc52a3 | — slc6a11 | — slc6a15 | — slc6a17 |
| — slc6a1a | — slc6a1b | — slc6a1l | — slc6a7l | — slc9a8 | — slco1f1 | | | | |

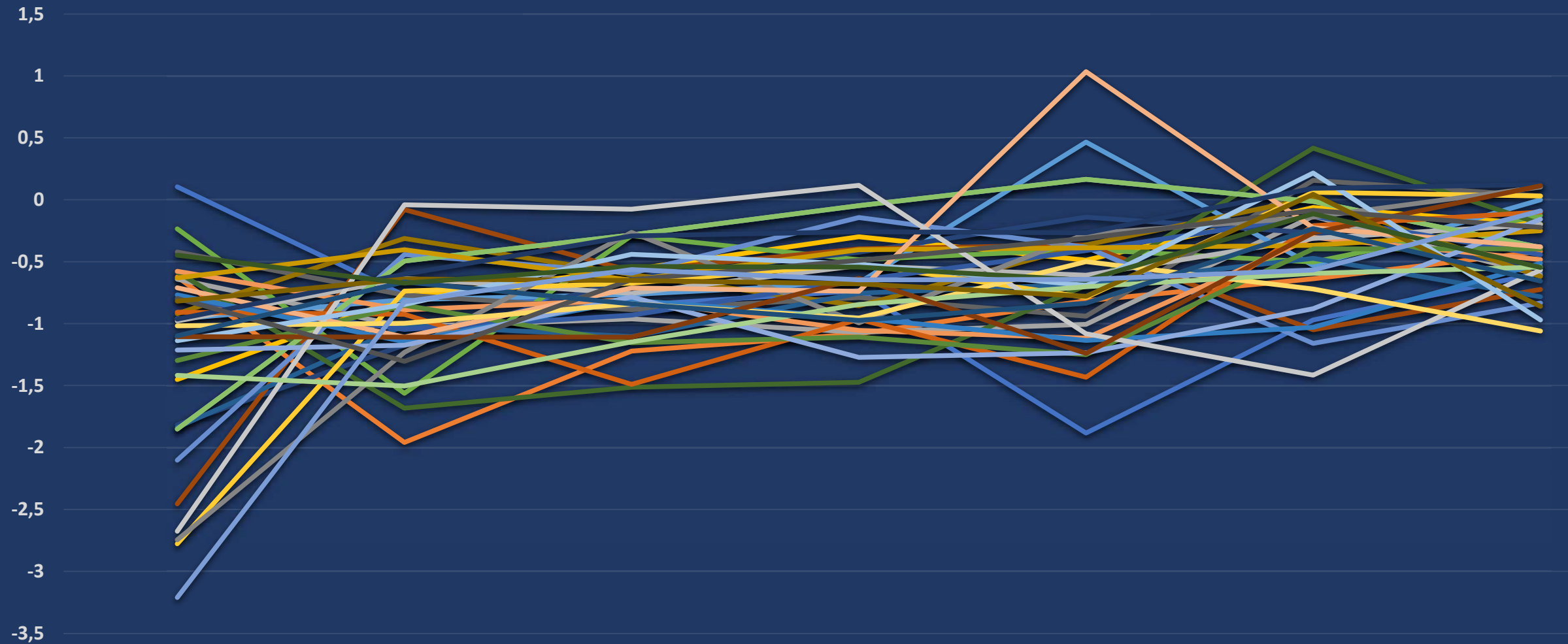
Solute carriers - cluster 9



Solute carriers - cluster 10



Solute carriers - cluster 11



V1

V2

V3

V4

V5

V6

V7

slc12a3

slc12a7b

slc12a8

slc12a9

slc13a3

slc14a2

slc16a12b

slc16a2.mct8

slc16a8

slc17a9a

slc20a1a

slc22a2

slc22a31

slc25a12

slc25a14

slc25a24l

slc25a29

slc25a29

slc25a33

slc25a39

slc2a2

slc2a3a

slc2a9l1

slc30a1

slc35c1

slc35f6

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slc37a2

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slc3a2b

slc43a1b

slc43a2

slc43a2a

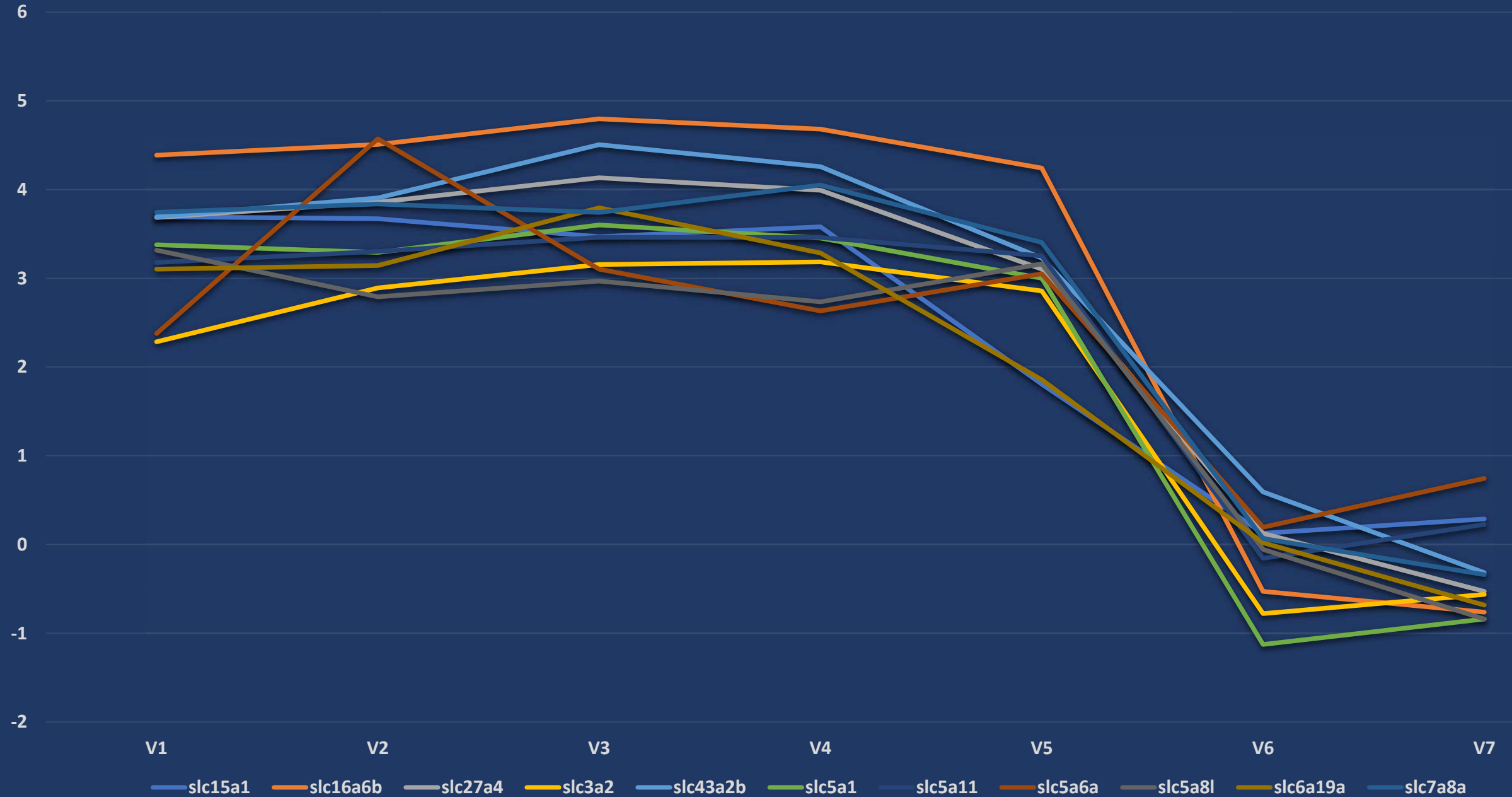
slc50a1

slc5a12

slc5a6

slc6a5

Solute carriers - cluster 6



Solute Carriers – Cluster 6

Gut

slc15a1b

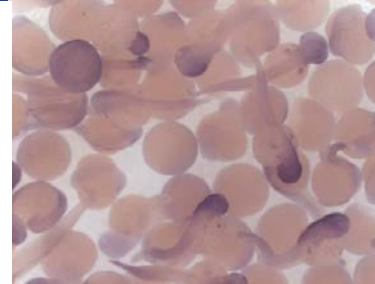
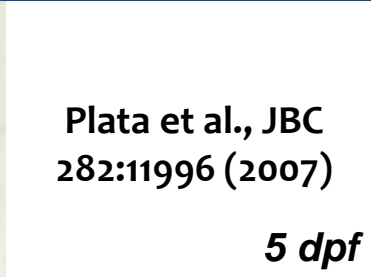
slc27a4

slc5a1

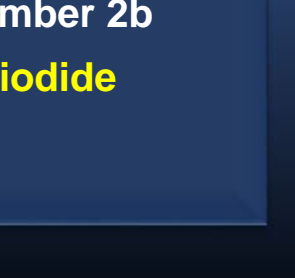
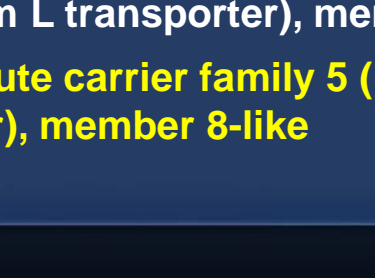
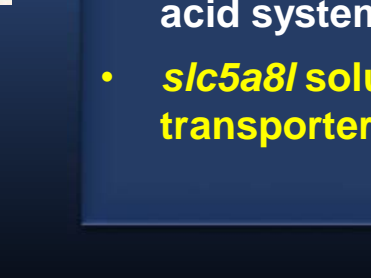
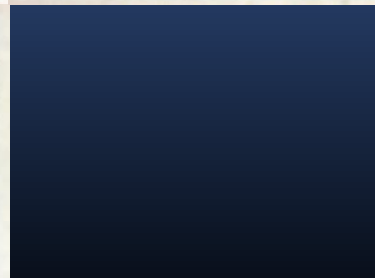
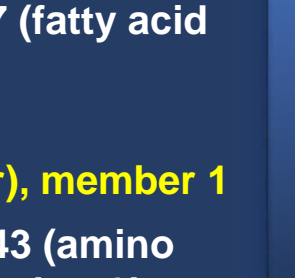
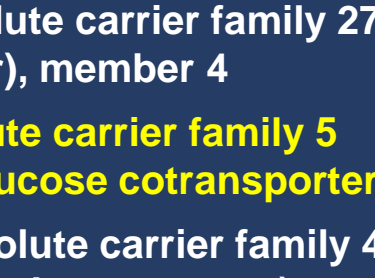
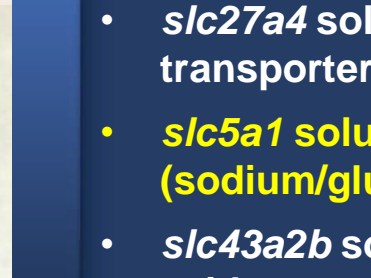
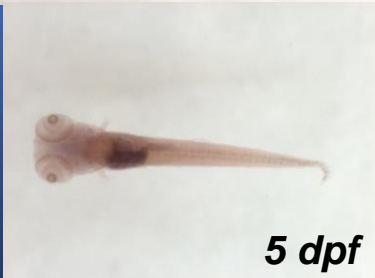
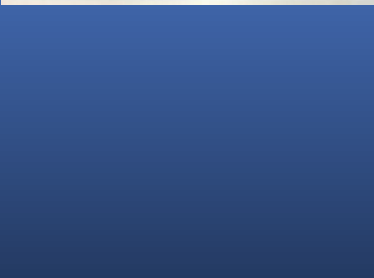
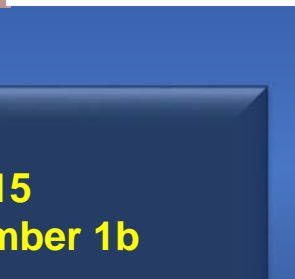
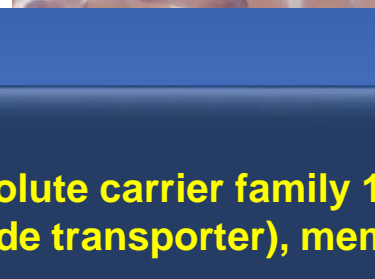
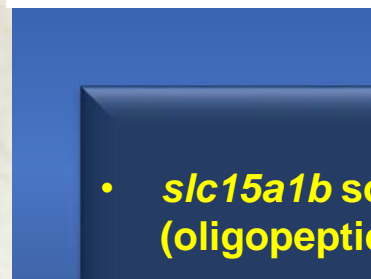
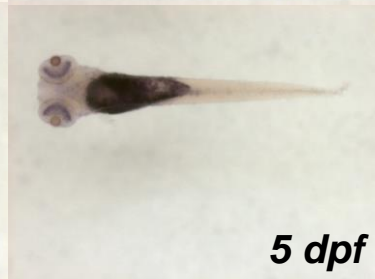
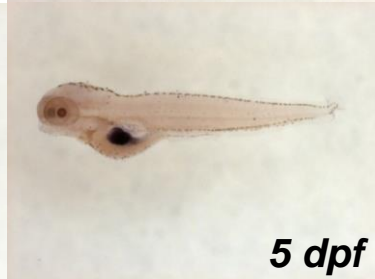
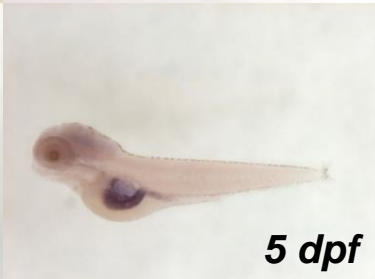
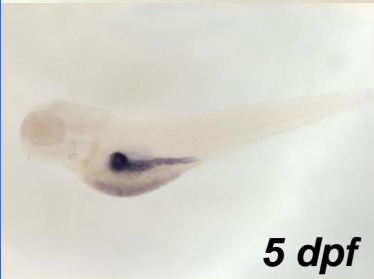
slc43a2b

slc5a8l

slc5a11

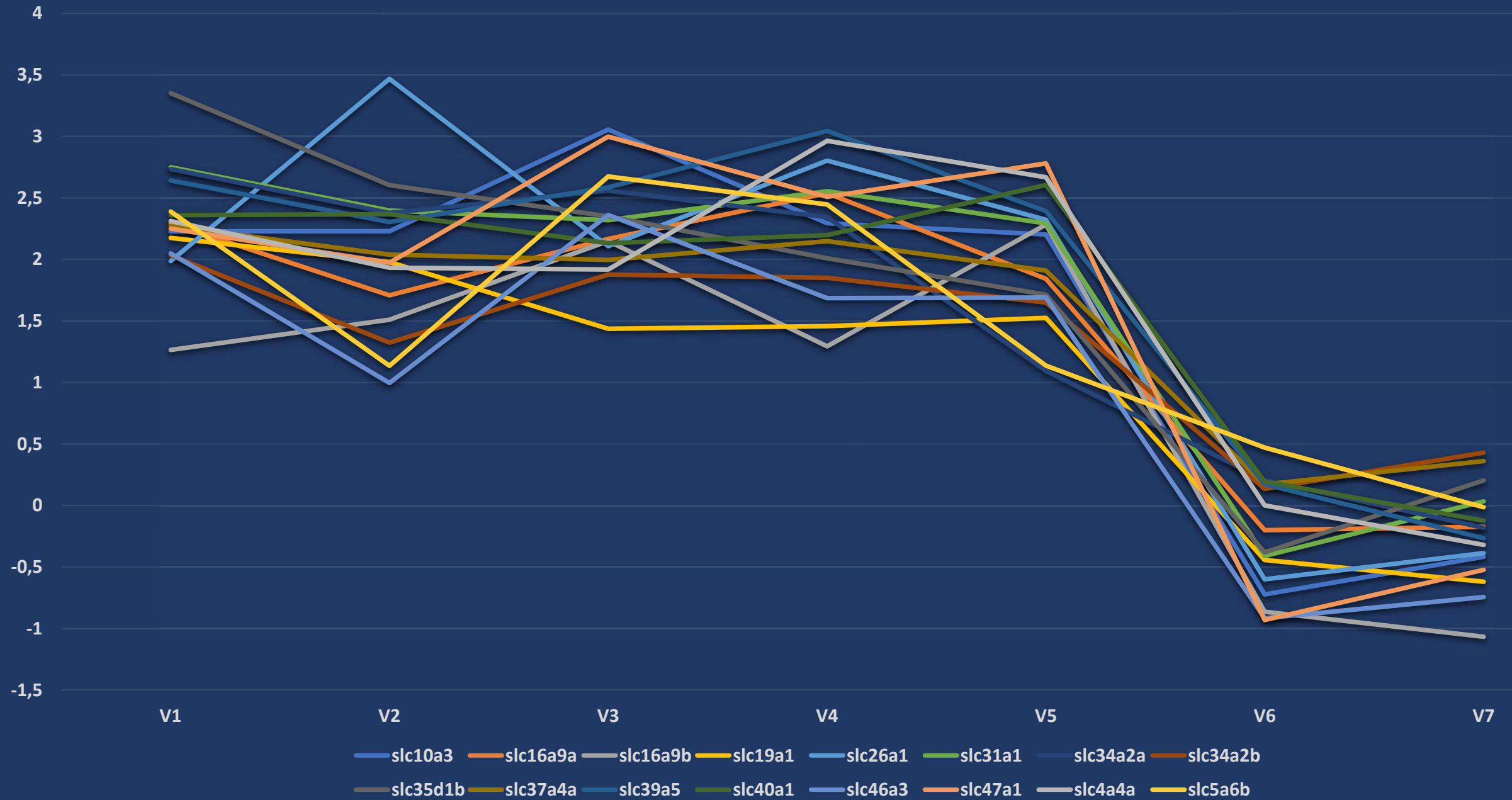


slc3a2 (?)
slc5a6a (?)
slc6a19a (?)
slc7a8a (?)
slc16a6b (?)



- *slc15a1b* solute carrier family 15 (oligopeptide transporter), member 1b
- *slc27a4* solute carrier family 27 (fatty acid transporter), member 4
- *slc5a1* solute carrier family 5 (sodium/glucose cotransporter), member 1
- *slc43a2b* solute carrier family 43 (amino acid system L transporter), member 2b
- *slc5a8l* solute carrier family 5 (iodide transporter), member 8-like

Solute carriers - cluster 3



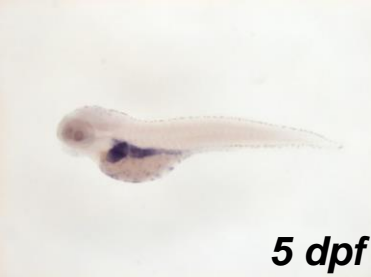
Solute Carriers – Cluster 3

Gut →

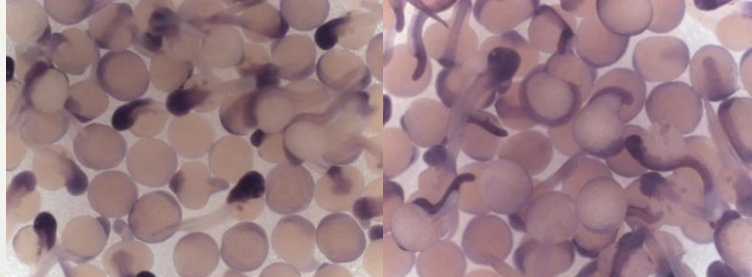
slc37a4a

slc10a3

slc35d1b



5 dpf

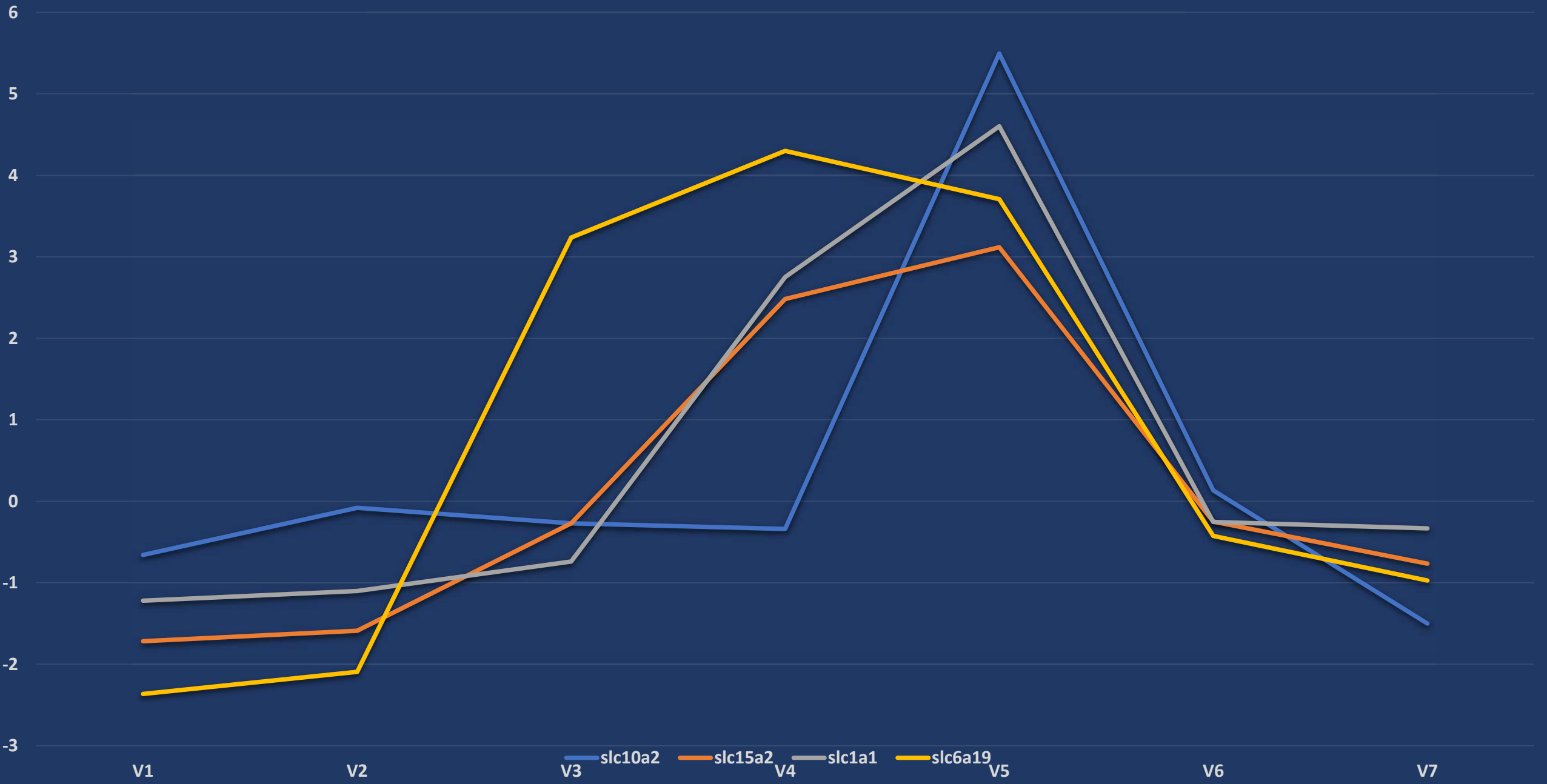


5 dpf

slc6a19a (?)
slc6a19b (?)
slc19a1 (?)
slc26a1 (?)
slc31a1 (?)
slc34a2a (?)
slc34a2b (?)
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slc40a1 (?)
slc46a3 (?)
slc47a1 (?)
slc4a4a (?)
slc5a6b (?)

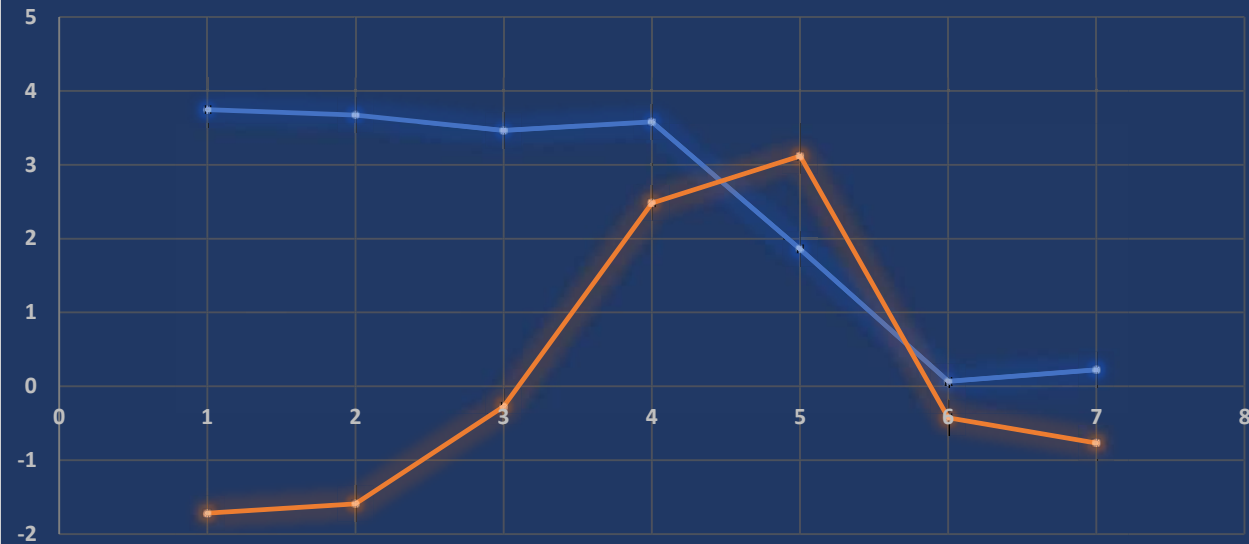
- *slc37a4a* solute carrier family 37 (glucose-6-phosphate transporter), member 4a
- *slc10a3* solute carrier family 10, member 3
- *slc35b1* solute carrier family 35, member B1

Solute carriers - cluster 9



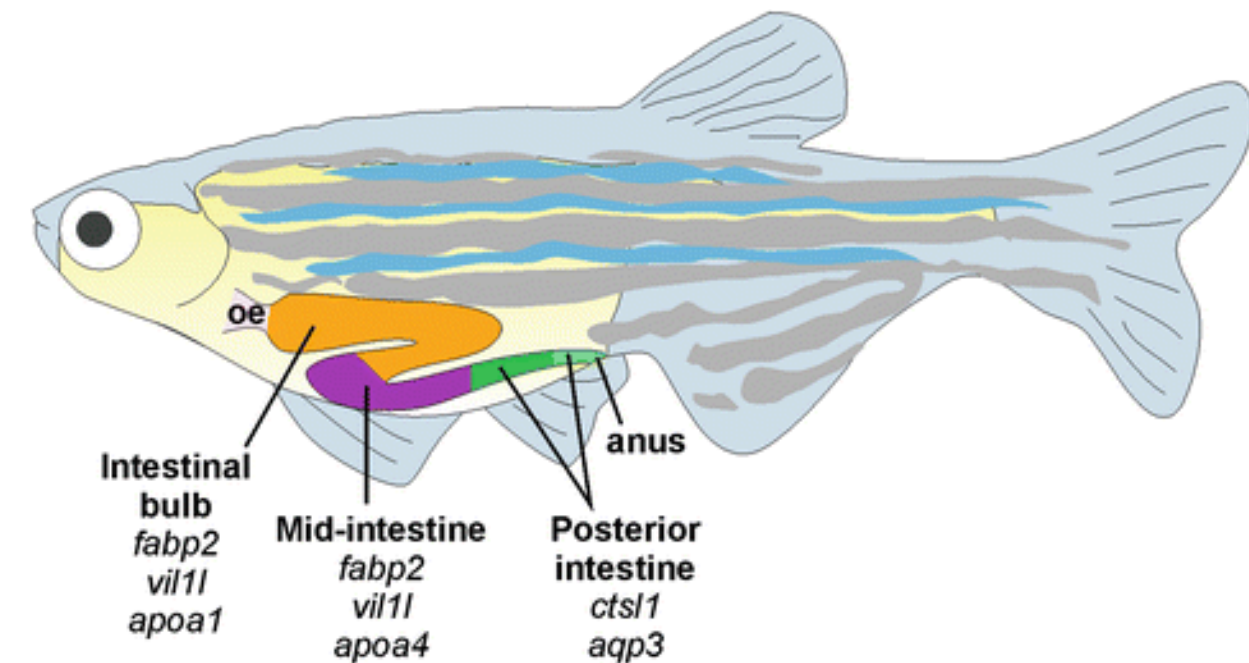
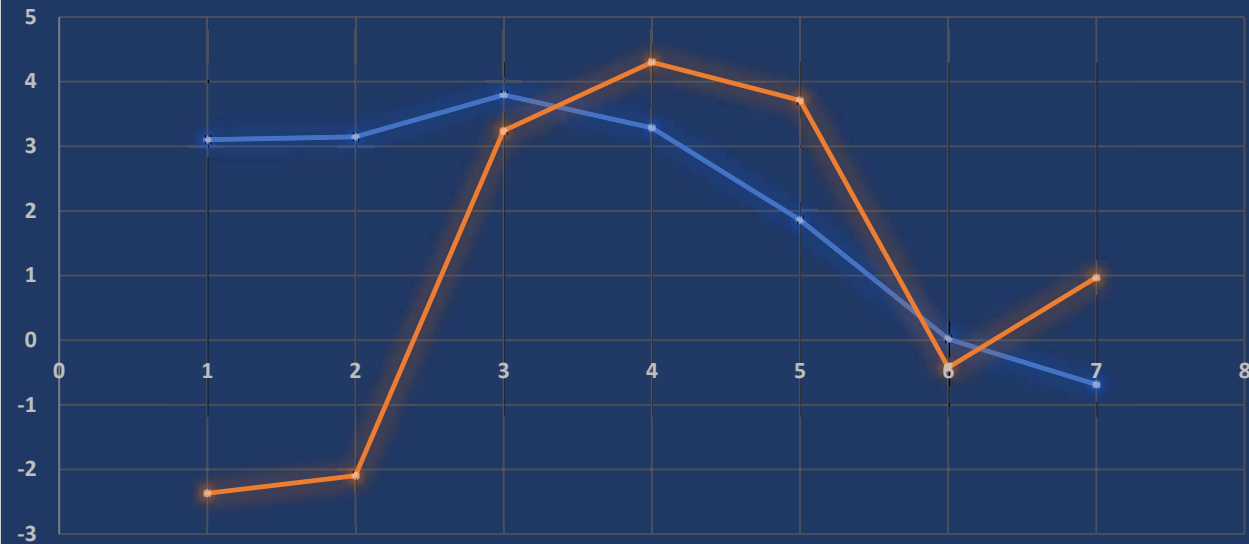
slc15a1 vs. slc15a2

—●— slc15a1 —●— slc15a2



slc6a19a vs. slc6a19

—●— slc6a19a —●— slc6a19



***slc15a2* solute carrier family 15 (oligopeptide transporter), member 2**

***slc6a19a.1* solute carrier family 6 (neutral amino acid transporter), member 19a, tandem duplicate 1**

***slc6a19a.2* solute carrier family 6 (neutral amino acid transporter), member 19a, tandem duplicate 2**

***slc6a19b* solute carrier family 6 (neutral amino acid transporter), member 19b**

***slc10a2* solute carrier family 10 (sodium/bile acid cotransporter), member 2**

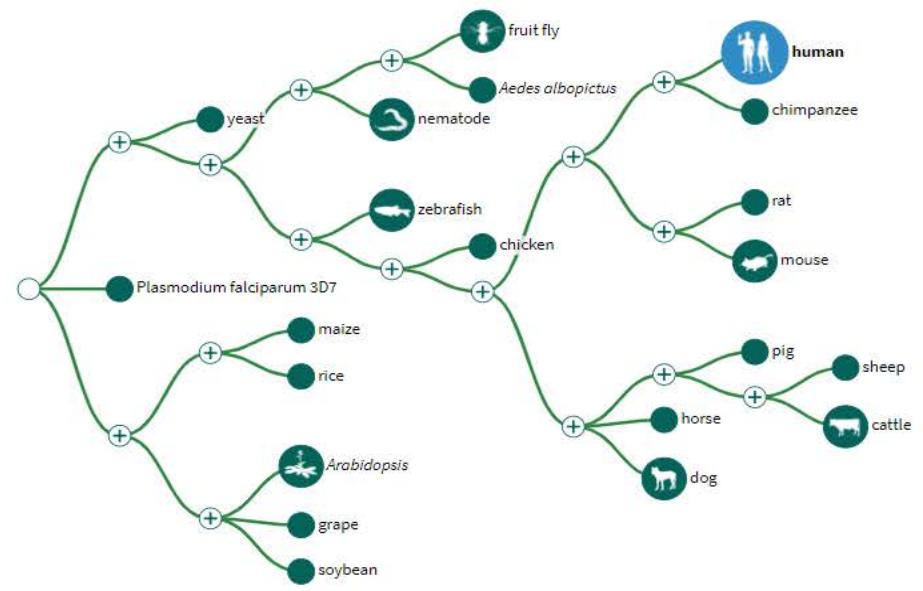
***slc1a1* solute carrier family 1 (neuronal/epithelial high affinity glutamate transporter, system Xag), member 1**

The SLC family series in teleost fish

Genome Data Viewer

GDV is a genome browser supporting the exploration and analysis of more than 600 eukaryotic RefSeq genome assemblies.

Select organism
Homo sapiens (human)



Homo sapiens (human) genome

Search in genome
Location, gene or phenotype
Examples: TP53, chr17:7667000-7689000, rs334, DNA repair

Assembly
GRCh38.p12

[Browse genome](#) [BLAST genome](#)

Assembly details

| | |
|-------------------|--------------------------------------------------|
| Name | GRCh38.p12 |
| RefSeq accession | GCF_000001405.38 |
| GenBank accession | GCA_000001405.27 |
| Download via FTP | RefSeq , GenBank |
| Submitter | Genome Reference Consortium |
| Level | Chromosome |
| Category | Reference genome |

Annotation details

Annotation Release 109
Release date 2018-03-26

A chromosome ideogram showing the human genome with chromosomes 1 through 22, X, and Y. The ideogram is color-coded and shows the relative positions of the chromosomes. The selected assembly, GRCh38.p12, is highlighted in blue.

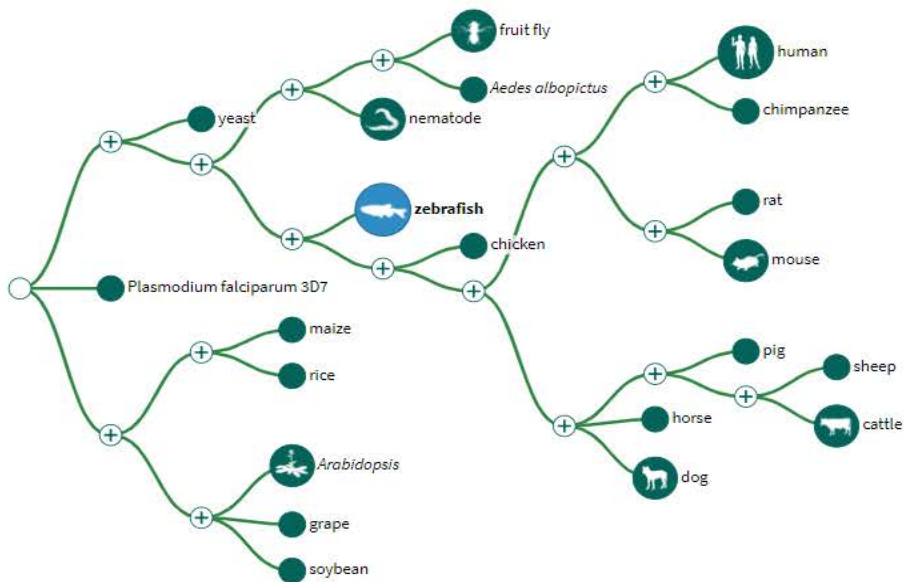
The SLC family series in teleost fish

Genome Data Viewer

GDV is a genome browser supporting the exploration and analysis of more than 600 eukaryotic RefSeq genome assemblies. [?](#)

Select organism

Danio rerio (zebrafish)



Danio rerio (zebrafish) genome

Search in genome

Location, gene or phenotype



Examples: myod1, chr25:31420000-31425000, DNA repair

Assembly

GRCz11

Browse genome

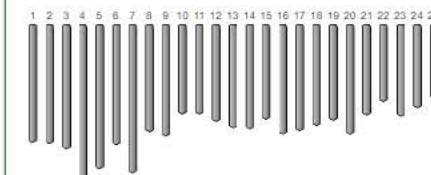
BLAST genome

Assembly details

Name GRCz11
RefSeq accession GCF_000002035.6
GenBank accession GCA_000002035.4
Download via FTP RefSeq, GenBank
Submitter Genome Reference Consortium
Level Chromosome
Category Reference genome

Annotation details

Annotation Release 106
Release date 2017-06-26



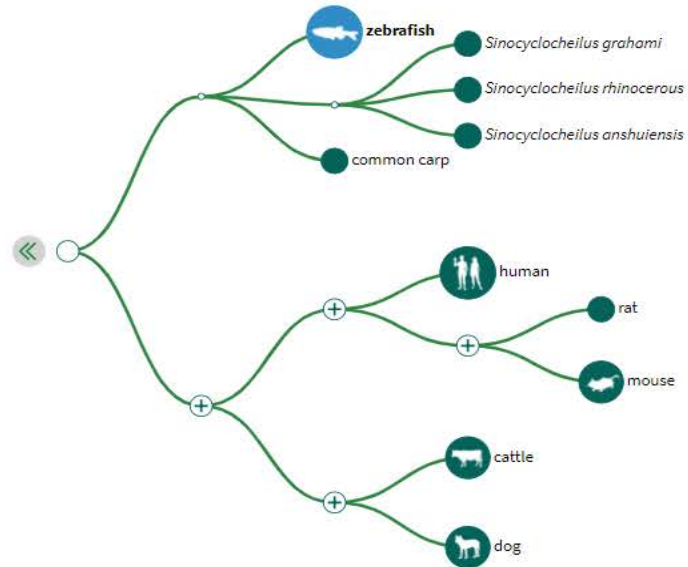
The SLC family series in teleost fish

Genome Data Viewer

GDV is a genome browser supporting the exploration and analysis of more than 600 eukaryotic RefSeq genome assemblies. ⓘ

Select organism

Danio rerio (zebrafish)



Danio rerio (zebrafish) genome

Search in genome

Location, gene or phenotype

Examples: myod1, chr25:31420000-31425000, DNA repair

Assembly

GRCz11

Browse genome

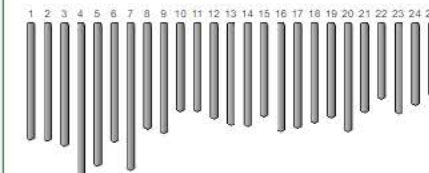
BLAST genome

Assembly details

Name GRCz11
RefSeq accession GCF_000002035.6
GenBank accession GCA_000002035.4
Download via FTP RefSeq, GenBank
Submitter Genome Reference Consortium
Level Chromosome
Category Reference genome

Annotation details

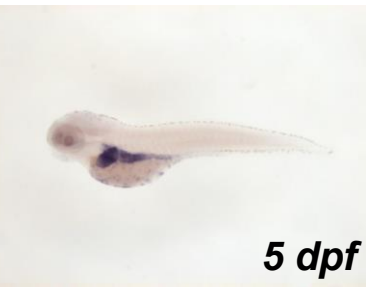
Annotation Release 106
Release date 2017-06-26



Conclusions (3)

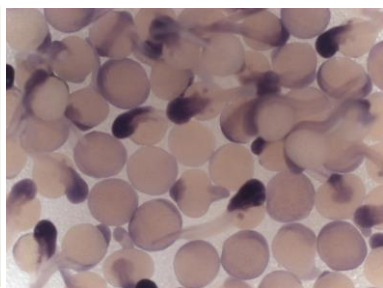
- zebrafish *slc15a1* (*pept1*) as a case study
- passing from 'a case study' to the array of all the SLC transport(ers)
- from *pept1* as a marker for teleost fish gut regionalization, differentiation and morphogenesis to effective functionalization of the organ
- '*nephronizing*' the zebrafish gut

slc37a4a

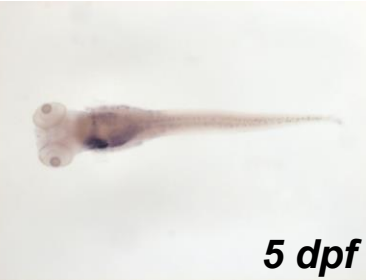
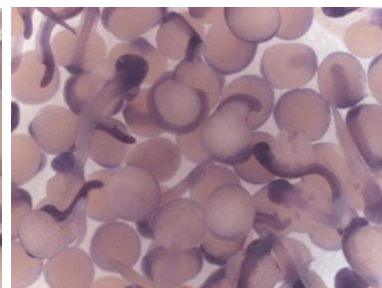


5 dpf

slc10a3



slc35d1b



5 dpf

slc5a8l

slc34a2b

slc31a1

slc26a1

slc19a1

slc27a4



5 dpf

slc5a1



5 dpf

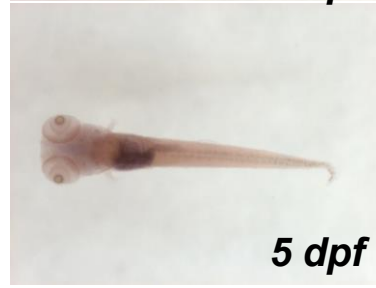
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5 dpf



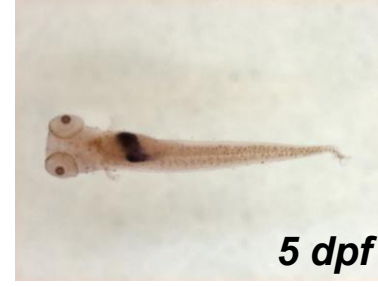
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5 dpf

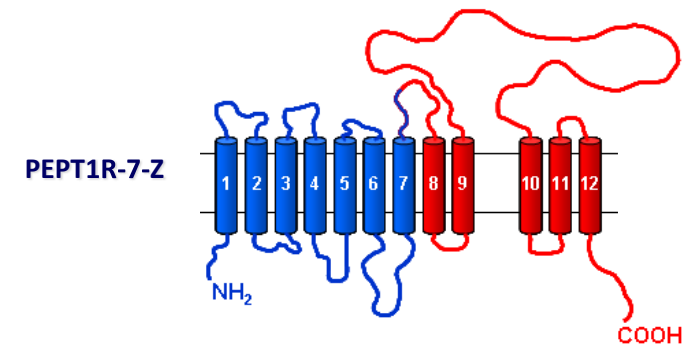
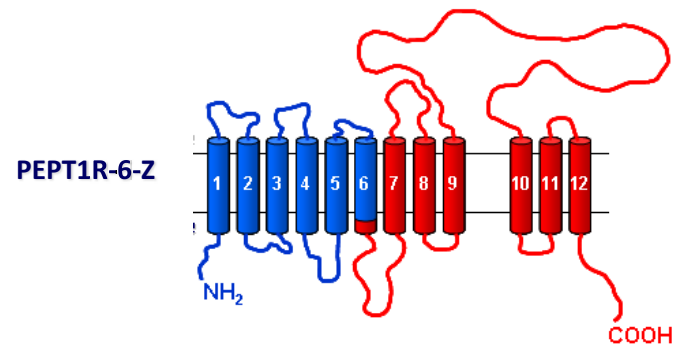
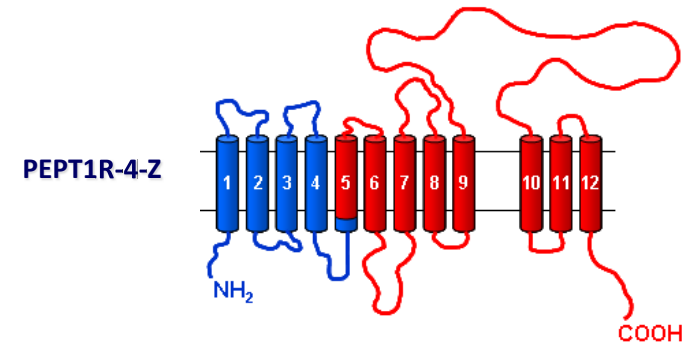
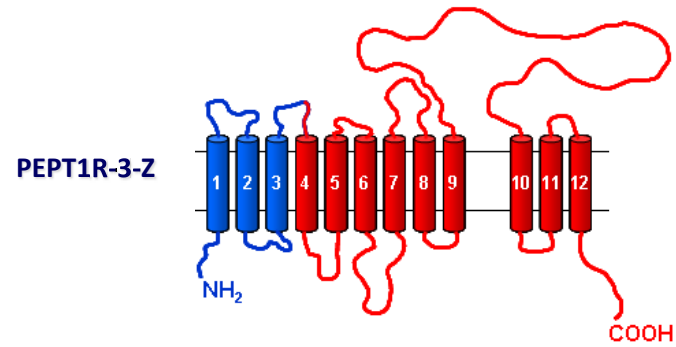
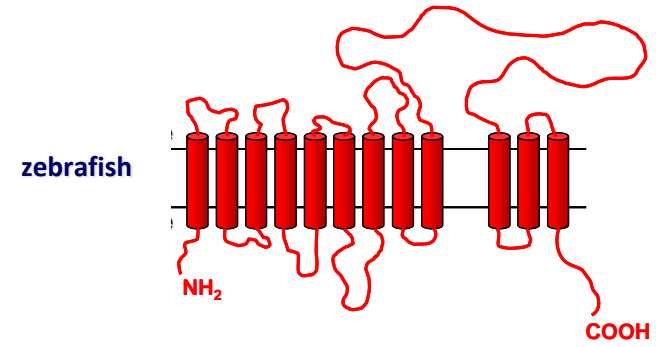
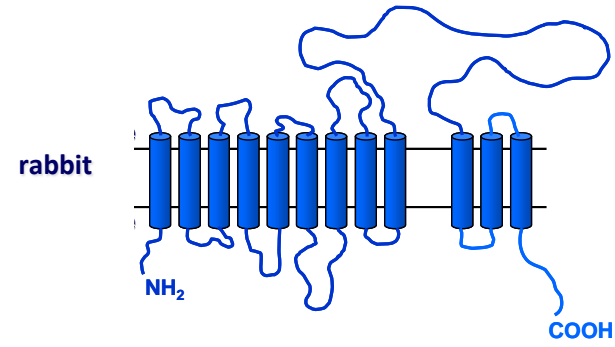


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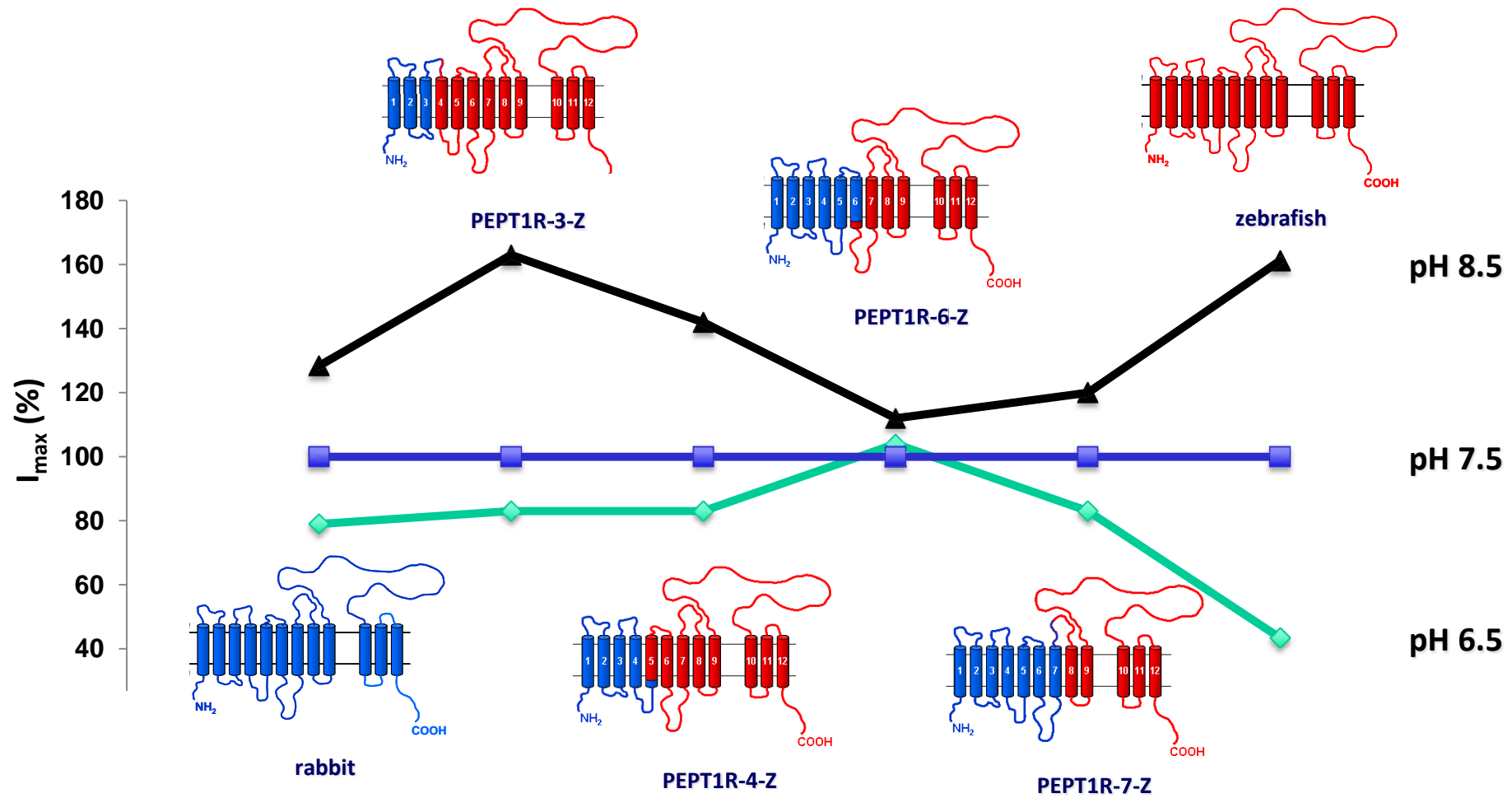


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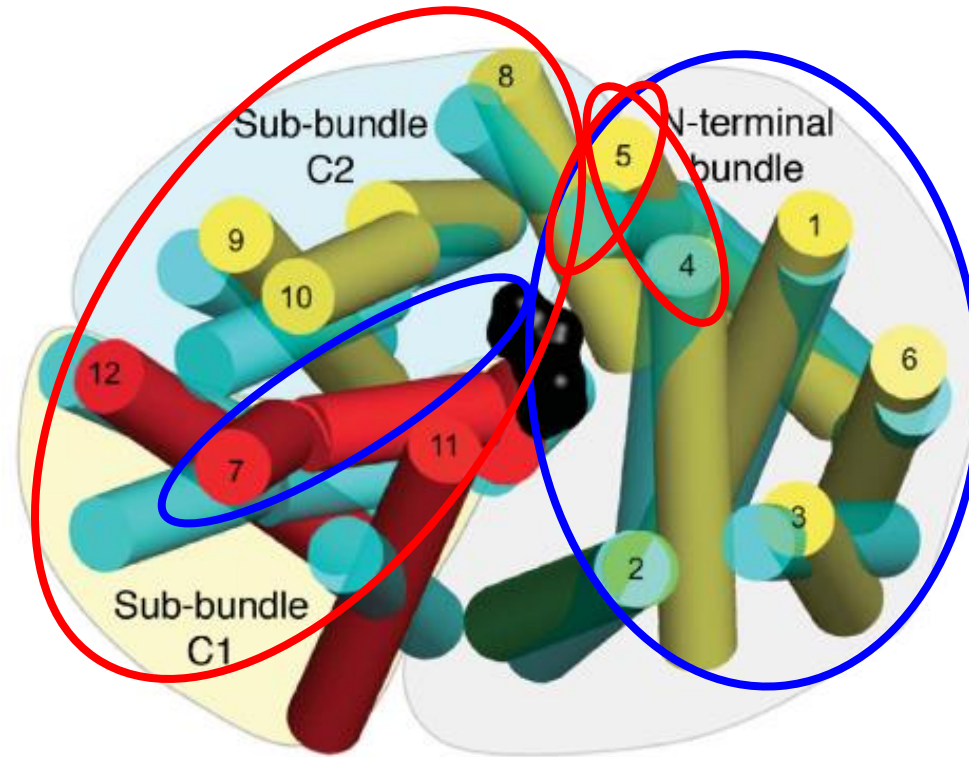
Rabbit/zebrafish PEPT1 chimeric approach



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SOLUTE TRANSPORT(ERS) IN ZEBRAFISH INTESTINE

Tiziano Verri

*Laboratory of General Physiology, Department of Biological and Environmental
Sciences and Technologies, University of Salento, Lecce (Italy)*



ZF-MED – ZEBRAFISH AND OTHER AQUATIC MODELS IN MEDITERRANEAN LABS

Giornate studio sull'impiego dei Modelli Acquatici a fini scientifici

Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise 'G. Caporale'

Teramo – October 15, 2018

PEPT1 and peptide(Lys-Gly)-containing diets