

## Differential Expression of Presynaptic Genes in a Rat Model of Postnatal Hypoxia: Relevance to Schizophrenia

J. U. Sommer<sup>1§</sup>, A. Schmitt<sup>2,3§</sup>, M. Heck<sup>1</sup>, E. L. Schaeffer<sup>3</sup>, M. Fendt<sup>4</sup>, M. Zink<sup>1</sup>, K. Nieselt<sup>5</sup>, S. Symons<sup>5</sup>, G. Petroianu<sup>6</sup>, A. Lex<sup>7</sup>, M. Herrera-Marschitz<sup>8</sup>, R. Spanagel<sup>1</sup>, P. Falkai<sup>2</sup>, P. J. Gebicke-Haerter<sup>1\*</sup>

<sup>1</sup> Central Institute of Mental Health, Dept. of Psychopharmacology, 68159 Mannheim, Germany

<sup>2</sup> Department of Psychiatry, University of Göttingen, 37075 Göttingen, Germany

<sup>3</sup> Laboratory of Neuroscience (LIM27), Institute of Psychiatry, University of Sao Paulo, Rua Dr. Ovidio Pires de Campos 785, 05453-010 São Paulo - SP - Brazil

<sup>4</sup> Animal Physiology, Zoological Institute, Faculty of Biology, University of Tübingen, Auf der Morgenstelle 28, 72076 Tübingen, Germany

<sup>5</sup> Department of Information and Cognitive Sciences, Center for Bioinformatics Tübingen, University of Tübingen, Germany

<sup>6</sup> Department of Cellular Biology & Pharmacology, Florida International University, 11200 SW 8th Street, GL 495E, Miami, FL 33199, USA

<sup>7</sup> Animal Physiology, Biological Institute, University of Stuttgart, Pfaffenwaldring 57, 70550 Stuttgart, Germany

<sup>8</sup> Dept. of Molecular and Clinical Pharmacology, ICBM, Medical Faculty, University of Chile, Av. Independencia 1027, Independencia, Santiago, Chile

J.U.S.: new address: Dept. of Otorhinolaryngology, Head and Neck Surgery, University Hospital Mannheim, University of Heidelberg

M.H.: new address: Dept. of Dermatology, Klinikum Mannheim, University of Heidelberg

§equally contributing authors

### \*Correspondence to:

Prof. Dr. P.J. Gebicke-Haerter

Department of Psychopharmacology

Central Institute of Mental Health, J5

68159 Mannheim, Germany

Tel.: +49(621)17036256

Fax : +49(621)17036255

e-mail : [peter.gebicke@zi-mannheim.de](mailto:peter.gebicke@zi-mannheim.de)

**ESM Table 1b-f**

List of genes on the glutamate chip

<u>Gene ID</u>	<u>Accession No.</u>	<u>Description</u>
AATF	NM_053720	Apoptosis antagonizing transcription factor
ACTB	NM_031144	actin, beta
ADCY2	NM_031007	Adenylate cyclase 2
ADCY3	NM_130779	Adenylate cyclase 3
ADCY4	NM_019285	Adenylate cyclase 4
ADCY5	M96159	Adenylate cyclase 5
ADCY6	NM_012821	Adenylate cyclase 6
AKAP12	NM_057103	A kinase (PRKA) anchor protein (gravin) 12
ARC	NM_019361	Activity regulated cytoskeletal-associated protein
ARRB2	NM_012911	arrestin, beta 2
ATF2	NM_031018	Activating transcription factor 2
ATF4	NM_024403	Activating transcription factor 4
ATP2A2	NR_027839	rat ATPase, Ca <sup>++</sup> transporting, cardiac muscle, slow twitch 2
AURKB	NM_053749	Aurora kinase B
BDNF	NM_012513	rat Brain derived neurotrophic factor
BDNF	NM_007540	mouse Brain derived neurotrophic factor
CABIN1	NM_053575	Calcineurin binding protein 1
CALM2	NM_017326	Calmodulin 2
CAMK4	NM_012727	Calcium/calmodulin-dependent protein kinase IV
CAP1	NM_022383	CAP, adenylate cyclase-associated protein 1 (yeast)
CAP2	NM_053874	RNA binding motif protein 24 (predicted)
CAPN1	NM_019152	Calpain 1
CAPN10	NM_031673	Calpain 10
CAPN2	NM_017116	Calpain 2
CAPN3	NM_017117	Calpain 3
CAPN6	NM_031808	Calpain 6
CAPN8	NM_133309	Calpain 8
CAPON	NM_138922	C-terminal PDZ domain ligand of neuronal nitric oxide synthase
CASK	NM_022184	calcium/calmodulin-dependent serine protein kinase (MAGUK family)
CASQ2	NM_017131	Calsequestrin 2
CAST	NM_053295	calpastatin
CDKL3	NM_021772	Cyclin-dependent kinase-like 3
CHP	NM_024139	Calcium binding protein p22
COT1	Hs.594609	Full-length cDNA clone CS0DJ011YE02 of T cells (Jurkat cell line) Cot 10-normalized of H
CPLX1	NM_022864	Complexin 1
CPLX2	NM_053878	Complexin 2
CREB1	NM_134443	CAMP responsive element binding protein 1
CREBBP	NM_133381	CREB binding protein
CREM	NM_017334	CAMP responsive element modulator
DAO	NM_001917	D-amino-acid oxidase
DAOA	NM_172370	Homo sapiens D-amino acid oxidase activator (DAOA), mRNA
DAT1	NM_139112	LIM domain only 3
DBNDD1	NM_001042610	Homo sapiens dysbindin (dystrobrevin binding protein 1) domain containing 1
DEAD BOX XM_214290		DEAD (Asp-Glu-Ala-Asp) box polypeptide 49 (predicted)
DLGAP1	U67987	PSD-95 binding protein
DLGAP2	U67138	Discs, large (Drosophila) homolog-associated protein 2
DLGH2	U50717	Discs, large homolog 2 (Drosophila)
DRD2	NM_012547	Dopamine receptor 2
DRIP78	NM_053690	DnaJ (Hsp40) homolog, subfamily C, member 14
DUSP1	NM_053769	Dual specificity phosphatase 1
DUSP4	NM_022199	dual specificity phosphatase 4
EAAT3	NM_013032	Solute carrier family 1 (neuronal/epithelial high affinity glutamate transporter, system Xag),
EAAT4	NM_005071	Solute carrier family 1 (high affinity aspartate/glutamate transporter), member 6
ELK1	NM_145095	Potassium voltage-gated channel, subfamily H, member 8
ERK7	NM_173331	Extracellular signal-regulated kinase 7
ETS1	L20681	V-ets erythroblastosis virus E26 oncogene homolog 1 (avian)
FEZ1	NM_031066	Fasciculation and elongation protein zeta 1 (zygin I)
FYN	NM_012755	Fyn proto-oncogene
GABBR1	AF112975	Gamma-aminobutyric acid (GABA) B receptor 1
GABRG3	X63324	Gamma-aminobutyric acid (GABA) A receptor, subunit gamma 3
GAD1	NM_017007	Glutamate decarboxylase 1
GAD67	NM_000817	Glutamate decarboxylase 1 (brain, 67kDa)

GADD45A	NM_024127	Growth arrest and DNA-damage-inducible 45 alpha
GAP43	NM_017195	Growth associated protein 43
GAPDH	NM_017008	Glyceraldehyde-3-phosphate dehydrogenase
GAT1	NM_003042	Solute carrier family 6 (neurotransmitter transporter, GABA), member 1
GAT3	NM_014229	Solute carrier family 6 (neurotransmitter transporter, GABA), member 11
GATA4	L22761	GATA binding protein 4
GLUR4	M85037	glutamate receptor subunit 4, non-NMDA
GNA12	NM_031034	Guanine nucleotide binding protein, alpha 12
GNA15	NM_053542	guanine nucleotide binding protein, alpha 15
GNAI2	NM_031035	Guanine nucleotide binding protein, alpha inhibiting 2
GNAO	NM_017327	Guanine nucleotide binding protein, alpha o
GNAS	M17525	GTP-binding protein (G-alpha-8)
GNG8	NM_139185	Guanine nucleotide binding protein (G protein), gamma 8 subunit
GPRASP1	NM_134386	G protein-coupled receptor associated sorting protein 1
GPSM1	NM_144745	G-protein signalling modulator 1 (AGS3-like, C. elegans)
GRIA1	NM_031608	Glutamate receptor, ionotropic, AMPA1 (alpha 1)
GRIA2	NM_017261	Glutamate receptor, ionotropic, 2
GRIA3	NM_032990	Glutamate receptor, ionotropic, AMPA3 (alpha 3)
GRIA4	NM_017263	Glutamate receptor, ionotropic, 4
GRIK1	NM_017241	Glutamate receptor, ionotropic, kainate 1
GRIK2	NM_019309	Glutamate receptor, ionotropic, kainate 2
GRIK3	NM_181373	Glutamate receptor, ionotropic, kainate 3
GRIK4	NM_012572	Glutamate receptor, ionotropic, kainate 4
GRIK5	NM_031508	Glutamate receptor, ionotropic, kainate 5
GRIN1	NM_000832	Homo sapiens Glutamate receptor, ionotropic, N-methyl D-aspartate 1
GRIN1	NM_017010	rat Glutamate receptor, ionotropic, N-methyl D-aspartate 1
GRIN2A	NM_012573	Glutamate receptor, ionotropic, N-methyl D-aspartate 2A
GRIN2A	NM_000833	human glutamate receptor, ionotropic, N-methyl D-aspartate 2A
GRIN2B	NM_012574	Glutamate receptor, ionotropic, N-methyl D-aspartate 2B
GRIN2C	NM_000835	Homo sapiens Glutamate receptor, ionotropic, N-methyl D-aspartate 2C
GRIN2C	NM_012575	rat Glutamate receptor, ionotropic, NMDA2C
GRIN2C	NM_010350	mouse Glutamate receptor, ionotropic, NMDA2C (epsilon 3) (Grin2c), mRNA
GRIN2D	NM_022797	rat Glutamate receptor, ionotropic, NMDA2D
GRIN2D	NM_000836	Homo sapiens Glutamate receptor, ionotropic, NMDA2D (epsilon 4) (Grin2d), mRNA
GRIN3A	NM_133445	Homo sapiens glutamate receptor, ionotropic, N-methyl-D-aspartate 3A
GRIN3B	NM_133308	Glutamate receptor, ionotropic, N-methyl-D-aspartate 3B
GRINA	NM_153308	Glutamate receptor, ionotropic, N-methyl D-aspartate-associated protein 1 (glutamate bindi
GRIP1	U88572	Glutamate receptor interacting protein 1
GRIP2	AF090113	Glutamate receptor interacting protein 2
GRM1	NM_017011	Glutamate receptor, metabotropic 1
GRM2	XM_343470	Glutamate receptor, metabotropic 2
GRM4	NM_022666	Glutamate receptor, metabotropic 4
GRM5	NM_017012	Glutamate receptor, metabotropic 5
GRM7	NM_031040	Glutamate receptor, metabotropic 7
GRM8	NM_000845	Glutamate receptor, metabotropic 8
GSTM3	NM_012504	Glutathione S-transferase, mu type 3
HOMER1	NM_031707	Homer homolog 1 (Drosophila)
HOMER2	NM_053309	Homer homolog 2 (Drosophila)
HTR7	L22558	5-hydroxytryptamine (serotonin) receptor 7
ITPKA	NM_031045	Inositol 1,4,5-trisphosphate 3-kinase A
ITPR1	NM_001007235	Inositol 1,4,5-triphosphate receptor 1
ITPR3	NM_013138	Inositol 1, 4, 5-triphosphate receptor 3
LAO1	NM_001106682	L-amino acid oxidase 1
LOC362704	NM_199270	Brain and reproductive organ-expressed protein
MAPK1	NM_053842	Mitogen activated protein kinase 1
MAPK14	NM_031020	Mitogen activated protein kinase 14
MAPK3	NM_017347	Mitogen activated protein kinase 3
MAPRE2	NM_014268	Microtubule-associated protein, RP/EB family, member 2
MARK1	Z83868	MAP/microtubule affinity-regulating kinase 1
MHC2	NM_198741.2	Major histocompatibility complex, class II, M
MKR3		Major histocompatibility complex, class III, M
MKR3		Major histocompatibility complex, class III, M
MRPS7	NM_031017	Mitochondrial ribosomal protein S7

MTAP2	NM_013066	Microtubule-associated protein 2
MYD116	NM_133546	Myeloid differentiation primary response gene 116Gene Myd116
NELL2	U48245	protein kinase C-binding protein, NEL-Like 2
NGFR	NM_012610	Nerve growth factor receptor (TNFR superfamily, member 16)
NOS1	NM_052799	nitric oxide synthase 1, neuronal
NOS2	NM_012611	Nitric oxide synthase 2, inducible
NPY	NM_012614	Neuropeptide Y
NR2F1	NM_031130	Nuclear receptor subfamily 2, group F, member 1
NRG1	NM_013956	Homo sapiens neuregulin 1 isoform
NRG1	NM_031588	Neuregulin 1
NRXN1	NM_020252	mouse Neurexin I
NRXN2	NM_053846	neurexin 2
NRXN2	NM_020253	mouse Neurexin II
NRXN3	NM_053817	rat Neurexin 3
NRXN3	NM_172544	mouse Neurexin III
NSF	NM_021748	N-ethylmaleimide-sensitive factor
NTRK2	NM_012731	neurotrophic tyrosine kinase, receptor, type 2
NTRK2	NM_001163169	neurotrophic tyrosine kinase, receptor, type 2, transcript variant 3
NUP54	NM_017361	nucleoporin 54
OPRS1	NM_030996	Opioid receptor, sigma 1
PACSN2	NM_130740	Protein kinase C and casein kinase substrate in neurons 2
PCYT1A	NM_078622	Phosphate cytidyltransferase 1, choline, alpha isoform
PDE4B	NM_017031	Phosphodiesterase 4B, cAMP specific
PER2	NM_031678	Period homolog 2 (Drosophila)
PIK3C3	NM_022958	Phosphoinositide-3-kinase, class 3
PIM3	NM_022602	Serine/threonine-protein kinase pim-3
PKCAMP	X53261	Protein kinase, cAMP dependent, catalytic, beta (predicted)
PKN1	NM_017175	Protein kinase N1
PLAT	NM_013151	Plasminogen activator, tissue
PLCB4	NM_024353	Phospholipase C, beta 4
PLCG1	NM_013187	Phospholipase C, gamma 1
PLD1	NM_030992	Phospholipase D1
PLD2	NM_033299	Phospholipase D2
PLEKHC1	NM_001011915	Pleckstrin homology domain containing, family C (with FERM domain) member 1
PNOC	NM_013007	Prepronociceptin
POU1F1	NM_013008	POU class 1 homeobox 1
POU2F1	U17013	POU domain, class 2, transcription factor 1
POU3F3	NM_138837	POU domain, class 3, transcription factor 3
POU3F4	M72711	POU domain, class 3, transcription factor 4
PPARGC1A	NM_031347	Peroxisome proliferative activated receptor, gamma, coactivator 1 alpha
PPM1B	NM_033096	Protein phosphatase 1B, magnesium dependent, beta isoform
PPM1E	NM_198773	calmodulin-dependent protein kinase protein phosphatase 1E
PPM1G	NM_147209	Protein phosphatase 1G (formerly 2C), magnesium-dependent, gamma isoform
PPP1CA	NM_031527	protein phosphatase 1, catalytic subunit, alpha isoform
PPP1CC	NM_022498	Protein phosphatase 1, catalytic subunit, gamma isoform
PPP1R10	NM_022951	Protein phosphatase 1, regulatory subunit 10
PPP1R14A	NM_130403	Protein phosphatase 1, regulatory (inhibitor) subunit 14A
PPP1R14B	NM_172045	Protein phosphatase 1, regulatory (inhibitor) subunit 14B
PPP1R14C	NM_133425	Protein phosphatase 1, regulatory (inhibitor) subunit 14c
PPP1R1A	NM_022676	Protein phosphatase 1, regulatory (inhibitor) subunit 1A
PPP2R2B	NM_022209	Protein phosphatase 2 (formerly 2A), regulatory subunit B (PR 52), beta isoform
PPP2R2C	NM_057116	protein phosphatase 2 (formerly 2A), regulatory subunit B, gamma isoform
PPP2R5B	NM_181379	Protein phosphatase 2, regulatory subunit B (B56), beta isoform
PPP3CA	X57115	Protein phosphatase 3, catalytic subunit, alpha isoform
PPP4R1	NM_080907	Protein phosphatase 4, regulatory subunit 1
PPP5C	NM_031729	Protein phosphatase 5, catalytic subunit
PPP6C	NM_133589	Protein phosphatase 6, catalytic subunit
PRKCABP	NM_053460	Protein kinase C, alpha
PRKCB1	NM_012713	Protein kinase C, beta 1
PRKCC	NM_012628	Protein kinase C, gamma
PRKCD	NM_133307	Protein kinase C, delta
PRKCH	NM_031085	Protein kinase C, eta
PRKCZ	NM_022507	Protein kinase C, zeta

PTP4A1	NM_031579	Protein tyrosine phosphatase 4a1
PTP4A2	NM_053475	Protein tyrosine phosphatase 4a2
PTPH6	NM_053908	Protein tyrosine phosphatase, non-receptor type 6
PTPN13	AF543484	protein tyrosine phosphatase non-receptor type 13
PTPN2	NM_053990	Protein tyrosine phosphatase, non-receptor type 2
PTPN21	NM_133545	Protein tyrosine phosphatase 2E
PTPN5	NM_019253	Protein tyrosine phosphatase, non-receptor type 5
PTPNS1	NM_013016	Protein tyrosine phosphatase, non-receptor type substrate 1
PTPRA	XM_215102	Protein tyrosine phosphatase, receptor type, A
PTPRC	XM_213985	Protein tyrosine phosphatase, receptor type, C
PTPRD	NM_019140	Protein tyrosine phosphatase, receptor type, D
PTPRF	NM_019249	Protein tyrosine phosphatase, receptor type, F
PTPRG	NM_134356	Protein tyrosine phosphatase, receptor type, G
PTPRH	D45413	Protein tyrosine phosphatase, receptor type, H
PTPRJ	NM_017269	Protein tyrosine phosphatase, receptor type, J
PTPRN	NM_053881	Protein tyrosine phosphatase, receptor type, N
PTPRN2	NM_031600	Protein tyrosine phosphatase, receptor type, N polypeptide 2
PTPRO	NM_017336	Protein tyrosine phosphatase, receptor type, O
PTPRQ	NM_022925	Protein tyrosine phosphatase, receptor type, Q
PTPRR	NM_053594	Protein tyrosine phosphatase, receptor type, R
RAB10	NM_017359	RAB10, member RAS oncogene family
RAB14	NM_053589	RAB14, member RAS oncogene family
RAB34	NM_031527	member of RAS oncogene family
RAB3A	NM_013018	RAB3A, member RAS oncogene family
RAB3B	NM_031091	RAB3B, member RAS oncogene family
RAB3C	NM_133536	RAB3C, member RAS oncogene family
RELN	NM_005045	human Reelin
RELN	NM_080394	Reelin
RGS2	NM_053453	Regulator of G-protein signaling 2
RGS3	NM_019340	Regulator of G-protein signalling 3
RN.25045	NM_001034010	Similar to RIKEN cDNA 1200009O22; EST AI316813
RN.97552	BD005398	Transcribed locus
SACM1L	NM_181374	SAC1 (supressor of actin mutations 1, homolog)-like (S. cerevisiae
SHANK1	NM_031751	SH3 and multiple ankyrin repeat domains 1
SHANK2	NM_133440	SH3/ankyrin domain gene 2
SLC17A7	NM_053859	Solute carrier family 17 (sodium-dependent inorganic phosphate cotransporter), member 7
SLC1A2	NM_017215	Solute carrier family 1 (glial high affinity glutamate transporter), member 2
SLC1A3	S59158	Solute carrier family 1 (glial high affinity glutamate transporter), member 3
SLC1A6	U89608	Solute carrier family 1 (high affinity aspartate/glutamate transporter), member 6
SLC2A1	NM_138827	Solute carrier family 2 (facilitated glucose transporter), member 1
SLC32A1	NM_031782	solute carrier family 32 (GABA vesicular transporter), member 1
SLC6A11	M95738	Solute carrier family 6 (neurotransmitter transporter, GABA), member 11
SLC6A12	NM_017335	Solute carrier family 6 (neurotransmitter transporter, betaine/GABA), member 12
SLC6A13	M95762	Solute carrier family 6 (neurotransmitter transporter, GABA), member 13
SLK	NM_019349	STE20-like kinase
SMAGP	NM_182817	Small cell adhesion glycoprotein
SMYD3	NM_001025762	SET and MYND domain containing 3
SNAP25	NM_030991	Synaptosomal-associated protein 25 (Snap25), mRNA
SOD1	NM_017050	Superoxide dismutase 1
SP1	NM_012655	Sp1 transcription factor
SRC	NM_031977	Rous sarcoma oncogene
STAT3	NM_012747	Signal transducer and activator of transcription 3
STK10	XM_001065000	erine/threonine kinase 10, transcript variant 2
STK16	NM_173142	Serine/threonine kinase 16
STK17B	NM_133392	Serine/threonine kinase 17b (apoptosis-inducing)
STK23	NM_184045	Serine/threonine kinase 23
STK39	NM_019362	Serine/threonine kinase 39, STE20/SPS1 homolog (yeast)
STK6	NM_153296	Serine/threonine kinase 6
STX1A	NM_053788	rat syntaxin 1A
STX1A	NM_016801	mouse Syntaxin 1A (brain)
SYN1	NM_019133	rat Synapsin I
SYN1	NM_013680	mouse Synapsin I
SYN2	NM_001034020	rat Synapsin II

SYN2	NM_001111015.1	mouse Synapsin II
SYN3	NM_017109	rat Synapsin III
SYN3	NM_013722.3	mouse Synapsin III
SYP	NM_012664	Synaptophysin
SYT1	NM_001033680	rat Synaptotagmin 1
SYT1	NM_005639	human Synaptotagmin I
SYT1	NM_009306	mouse Synaptotagmin I
SYT3	NM_019122	Synaptotagmin 3
TCF12	XM_346829	Transcription factor 12
TH	NM_012740	tyrosine hydroxylase
TRANSC.LOCUS	00138500	Transcribed locus, strongly similar to NP_038502.1 apolipoprotein A-II [Mus musculus]
VAMP1	M24104	Rat vesicle associated membrane protein
VAMP1	NM_009496	mouse Vesicle-associated membrane protein 1
VAMP2	NM_012663	rat Vesicle-associated membrane protein 2
ZIP3	AF439403	protein kinase C-zeta-interacting protein