Enhancer	Gene	Target	Specificity	Position	Mouse_mr	Mouse_mm10
E1	Scn1a	PV	0.22	intergenic	chr2	66256056
E2	Scn1a	PV	0.9	intronic	chr2	66364036
E3	Scn1a	PV	0.57	intronic	chr2	66383190
E4	Scn1a	PV	0.14	intronic	chr2	66387764
E5	Scn1a	PYR	0.2	intronic	chr2	66392447
E6	Scn1a	VIP	0.88	intronic	chr2	66401767
E7	Scn1a	PV	0.33	intronic	chr2	66407834
E8	Scn1a	PV	0.61	intronic	chr2	66439814
E9	Scn1a	PV	0.47	intergenic	chr2	66441748
E10	Scn1a	PV	0.23	intergenic	chr2	66450594
E11	Pvalb	PV	0.9	intronic	chr15	78204152
E12	Pvalb	PV	0.59	intronic	chr15	78204583
E13	Pvalb	PV	0.67	intronic	chr15	78205234
E14	Acan	PV	0.94	intergenic	chr7	79052127
E15	Acan	PV	0.79	intergenic	chr7	79053118
E16	Acan	PV	0.58	intronic	chr7	79056553
E17	Acan	PV	0.54	intronic	chr7	79079999
E18	Tmem132c	PV	0.57	intronic	chr5	127243448
E19	Tmem132c	PV	0.57	intronic	chr5	127257256
E20	Tmem132c	PV	0.66	intronic	chr5	127290515
E21	Tmem132c	PV	0.71	intronic	chr5	127300767
E22	Tmem132c	PV	0.94	intronic	chr5	127305150
E23	Tmem132c	PV	0.64	intronic	chr5	127323924
E24	Tmem132c	PV	0.82	intronic	chr5	127331966
E25	Tmem132c	PV	0.73	intronic	chr5	127355818
E26	Lrrc38	PV	0.72	intergenic	chr4	143348892
E27	Lrrc38	PV	0.66	intronic	chr4	143361408
E28	Inpp5j	PV	0.83	intergenic	chr11	3504821
E29	Inpp5j	PV	0.94	intergenic	chr11	3509025
E30	Mef2c	PV	0.77	intergenic	chr13	83503268
E31	Mef2c	PV	0.63	intronic	chr13	83507235
E32	Mef2c	PV	0.7	intronic	chr13	83515122
E33	Mef2c	PV	0.82	intronic	chr13	83518268
E34	Pthlh	PV	0.48	intronic	chr6	147263395
E35	Pthlh	PV	0.86	intergenic	chr6	147266874

FIG. 1A-1

Mouse_mm10_	Size (bp)	mouse_mm10_DAS_Link
66257335	1279	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66256056,66257335
66364653	617	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66364036,66364653
66384021	831	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66383190,66384021
66388024	260	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66387764,66388024
66393109	662	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66392447,66393109
66402372	605	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66401767,66402372
66410263	2429	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66407834,66410263
66441457	1643	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66439814,66441457
66442268	520	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66441748,66442268
66451140	546	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr2:66450594,66451140
78204655	503	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr15:78204152,78204655
78204784	201	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr15:78204583,78204784
78205766	532	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr15:78205234,78205766
79052622	495	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr7:79052127,79052622
79053435	317	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr7:79053118,79053435
79057054	501	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr7:79056553,79057054
79080472	473	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr7:79079999,79080472
127244121	673	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127243448,127244121
127257594	338	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127257256,127257594
127291016	501	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127290515,127291016
127301107	340	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127300767,127301107
127305592	442	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127305150,127305592
127324468	544	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127323924,127324468
127332522	556	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127331966,127332522
127356133	315	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr5:127355818,127356133
143349749	857	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr4:143348892,143349749
143362362	954	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr4:143361408,143362362
3505244	423	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr11:3504821,3505244
3509652	627	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr11:3509025,3509652
83504033	765	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr13:83503268,83504033
83507457	222	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr13:83507235,83507457
83515409	287	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr13:83515122,83515409
83519179	911	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr13:83518268,83519179
147263584	189	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr6:147263395,147263584
147267390	516	http://genome.ucsc.edu/cgi-bin/das/mm10/dna?segment=chr6:147266874,147267390

FIG. 1A-1 (cont.)

Enhancer	Gene	Target	Specificity	Position	Human_hg38_chr	Human_hg38_start	Human_hg38_stop
E1	Scn1a	PV	22%	intergenic	chr2	165953030	165954796
E2	Scn1a	PV	90%	intronic	chr2	166084035	166084884
E3	Scn1a	PV	57%	intronic	chr2	166090876	166091720
E4	Scn1a	PV	14%	intronic	chr2	166094366	166094633
E5	Scn1a	PYR	20%	intronic	chr2	166103693	166104587
E6	Scn1a	VIP	88%	intronic	chr2	166118214	166118879
E7	Scn1a	PV	33%	intronic	chr2	165892760	165897884
E8	Scn1a	PV	61%	intronic	chr2	166148156	166149792
E9	Scn1a	PV	47%	intergenic	chr2	166150066	166150702
E10	Scn1a	PV	23%	intergenic	chr2	166160023	166160609
E11	Pvalb	PV	90%	intronic	chr22	36816984	36817612
E12	Pvalb	PV	59%	intronic	chr22	36817484	36817720
E13	Pvalb	PV	67%	intronic	chr22	36818134	36818727
E14	Acan	PV	94%	intergenic	chr15	88802240	88802877
E15	Acan	PV	79%	intergenic	chr15	88803290	88803678
E16	Acan	PV	58%	intronic	chr15	88807290	88807962
E17	Acan	PV	54%	intronic	chr15	88833390	88833984
E18	Tmem132c	PV	57%	intronic	chr12	128377753	128378783
E19	Tmem132c	PV	57%	intronic	chr12	128289803	128290279

FIG. 1A-2

Human_hg38_size_(bp)	human_hg38_DAS_link	% Conservation between mouse and human
1766	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:165953030,165954796	69%
849	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166084035,166084884	71%
844	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166090876,166091720	67%
267	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166094366,166094633	78%
894	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166103693,166104587	72%
665	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166118214,166118879	72%
5124	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:165892760,165897884	74%
1636	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166148156,166149792	75%
636	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166150066,166150702	72%
586	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr2:166160023,166160609	75%
628	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr22:36816984,36817612	78%
236	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr22:36817484,36817720	74%
593	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr22:36818134,36818727	73%
637	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr15:88802240,88802877	72%
388	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr15:88803290,88803678	84%
672	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr15:88807290,88807962	82%
594	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr15:88833390,88833984	86%
1030	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128377753,128378783	70%
476	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128289803,128290279	78%

FIG. 1A-2 (cont.)

E20	Tmem132c	PV	66%	intronic	chr12	128323153	128323718
E21	Tmem132c	PV	71%	intronic	chr12	128332503	128332974
E22	Tmem132c	PV	94%	intronic	chr12	128336003	128336491
E23	Tmem132c	PV	64%	intronic	chr12	128365603	128366181
E24	Tmem132c	PV	82%	intronic	chr12	128375853	128376606
E25	Tmem132c	PV	73%	intronic	chr12	128408553	128408930
E26	Lrrc38	PV	72%	intergenic	chr1	13388723	13390212
E27	Lrrc38	PV	66%	intronic	chr1	13469123	13470861
E28	Inpp5j	PV	83%	intergenic	chr22	31124894	31125629
E29	Inpp5j	PV	94%	intergenic	chr22	31132544	31133831
E30	Mef2c	PV	77%	intergenic	chr5	88655733	88657379
E31	Mef2c	PV	63%	intronic	chr5	88872683	88872997
E32	Mef2c	PV	70%	intronic	chr5	88745133	88745535
E33	Mef2c	PV	82%	intronic	chr5	88799783	88801354
E34	Pthlh	PV	48%	intronic	chr12	27969472	27969690
E35	Pthlh	PV	86%	intergenic	chr12	27973822	27974489

FIG. 1A-3

565	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128323153,128323718	77%
471	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128332503,128332974	74%
488	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128336003,128336491	75%
578	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128365603,128366181	85%
753	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128375853,128376606	74%
377	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:128408553,128408930	77%
1489	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr1:13388723,13390212	70%
1738	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr1:13469123,13470861	71%
735	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr22:31124894,31125629	77%
1287	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr22:31132544,31133831	74%
1646	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr5:88655733,88657379	-
314	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr5:88872683,88872997	68%
402	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr5:88745133,88745535	70%
1571	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr5:88799783,88801354	-
218	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:27969472,27969690	68%
667	http://genome.ucsc.edu/cgi-bin/das/hg38/dna?segment=chr12:27973822,27974489	69%

FIG. 1A-3 (cont.)

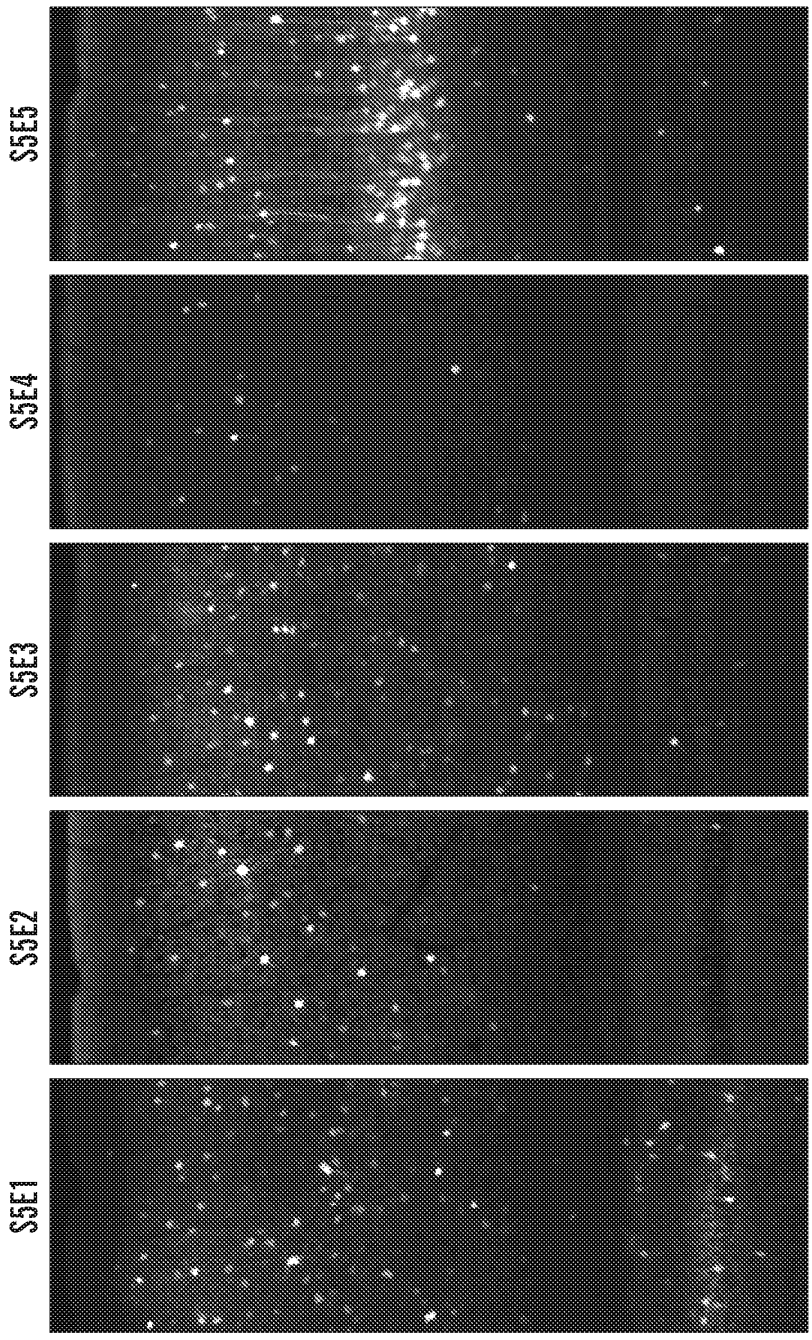


FIG. 1B-1

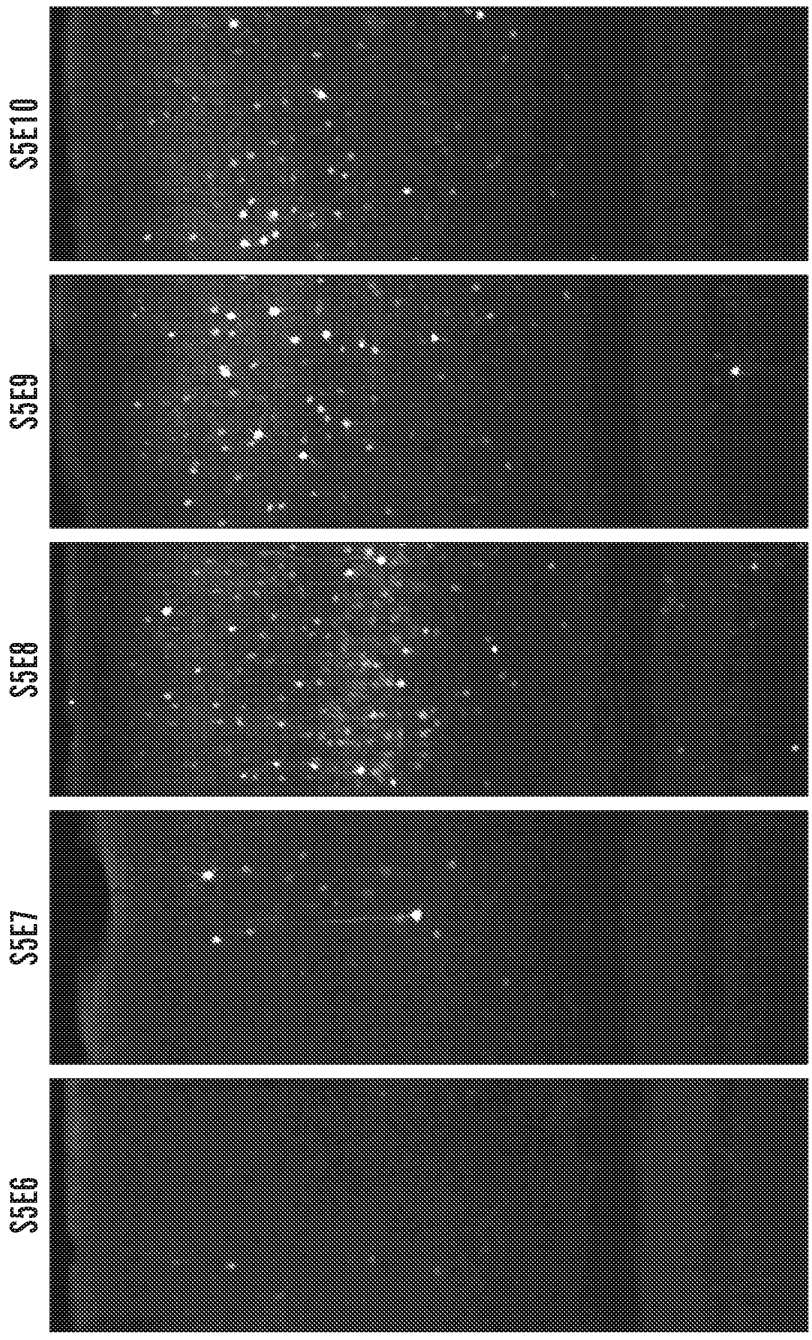


FIG. 1B-2

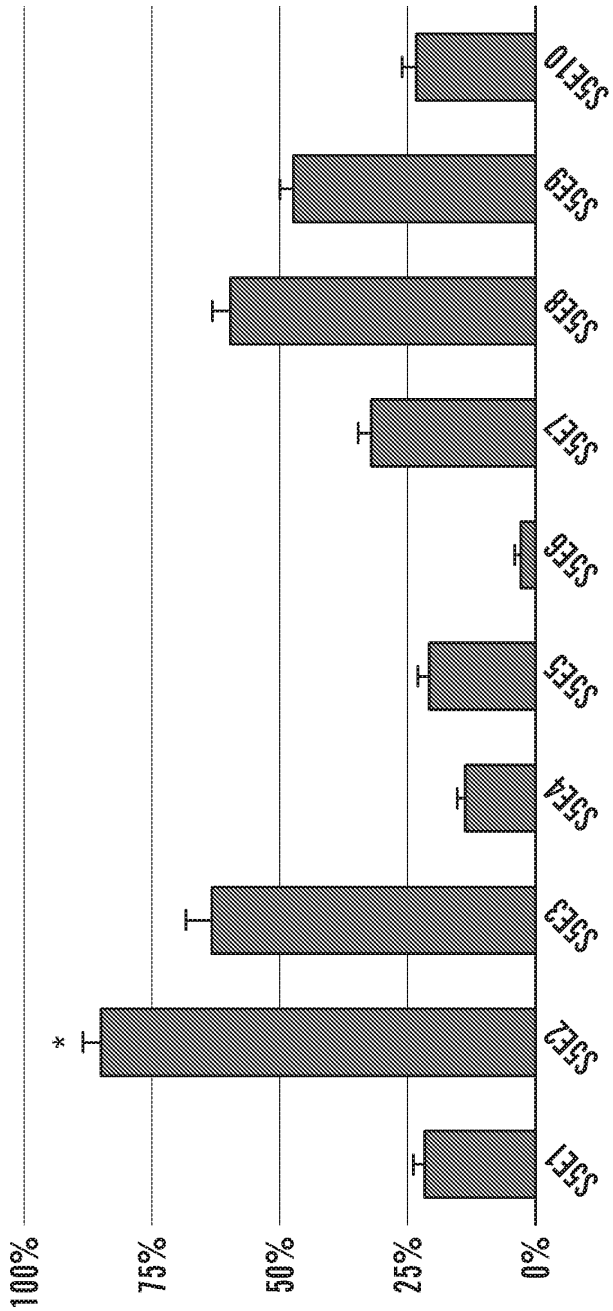

Specificity for PV
100%
75%
50%
25%
0%
*
S5E1
S5E2
S5E3
S5E4
S5E5
S5E6
S5E7
S5E8
S5E9
S5E10

FIG. 1C

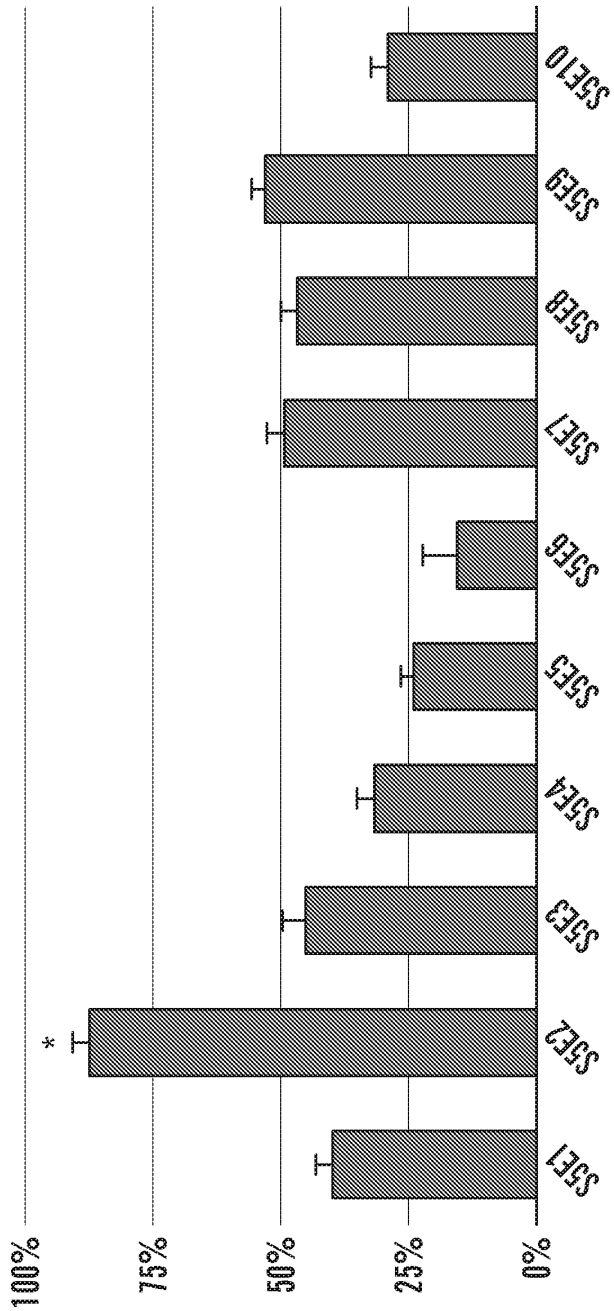

Sensitivity for PV
100%
75%
50%
25%
0%
*
S5E1
S5E2
S5E3
S5E4
S5E5
S5E6
S5E7
S5E8
S5E9
S5E10

FIG. 1D

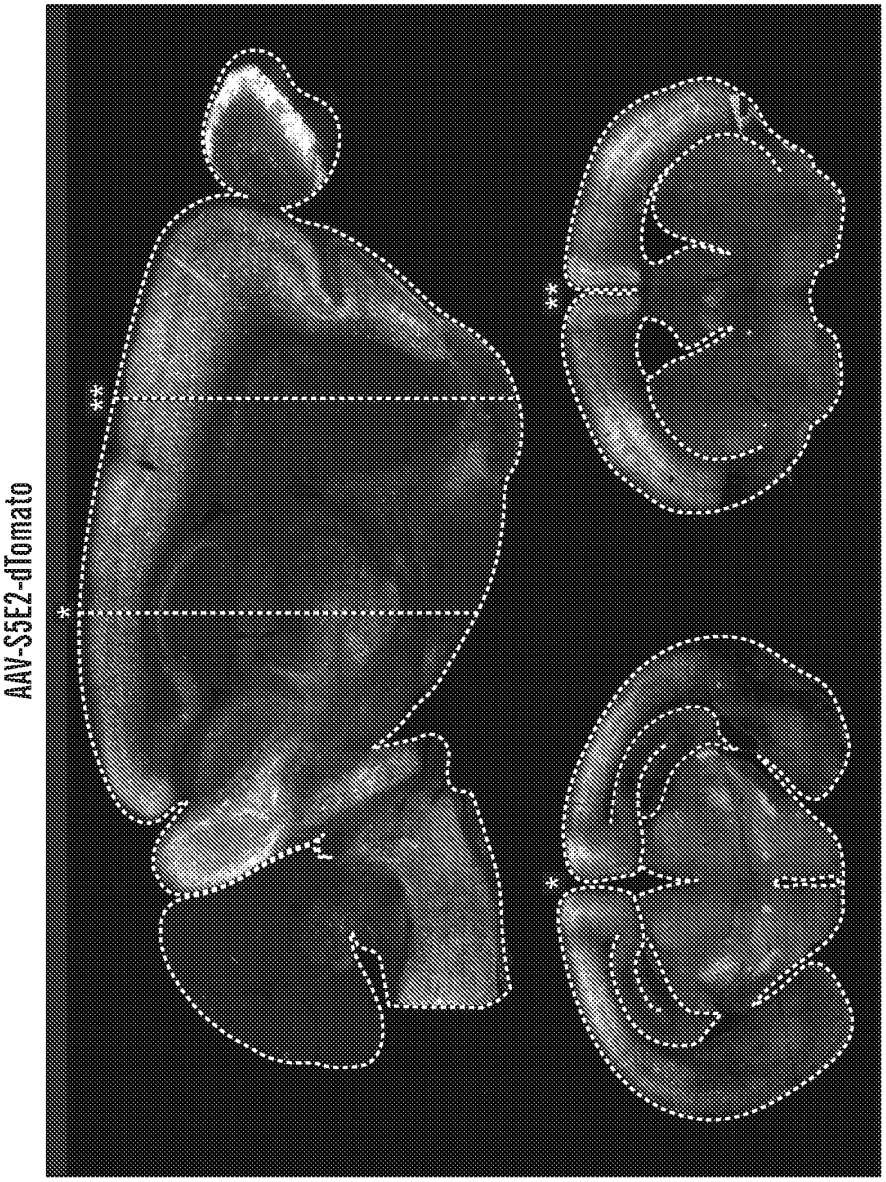


FIG. 2A

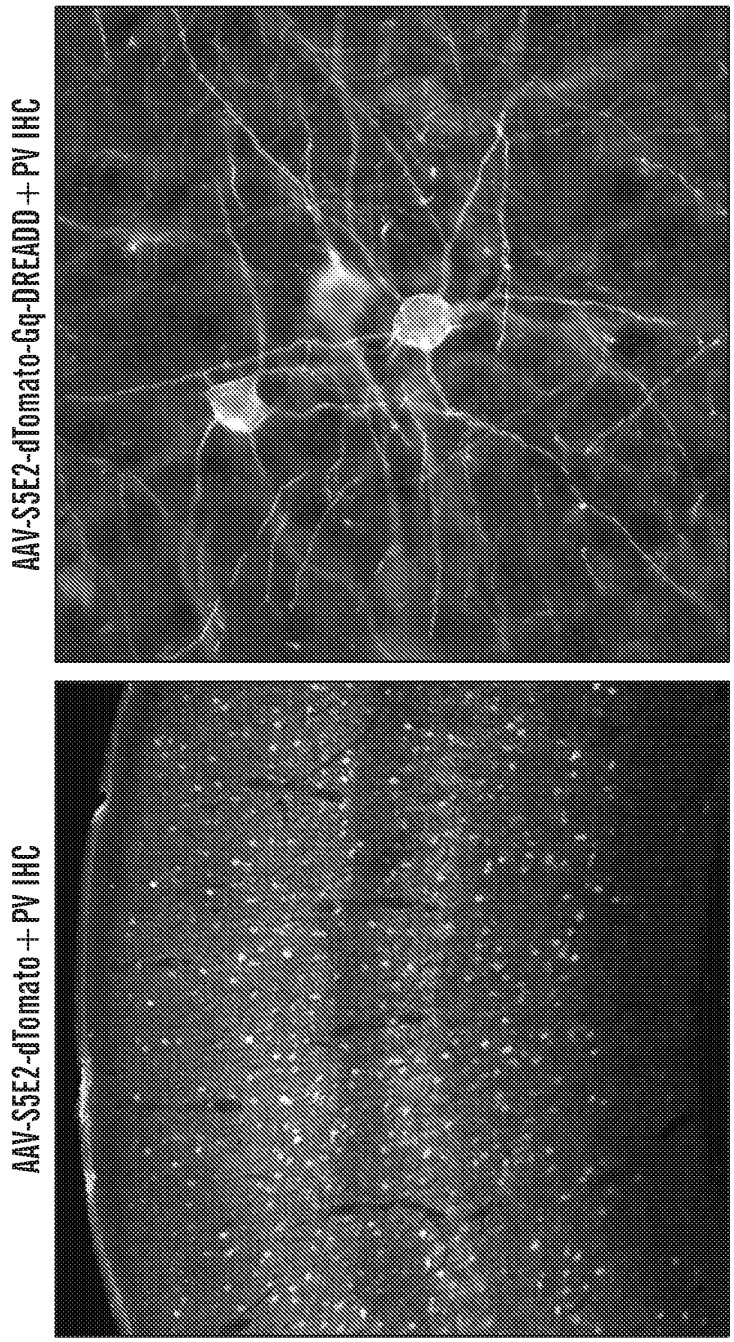


FIG. 2B

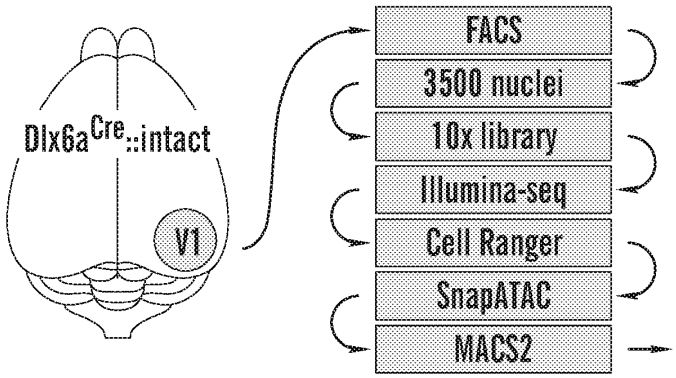


FIG. 3A

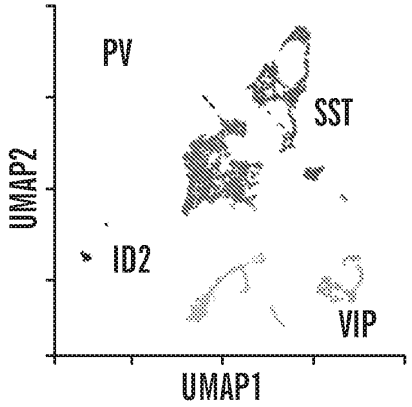


FIG. 3B

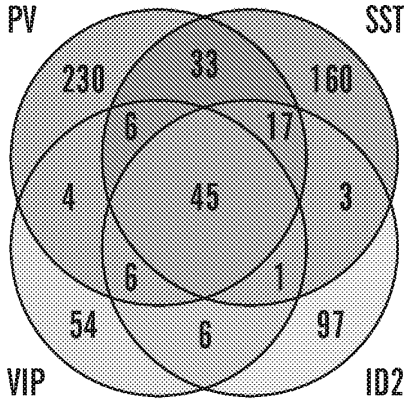


FIG. 3C

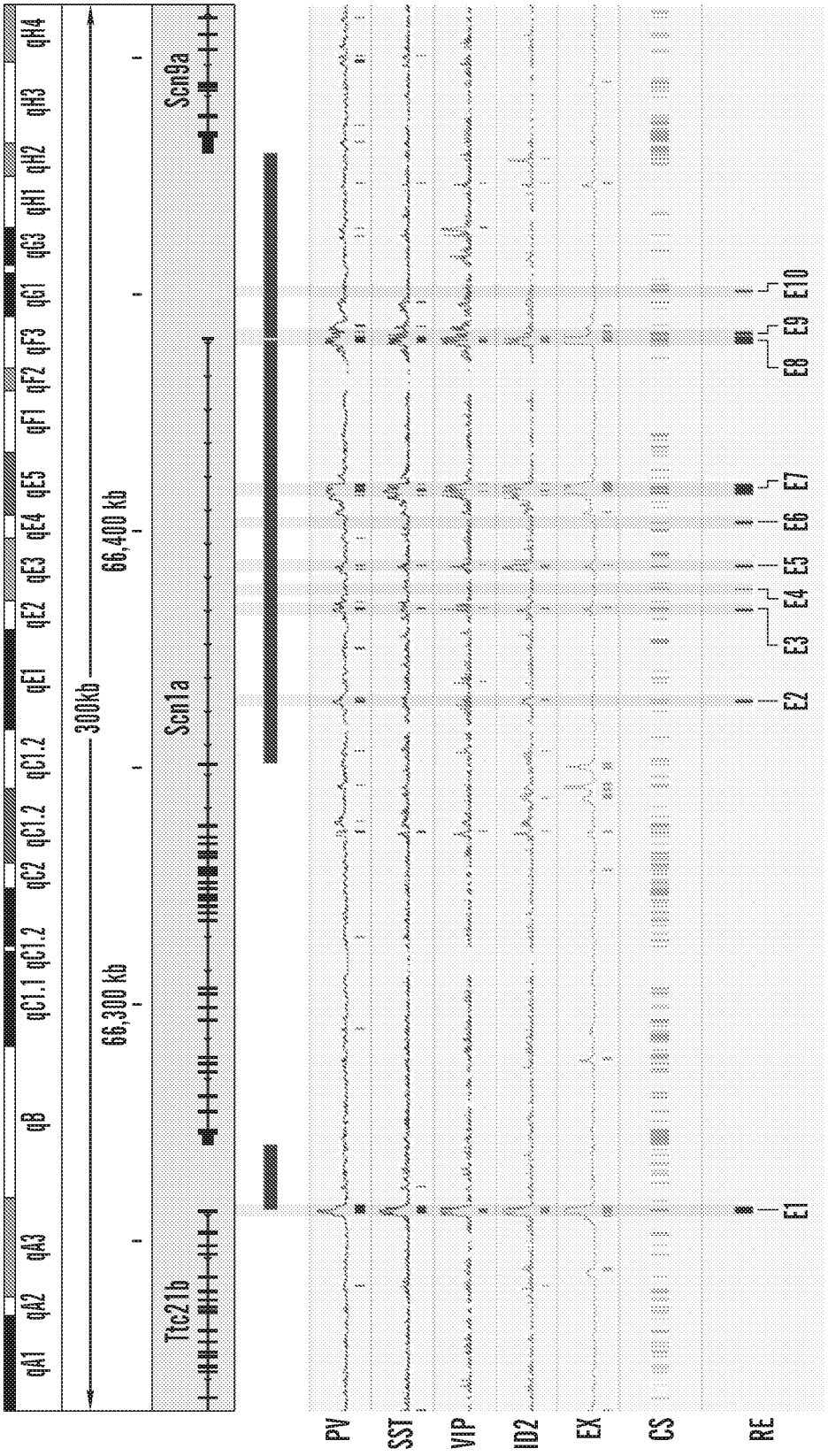

qA1
qA2
qA3
qB
qC1.1
qC1.2
qC2
qD1.2
qE1
qE2
qE3
qE4
qE5
qF1
qF2
qF3
qG1
qG3
qH1
qH2
qH3
qH4
66,300 kb
300kb
66,400 kb
Ttc21b
Scn1a
Scn9a
PV
SST
VIP
ID2
EX
CS
RE
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10

FIG. 3D

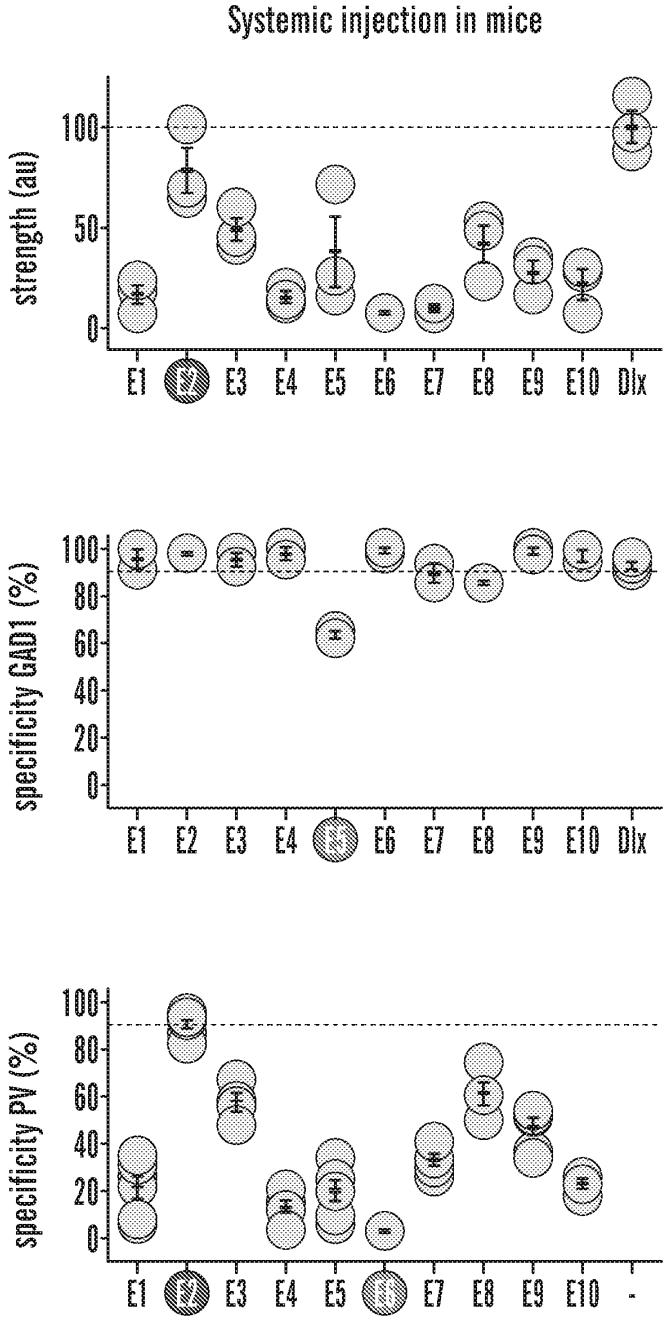

Systemic injection in mice
strength (au)
100
50
0
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
Dlx
specificity GAD1 (%)
100
80
60
40
20
0
E1
E2
E3
E4
E6
E7
E8
E9
E10
Dlx
specificity PV (%)
100
80
60
40
20
0
E1
E2
E3
E4
E5
E7
E8
E9
E10
-

FIG. 3E

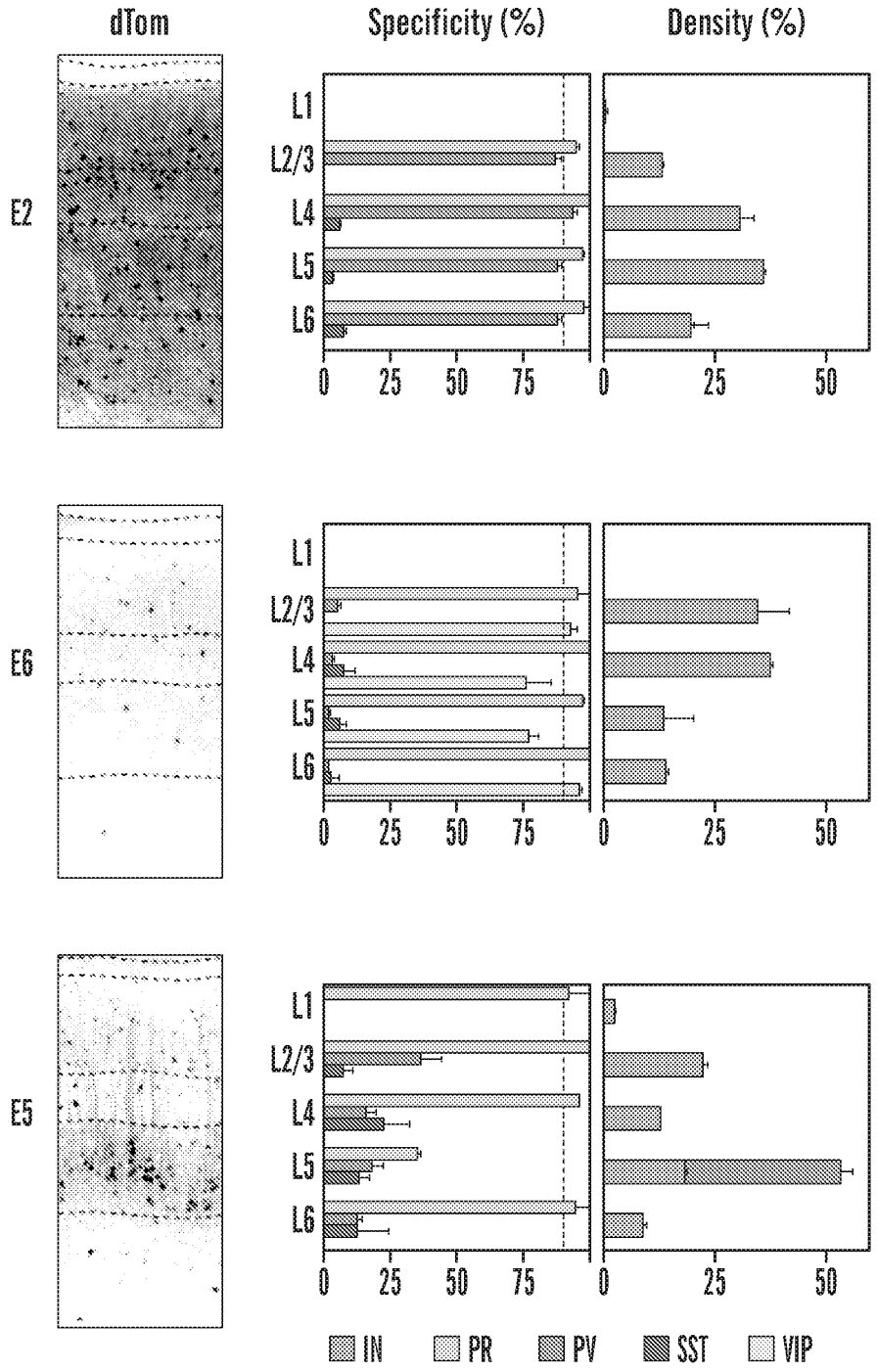

dTom
Specificity (%)
Density (%)
E2
E6
E5
L1
L2/3
L4
L5
L6
0
25
50
75
0
25
50
IN
PR
PV
SST
VIP

FIG. 3F

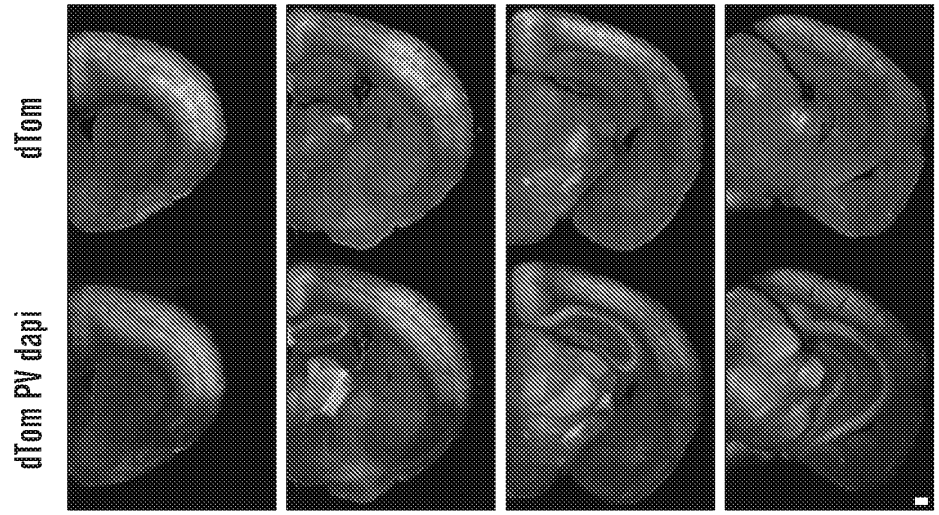


FIG. 4A

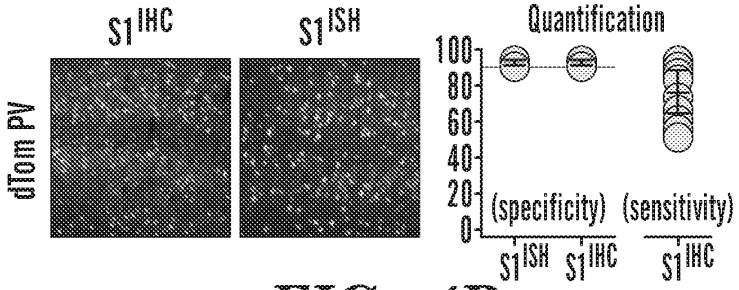


FIG. 4B

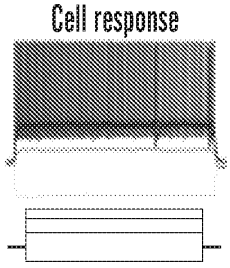


FIG. 4C

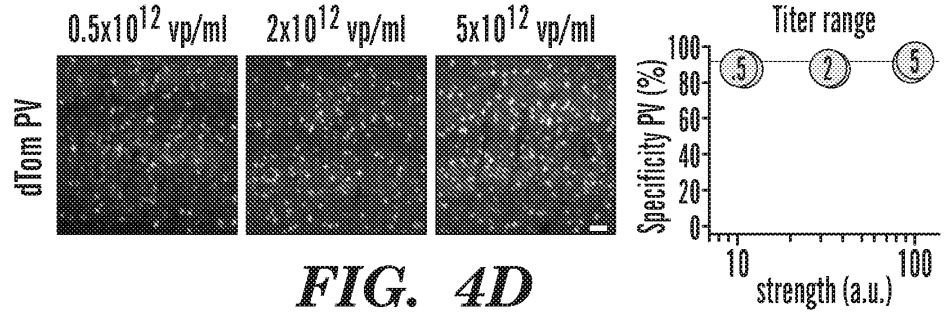


FIG. 4D

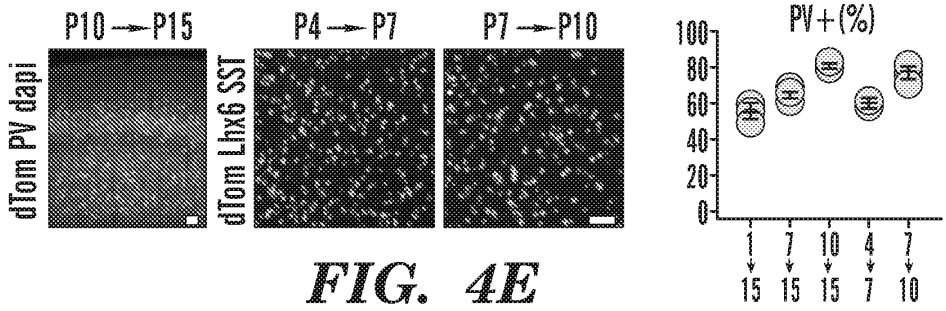


FIG. 4E

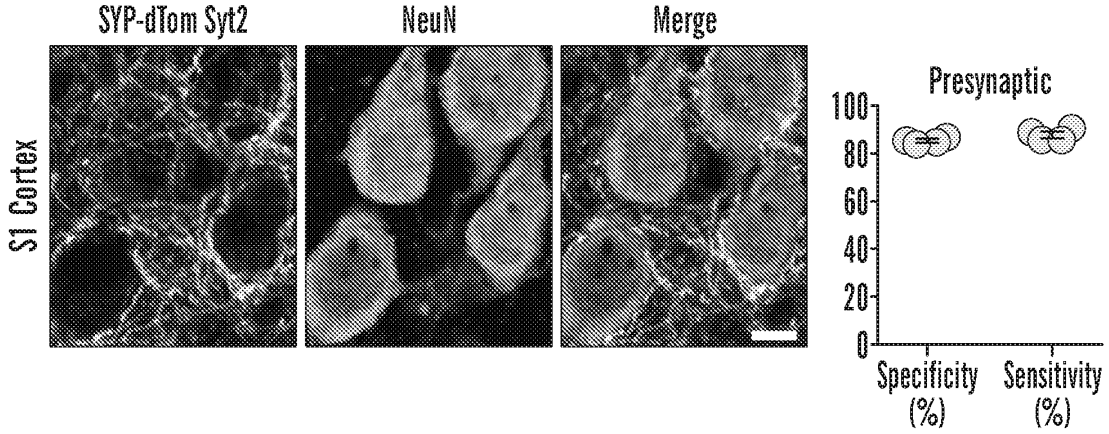


FIG. 5A

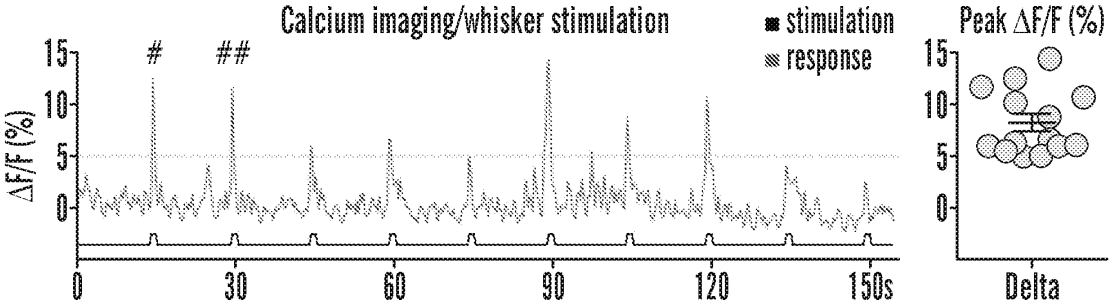


FIG. 5B

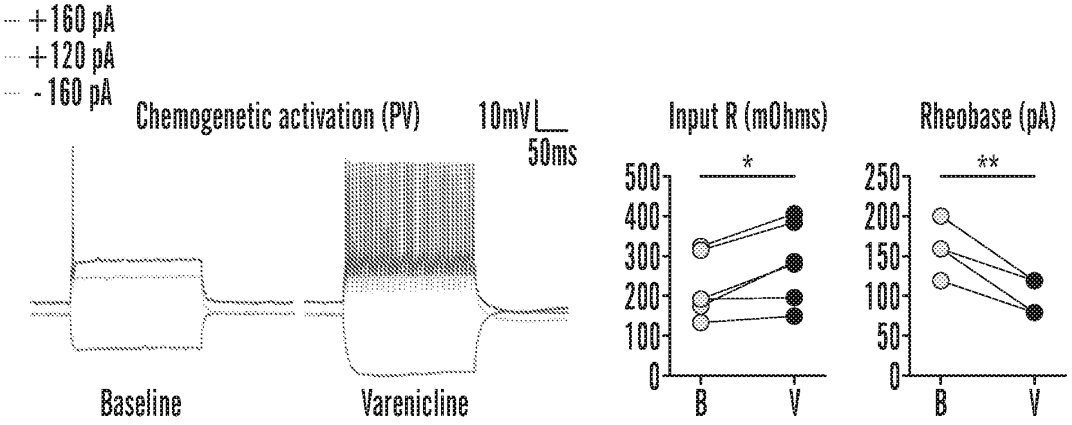


FIG. 5C

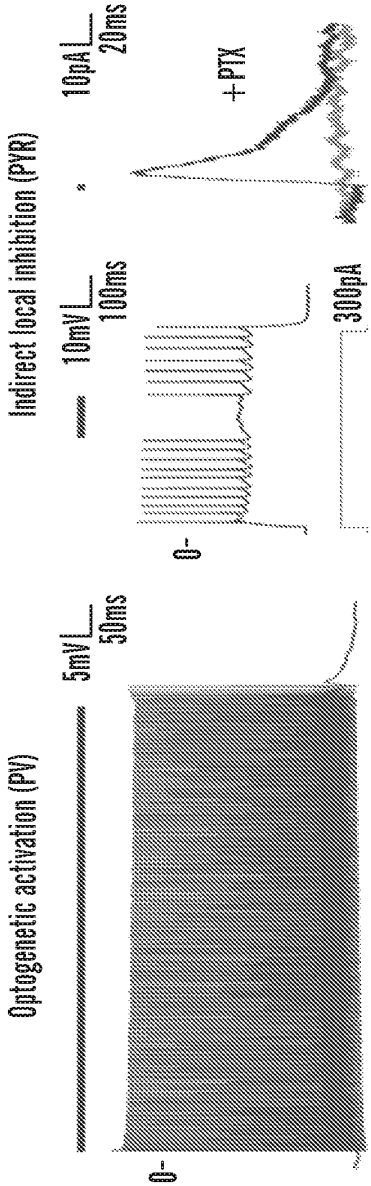

Optogenetic activation (PV)
5mV
50ms
0-
Indirect local inhibition (PYR)
10mV
100ms
0-
300pA
10pA
20ms
+PTX

FIG. 5D

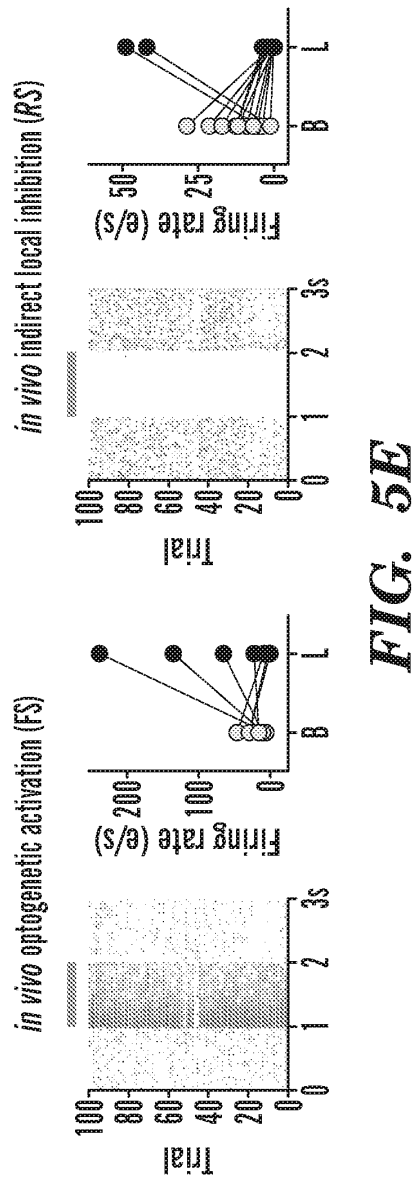

In vivo optogenetic activation (FS)
Firing rate (e/s)
200
100
0
B
L
Trial
100
80
60
40
20
0
0
1
2
3s
In vivo indirect local inhibition (RS)
Firing rate (e/s)
50
25
0
B
L
Trial
100
80
60
40
20
0
0
1
2
3s

FIG. 5E

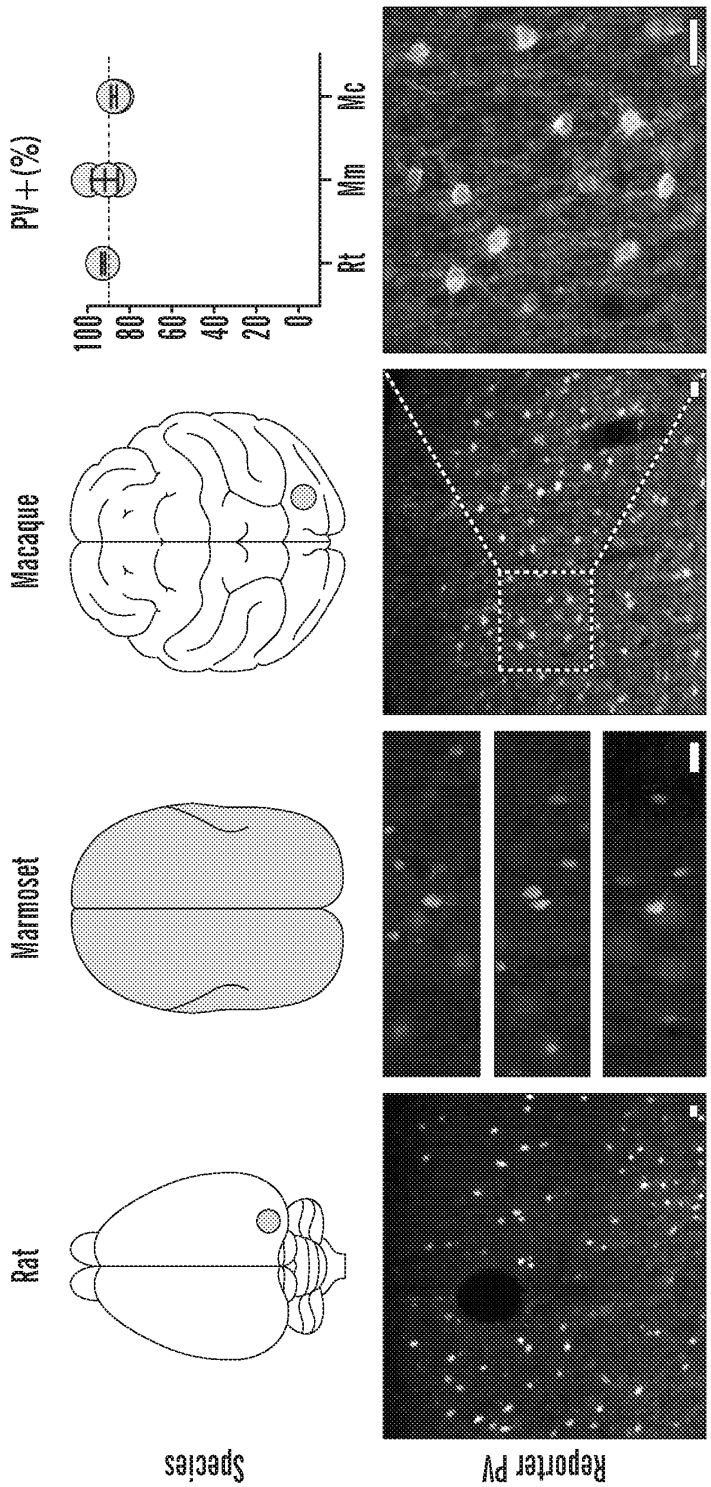

Species
Reporter PV
Rat
Marmoset
Macaque
PV+(%)
100
80
60
40
20
0
Rt
Mm
Mc

FIG. 6A

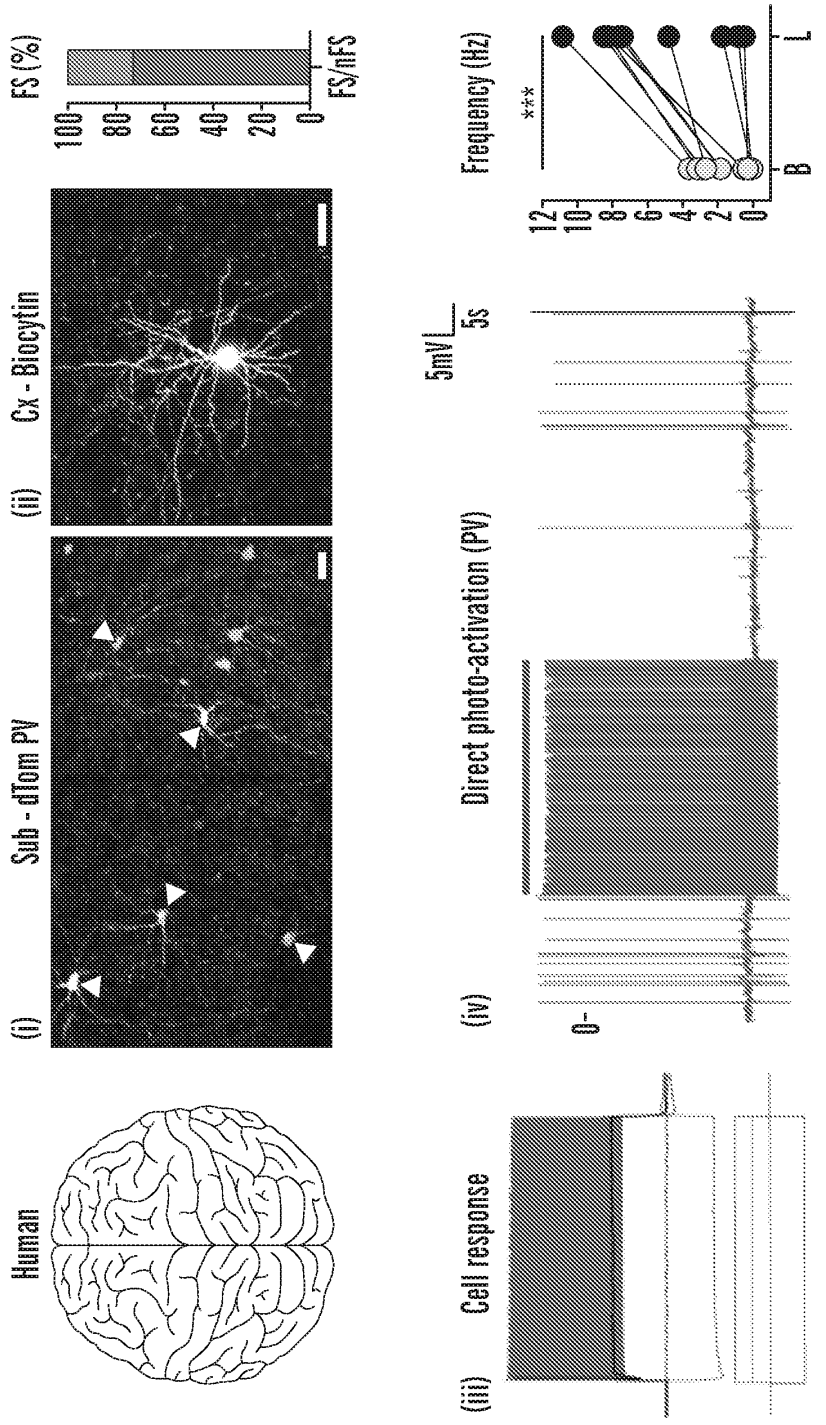

Human
(i) Sub - dTom PV
(ii) Cx - Biocytin
FS (%)
100
80
60
40
20
0
FS/nFS
(iii) Cell response
(iv) Direct photo-activation (PV)
5mV
5s
0
Frequency (Hz)
***
12
10
8
6
4
2
0
B
L

FIG. 6B

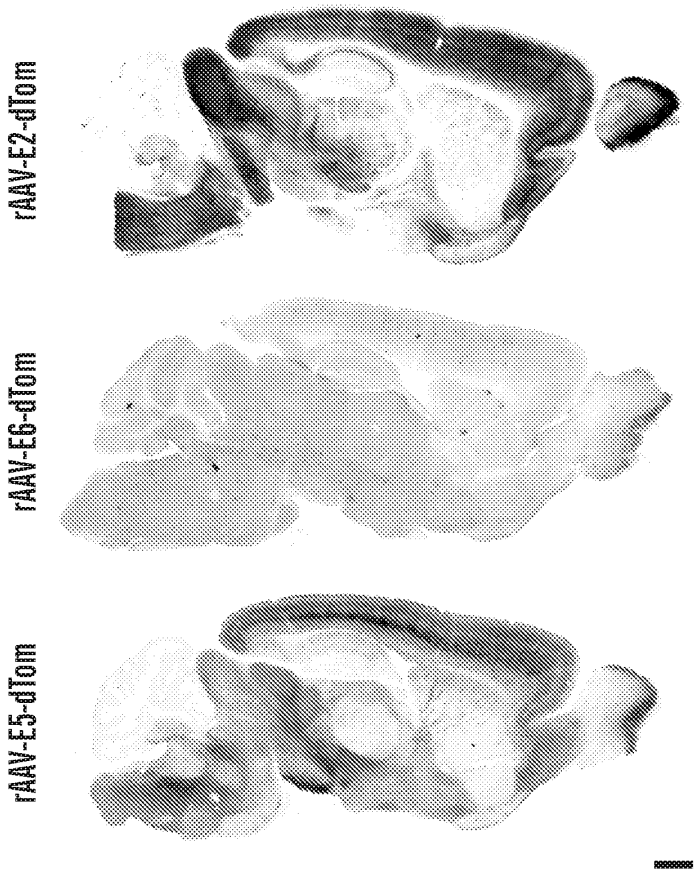


FIG. 7

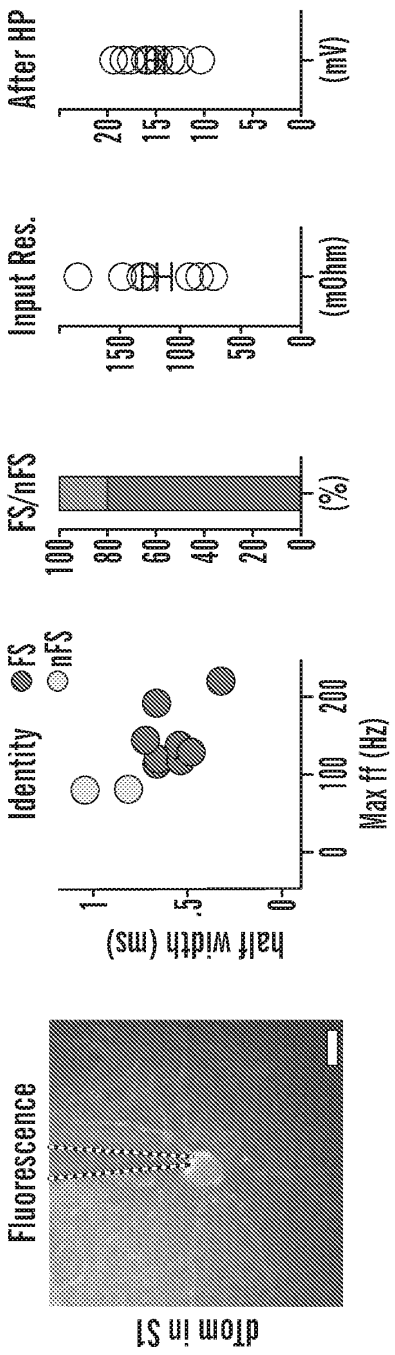

dtom in S1
Fluorescence
half width (ms)
Identity
FS
nFS
Max ff (Hz)
FS/nFS
(%)
Input Res.
(mOhm)
After HP
(mV)

FIG. 8A

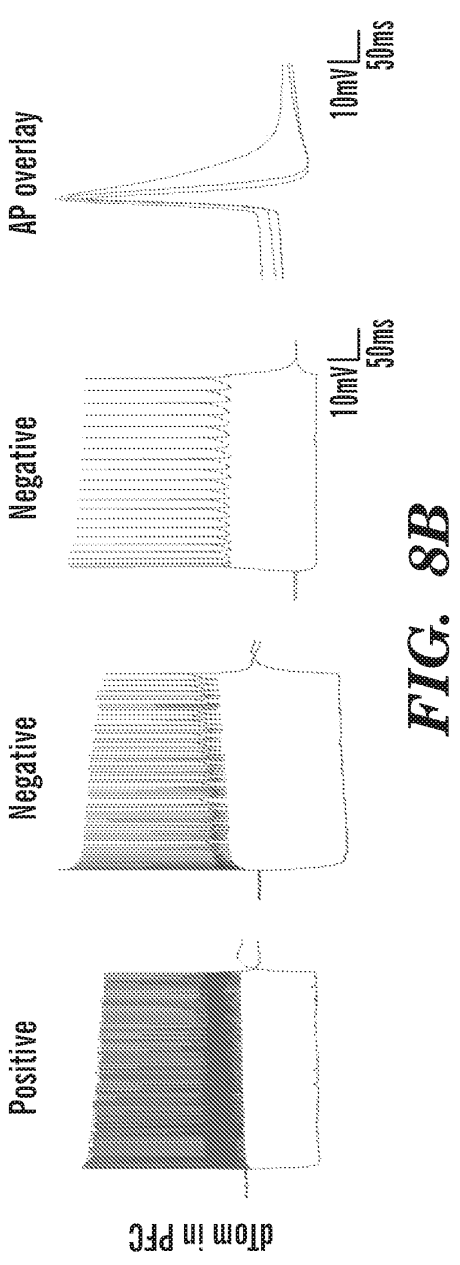

dtom in PFC
Positive
Negative
Negative
AP overlay
10mV
50ms
10mV
50ms

FIG. 8B

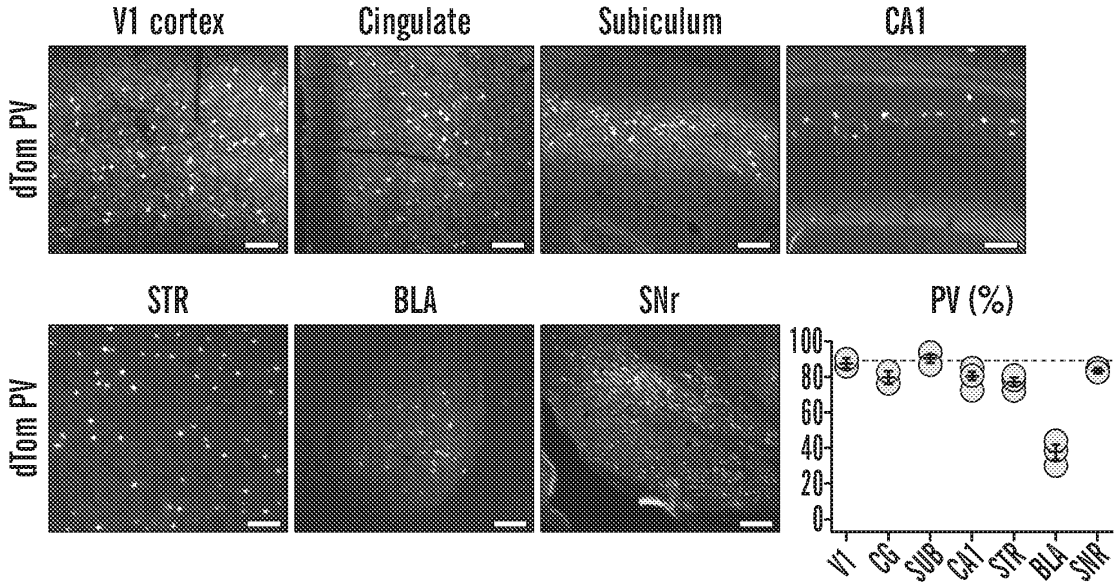

V1 cortex
Cingulate
Subiculum
CA1
dTom PV
STR
BLA
SNr
PV (%)
dTom PV
100
80
60
40
20
0
V1
CG
SUB
CA1
STR
BLA
SNR

FIG. 8C

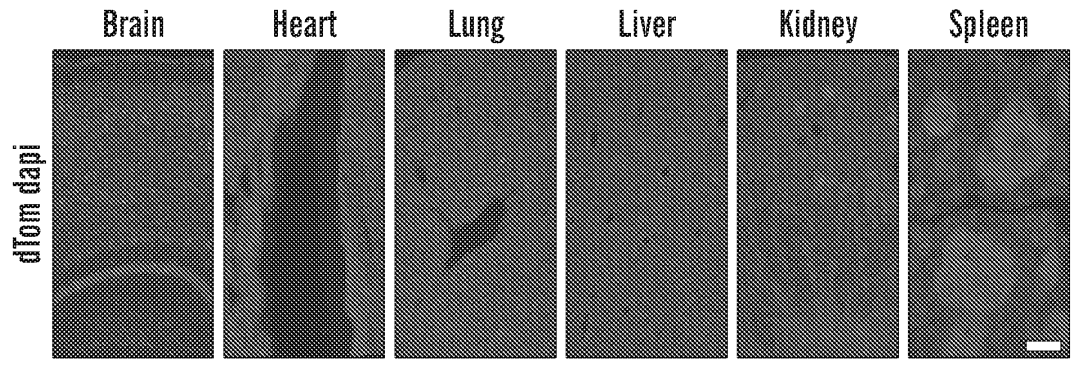

Brain
Heart
Lung
Liver
Kidney
Spleen
dTom dapi

FIG. 8D

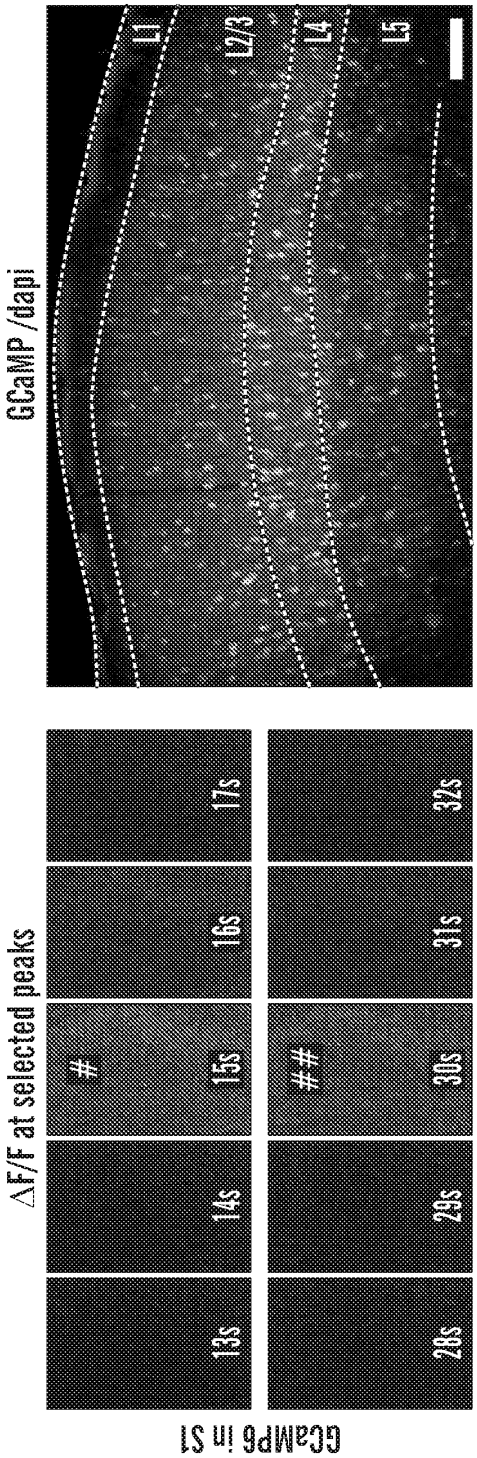

GCaMP6 in S1
ΔF/F at selected peaks
13s
14s
#
15s
16s
17s
28s
29s
##
30s
31s
32s
GCaMP /dapi
L1
L2/3
L4
L5

FIG. 9A

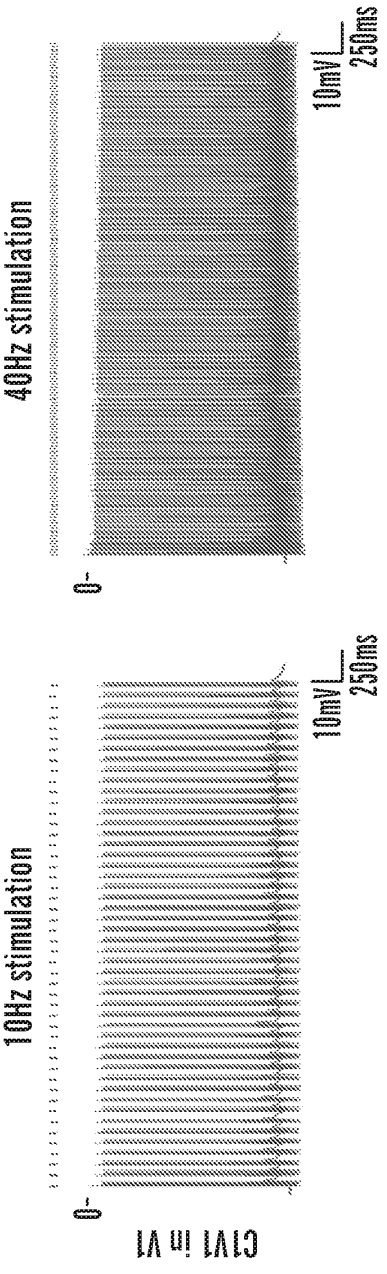

10Hz stimulation
40Hz stimulation
0-
0-
10mV
250ms
10mV
250ms
C1V1 in V1

FIG. 9B

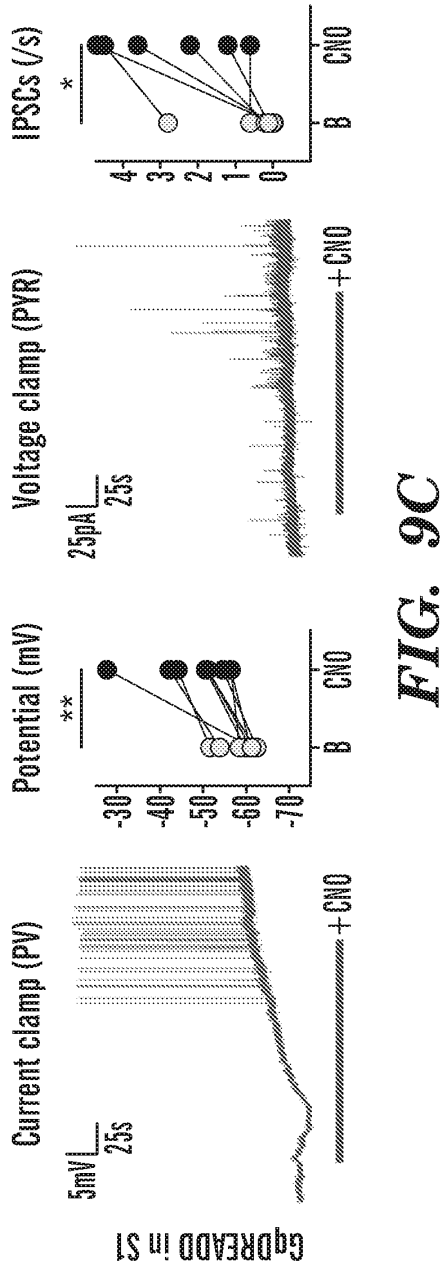

Current clamp (PV)
5mV
25s
+CNO
eqDREADD in SI
Potential (mV)
**
-30
-40
-50
-60
-70
B
CNO
Voltage clamp (PYR)
25pA
25s
+CNO
IPSCs (/s)
*
4
3
2
1
0
B
CNO

FIG. 9C

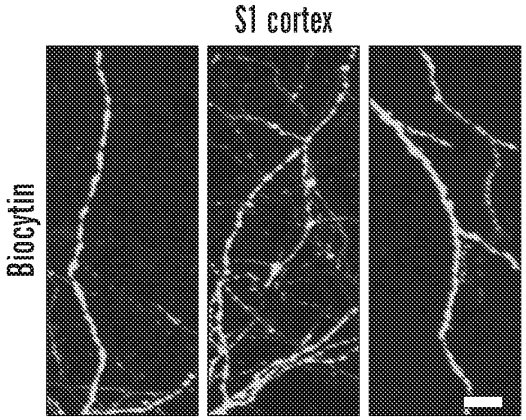


FIG. 10A

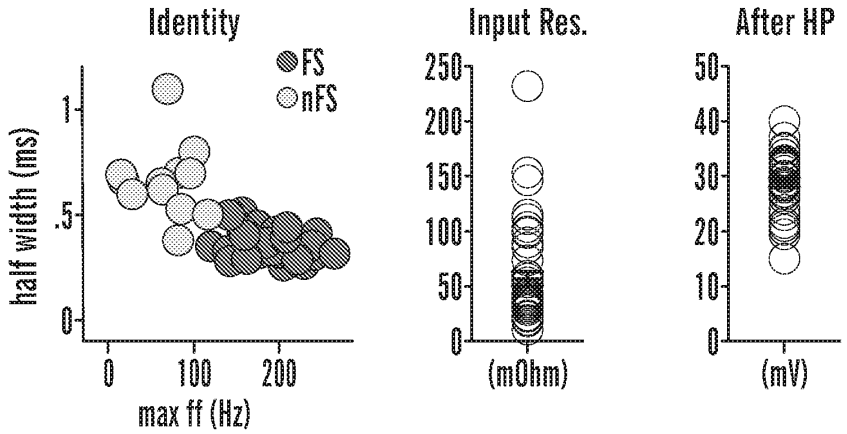


FIG. 10B

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	B	E1	Reporter	1-6	3	17.1	4.7
3	B	E2	Reporter	1-6	3	78.7	11.4
3	B	E3	Reporter	1-6	3	49.1	5.5
3	B	E4	Reporter	1-6	3	16	2.6
3	B	E5	Reporter	1-6	3	38.3	17
3	B	E6	Reporter	1-6	3	8.1	0.2
3	B	E7	Reporter	1-6	3	10.4	1.4
3	B	E8	Reporter	1-6	3	41.9	9.2
3	B	E9	Reporter	1-6	3	28.2	5.6
3	B	E10	Reporter	1-6	3	22.3	7.2
3	B	Dlx	Reporter	1-6	3	100.1	7.9
3	B	E1	Reporter / Gad1	1-6	2	95.1	4.3
3	B	E2	Reporter / Gad1	1-6	2	97.8	0
3	B	E3	Reporter / Gad1	1-6	2	95	2.8
3	B	E4	Reporter / Gad1	1-6	2	97.6	2.4
3	B	E5	Reporter / Gad1	1-6	2	63.7	1.5

FIG. 11

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	B	E6	Reporter / Gad1	1-6	2	98.7	1.3
3	B	E7	Reporter / Gad1	1-6	2	89.5	4
3	B	E8	Reporter / Gad1	1-6	2	85.4	0.5
3	B	E9	Reporter / Gad1	1-6	2	98.6	1.4
3	B	E10	Reporter / Gad1	1-6	2	96.7	2.4
3	B	Dlx	Reporter / Gad1	1-6	4	93.4	1.3
3	B	E1	Reporter / PV	1-6	6	50.3	5.6
3	B	E2	Reporter / PV	1-6	6	74	2.5
3	B	E3	Reporter / PV	1-6	4	45.5	2.1
3	B	E4	Reporter / PV	1-6	6	30.7	3.8
3	B	E5	Reporter / PV	1-6	6	22.8	2.4
3	B	E6	Reporter / PV	1-6	2	16	2
3	B	E7	Reporter / PV	1-6	6	50.8	2.1
3	B	E8	Reporter / PV	1-6	4	47.5	3.4
3	B	E9	Reporter / PV	1-6	6	52.8	6.3
3	B	E10	Reporter / PV	1-6	4	29	2.7

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	C	E2	Reporter / Gad1	1	3	0	0
3	C	E2	Reporter / Gad1	2/3	3	94.7	0.9
3	C	E2	Reporter / Gad1	4	3	100	0
3	C	E2	Reporter / Gad1	5	3	97.1	1
3	C	E2	Reporter / Gad1	6	3	97.2	2.8
3	C	E2	Reporter / PV	1	3	0	0
3	C	E2	Reporter / PV	2/3	3	86.5	2.8
3	C	E2	Reporter / PV	4	3	93.5	1.7
3	C	E2	Reporter / PV	5	3	87.3	2.1
3	C	E2	Reporter / PV	6	3	87.3	2.1
3	C	E2	Reporter / SST	1	3	0	0
3	C	E2	Reporter / SST	2/3	3	0	0
3	C	E2	Reporter / SST	4	3	6.1	0.8
3	C	E2	Reporter / SST	5	3	3.3	1
3	C	E2	Reporter / SST	6	3	7.6	1
3	C	E2	Reporter / VIP	1	3	na	na

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	C	E2	Reporter / VIP	2/3	3	na	na
3	C	E2	Reporter / VIP	4	3	na	na
3	C	E2	Reporter / VIP	5	3	na	na
3	C	E2	Reporter / VIP	6	3	na	na
3	C	E5	Reporter / Gad1	1	3	91.7	8.3
3	C	E5	Reporter / Gad1	2/3	3	98.9	1.1
3	C	E5	Reporter / Gad1	4	3	95.7	0
3	C	E5	Reporter / Gad1	5	3	35	1.7
3	C	E5	Reporter / Gad1	6	3	94.7	5.3
3	C	E5	Reporter / PV	1	3	0	0
3	C	E5	Reporter / PV	2/3	3	36.3	7.7
3	C	E5	Reporter / PV	4	3	15.8	3.8
3	C	E5	Reporter / PV	5	3	17.8	4.5
3	C	E5	Reporter / PV	6	3	12.9	2.1
3	C	E5	Reporter / SST	1	3	0	0
3	C	E5	Reporter / SST	2/3	3	7.1	4.3

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	C	E5	Reporter / SST	4	3	22.4	10.3
3	C	E5	Reporter / SST	5	3	13.1	4.3
3	C	E5	Reporter / SST	6	3	12.3	12.3
3	C	E5	Reporter / VIP	1	3	na	na
3	C	E5	Reporter / VIP	2/3	3	na	na
3	C	E5	Reporter / VIP	4	3	na	na
3	C	E5	Reporter / VIP	5	3	na	na
3	C	E5	Reporter / VIP	6	3	na	na
3	C	E6	Reporter / Gad1	1	3	0	0
3	C	E6	Reporter / Gad1	2/3	3	95.5	4.5
3	C	E6	Reporter / Gad1	4	3	100	0
3	C	E6	Reporter / Gad1	5	3	98.3	1.7
3	C	E6	Reporter / Gad1	6	3	100	0
3	C	E6	Reporter / PV	1	3	0	0
3	C	E6	Reporter / PV	2/3	3	5.4	1.4
3	C	E6	Reporter / PV	4	3	3.4	0.6

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	C	E6	Reporter / PV	5	3	2.3	0.6
3	C	E6	Reporter / PV	6	3	1.8	0.3
3	C	E6	Reporter / SST	1	3	0	0
3	C	E6	Reporter / SST	2/3	3	0	0
3	C	E6	Reporter / SST	4	3	7.5	4.6
3	C	E6	Reporter / SST	5	3	5.9	2.6
3	C	E6	Reporter / SST	6	3	2.9	2.9
3	C	E6	Reporter / VIP	1	3	0	0
3	C	E6	Reporter / VIP	2/3	3	92.5	2.6
3	C	E6	Reporter / VIP	4	3	76.3	8.8
3	C	E6	Reporter / VIP	5	3	76.7	3.8
3	C	E6	Reporter / VIP	6	3	96.2	3.8
3	C	E2	Density Gad1+	1	3	0.3	0.5
3	C	E2	Density Gad1+	2/3	3	12.5	1
3	C	E2	Density Gad1+	4	3	30.9	3.1
3	C	E2	Density Gad1+	5	3	35	1.4

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	C	E2	Density Gad1+	6	3	18.8	4.8
3	C	E2	Density Gad1-	1	3	0	0
3	C	E2	Density Gad1-	2/3	3	0.7	0.1
3	C	E2	Density Gad1-	4	3	0	0
3	C	E2	Density Gad1-	5	3	1.1	0.6
3	C	E2	Density Gad1-	6	3	0.7	0.9
3	C	E2	Density Gad1+	1	3	2.2	0.9
3	C	E5	Density Gad1+	2/3	3	22.2	1.5
3	C	E5	Density Gad1+	4	3	12.2	0.5
3	C	E5	Density Gad1+	5	3	18.6	0.3
3	C	E5	Density Gad1+	6	3	8.4	1.9
3	C	E5	Density Gad1-	1	3	0.3	0.4
3	C	E5	Density Gad1-	2/3	3	0.3	0.4
3	C	E5	Density Gad1-	4	3	0.6	0
3	C	E5	Density Gad1-	5	3	34.7	3
3	C	E5	Density Gad1-	6	3	0.6	0.8

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
3	C	E6	Density Gad1+	1	3	0	0
3	C	E6	Density Gad1+	2/3	3	34.7	7.2
3	C	E6	Density Gad1+	4	3	36.8	1.3
3	C	E6	Density Gad1+	5	3	13.7	6.6
3	C	E6	Density Gad1+	6	3	13.6	1
3	C	E6	Density Gad1-	1	3	0	0
3	C	E6	Density Gad1-	2/3	3	0	0
3	C	E6	Density Gad1-	4	3	0.6	0.9
3	C	E6	Density Gad1-	5	3	0	0
3	C	E6	Density Gad1-	6	3	0.6	0.9
4	B	E2	Reporter / PV	1-6	4	91.6	0.9
4	B	E2	Reporter / PV	1-6	8	90.8	1.1
4	B	E2	PV / reporter	1-6	19	75.7	2.9
4	D	E2	Reporter at .5	1-6	3	10	1.1
4	D	E2	Reporter at 2	1-6	3	33	10.6
4	D	E2	Reporter at 5	1-6	3	96.5	8.4

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
4	D	E2	Reporter / PV at .5	1-6	3	86.4	0.5
4	D	E2	Reporter / PV at 2	1-6	3	86.6	0.6
4	D	E2	Reporter / PV at 5	1-6	3	91.3	0.8
4	E	E2	Reporter / PV 1-15	1-6	4	56.7	2.3
4	E	E2	Reporter / PV 7-15	1-6	5	67.2	1.5
4	E	E2	Reporter / PV 10-15	1-6	3	81.7	1.1
4	E	E2	Reporter / PV 4-7	1-6	2	60.9	1.9
4	E	E2	Reporter / PV 7-10	1-6	5	78.1	1.8
5	A	E2	Reporter / PV	1-6	4	85.3	0.6
5	A	E2	PV / reporter	1-6	4	87.7	1.2
5	B	E2	Delta	1-6	14	8.2	0.8
5	A	E2	Rat	1-6	1	93	na

FIG. 11 (cont.)

FIG.	Panel	Enhancer	Marker	Layer	No.	Mean	s.e.m
5	A	E2	Marmoset	1-6	4	91.8	3.1
5	A	E2	Macaque	1-6	4	87.3	0.5
8	A	E2	IR	na	10	119.1	11.8
8	A	E2	AHP	na	10	15	0.9
8	B	E2	Reporter / PV V1	1-6	2	88.1	2.3
8	B	E2	Reporter / PV CG	na	2	80.2	3.7
8	B	E2	Reporter / PV SUB	na	3	91.1	2.1
8	B	E2	Reporter / PV CA1	na	6	80.5	1.9
8	B	E2	Reporter / PV STR	na	3	54.8	5.8
8	B	E2	Reporter / PV BLA	na	3	38.1	4.1
8	B	E2	Reporter / PV SNR	na	2	84.2	1.1
10	A	E2	IR	na	44	56.2	6.7
10	A	E2	AHP	na	45	28.8	0.8

FIG. 11 (cont.)

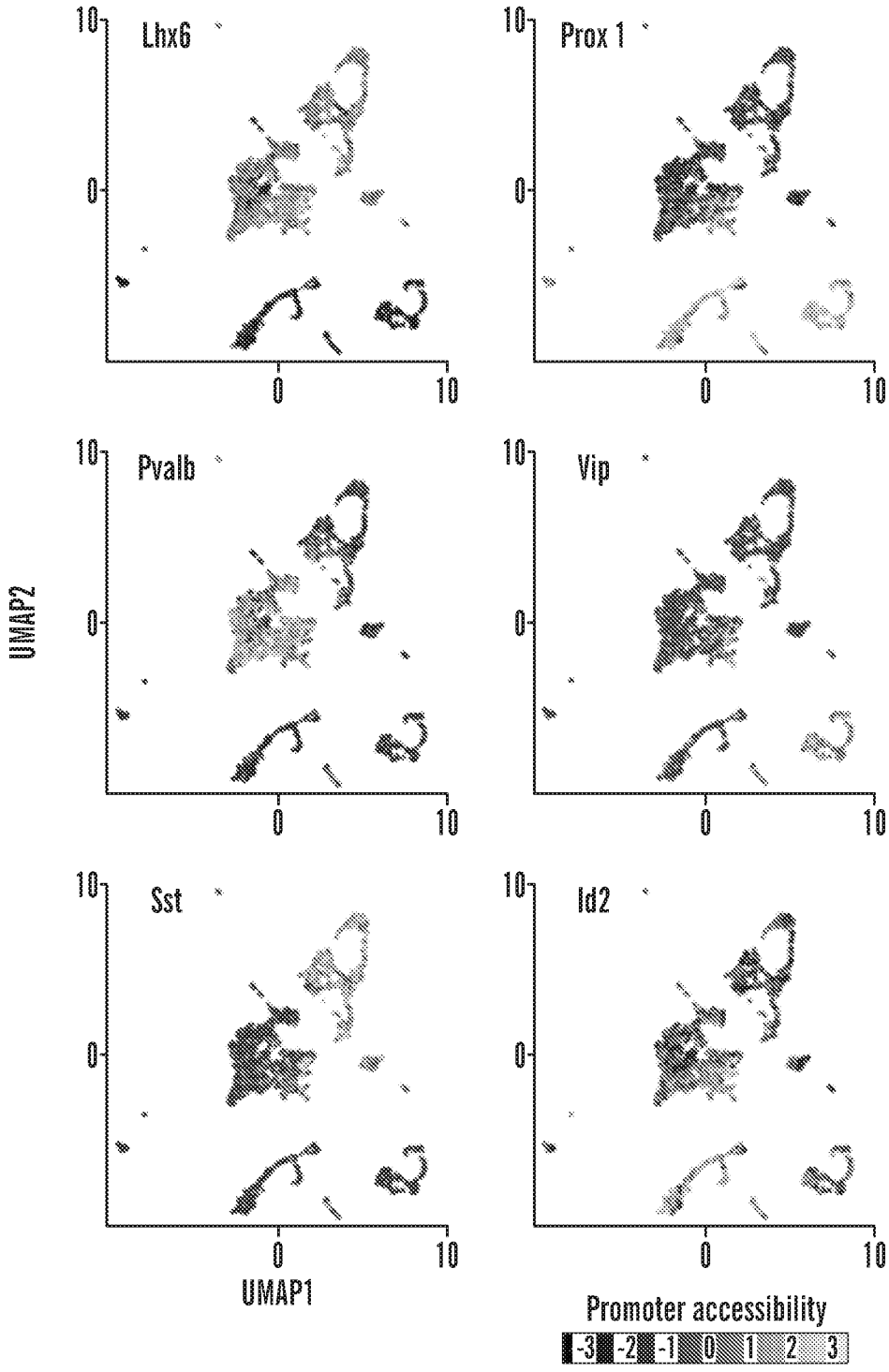

Lhx6
Prox 1
Pvalb
Vip
Sst
Id2
10
0
UMAP2
UMAP1
Promoter accessibility
-3 -2 -1 0 1 2 3

FIG. 12

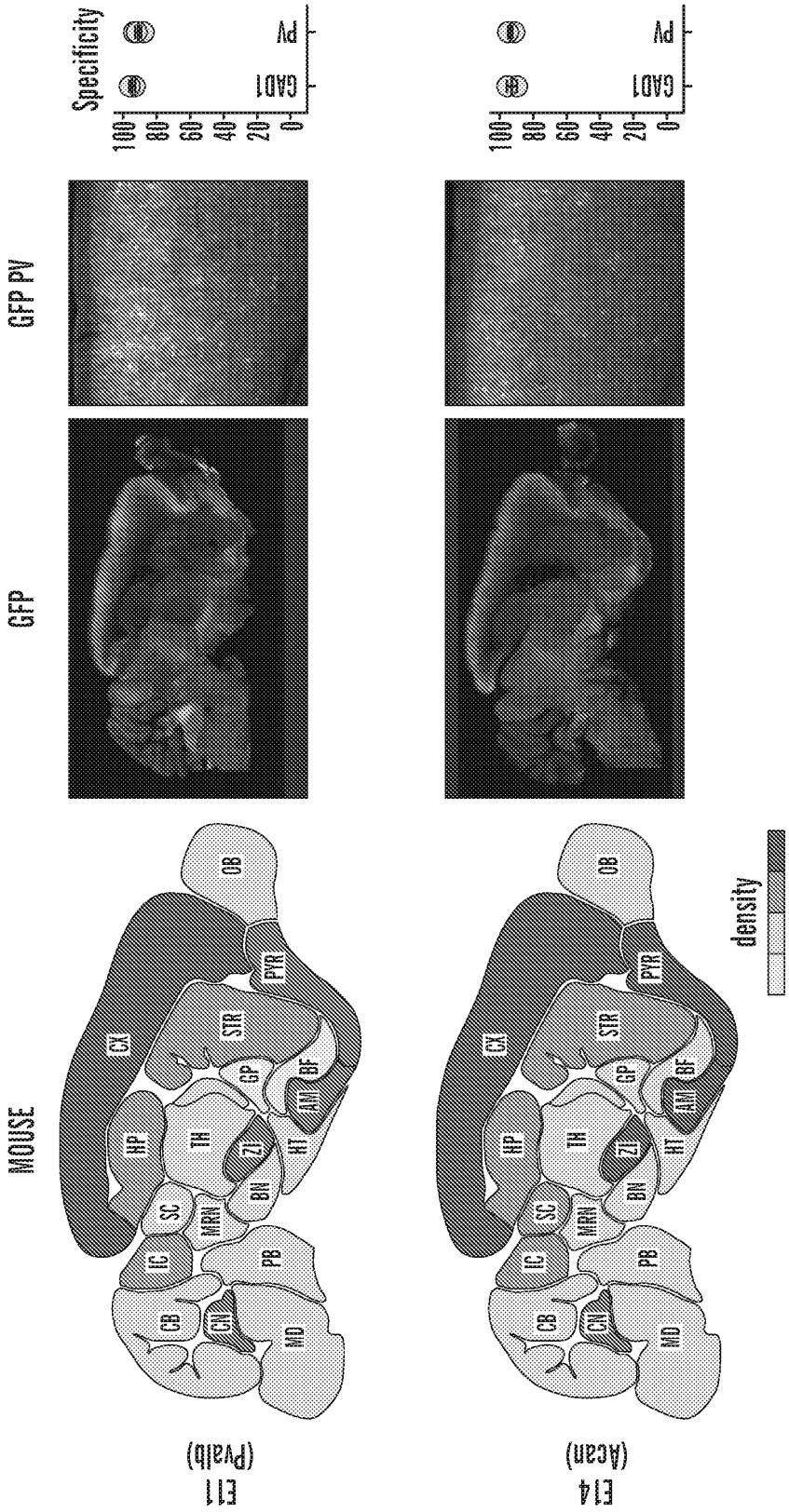

MOUSE
GFP
GFP PV
Specificity
CAD1
PV
100
80
60
40
20
0
density
OB
CX
PYR
STR
GP
BF
AM
HP
TH
ZI
HT
BN
SC
MRN
IC
PB
CB
CN
MD
E11
(Pvalb)
E14
(Acan)

FIG. 13A

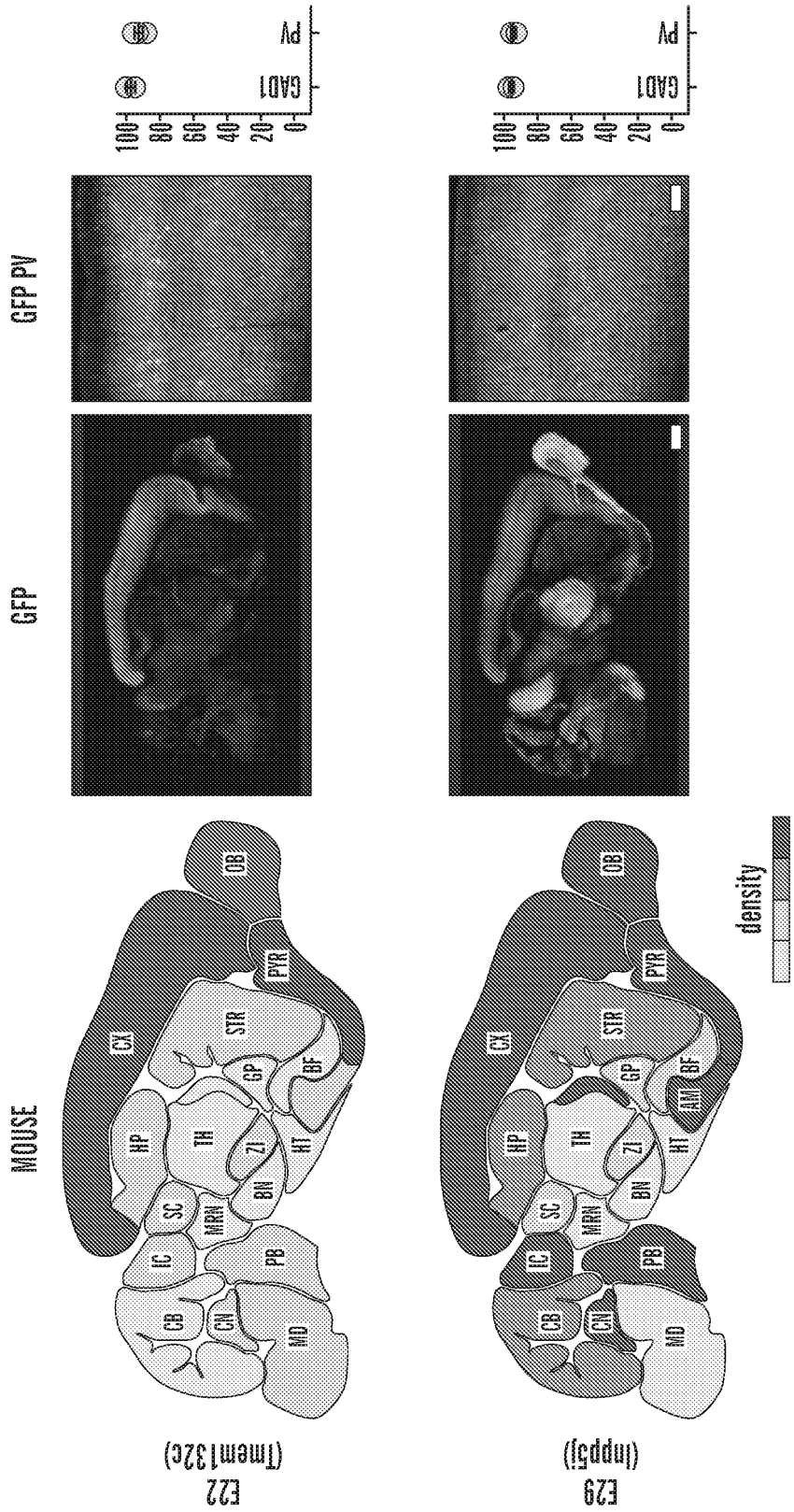

MOUSE
GFP
GFP PV
CAD1
PV
100
80
60
40
20
0
density
OB
PYR
CX
STR
GP
BF
AM
HP
TH
ZI
HT
BN
SC
MRN
IC
PB
CB
CN
MD
E29
(Impp5j)
E22
(Tmem132c)

FIG. 13A (cont.)

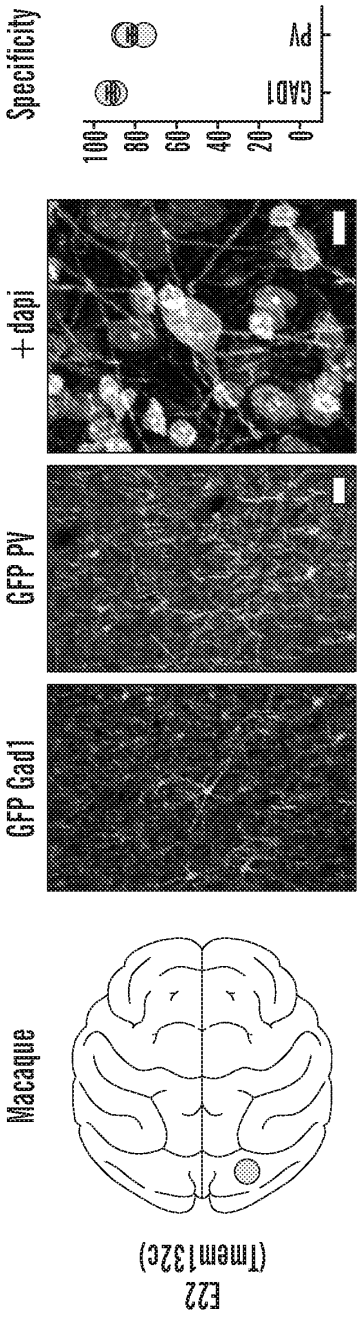

Specificity
PV
GAD1
100
80
60
40
20
0
+dapi
GFP PV
GFP Gad1
Macaque
E22
(Tmem132c)

FIG. 13B

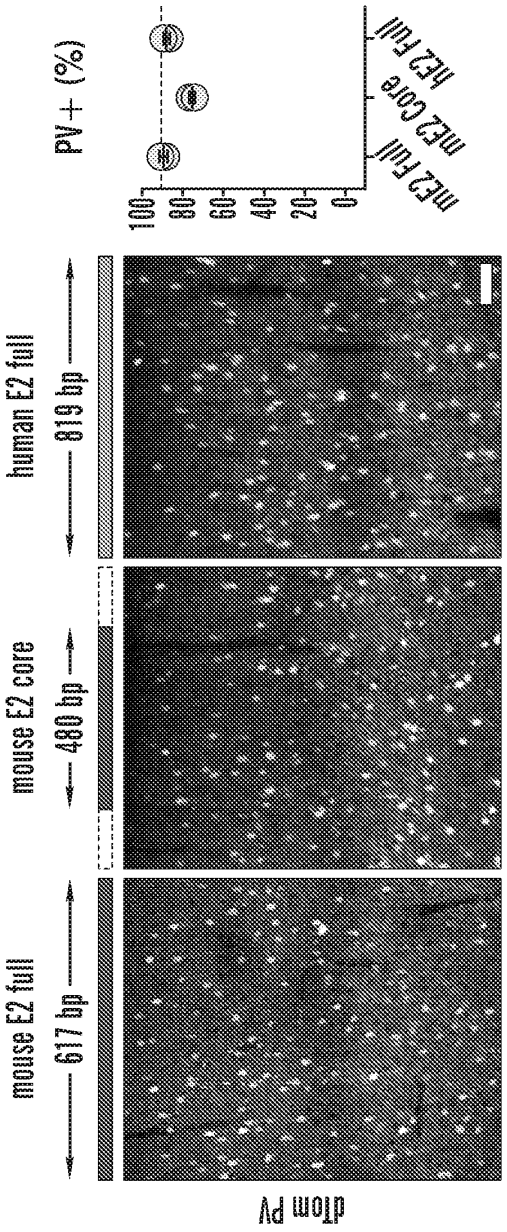

dTom PV
mouse E2 full
617 bp
mouse E2 core
480 bp
human E2 full
819 bp
PV+ (%)
100
80
60
40
20
0
mE2 full
mE2 core
hE2 full

FIG. 14

RE	Gene	Target	Specificity	Position	Chr	Start	Stop	Size (bp)	scATAC PV	scATAC SST	scATAC VIP	scATAC IID2	bATAC Ex	Ms/Hm
E1	Scn1a	PV	22%	intergenic	chr2	66256056	66257335	1279	1	1	1	1	1	69%
E2	Scn1a	PV	90%	intronic	chr2	66364036	66364653	617	1	0	0	1	0	71%
E3	Scn1a	PV	57%	intronic	chr2	66383190	66384021	831	1	1	1	1	1	67%
E4	Scn1a	PV	14%	intronic	chr2	66387764	66388024	260	0	0	0	0	0	78%
E5	Scn1a	PYR	20%	intronic	chr2	66392447	66393109	662	1	1	1	1	1	72%
E6	Scn1a	VIP	88%	intronic	chr2	66401767	66402372	605	0	0	0	0	0	72%
E7	Scn1a	PV	33%	intronic	chr2	66407834	66410263	2429	1	1	1	1	1	74%
E8	Scn1a	PV	61%	intronic	chr2	66439814	66441457	1643	1	1	1	1	1	75%
E9	Scn1a	PV	47%	intergenic	chr2	66441748	66442268	520	1	0	0	0	1	72%
E10	Scn1a	PV	23%	intergenic	chr2	66450594	66451140	546	1	1	1	1	1	75%
E11	Pvalb	PV	90%	intronic	chr15	78204152	78204655	503	1	1	1	1	0	78%
E12	Pvalb	PV	59%	intronic	chr15	78204583	78204784	201	1	1	0	0	0	74%
E13	Pvalb	PV	67%	intronic	chr15	78205234	78205766	532	0	1	0	0	0	73%
E14	Acan	PV	94%	intergenic	chr7	79052127	79052622	495	1	0	0	0	0	72%
E15	Acan	PV	79%	intergenic	chr7	79053118	79053435	317	1	1	1	1	1	84%
E16	Acan	PV	58%	intronic	chr7	79056553	79057054	501	0	0	0	0	0	82%
E17	Acan	PV	54%	intronic	chr7	79079999	79080472	473	1	0	0	0	0	86%

FIG. 15A-1

RE	Gene	Target	Specificity	Position	Chr	Start	Stop	Size (bp)	scATAC PV	scATAC SST	scATAC VIP	scATAC IID2	bATAC Ex	Ms/Hm
E18	Tmem132c	PV	57%	intronic	chr5	127243448	127244121	673	1	1	0	0	0	70%
E19	Tmem132c	PV	57%	intronic	chr5	127257256	127257594	338	0	1	0	0	0	78%
E20	Tmem132c	PV	66%	intronic	chr5	127290515	127291016	501	1	0	0	0	0	77%
E21	Tmem132c	PV	71%	intronic	chr5	127300767	127301107	340	0	0	0	0	0	74%
E22	Tmem132c	PV	94%	intronic	chr5	127305150	127305592	442	1	0	0	0	0	75%
E23	Tmem132c	PV	64%	intronic	chr5	127323924	127324468	544	1	1	1	1	0	85%
E24	Tmem132c	PV	82%	intronic	chr5	127331966	127332522	556	1	1	1	1	0	74%
E25	Tmem132c	PV	73%	intronic	chr5	127355818	127356133	315	1	0	0	0	0	77%
E26	Lrrc38	PV	72%	intergenic	chr4	143348892	143349749	857	1	1	1	0	0	70%
E27	Lrrc38	PV	66%	intronic	chr4	143361408	143362362	954	1	0	1	0	0	71%
E28	Inpp5j	PV	83%	intergenic	chr11	3504821	3505244	423	1	1	1	1	1	77%
E29	Inpp5j	PV	94%	intergenic	chr11	3509025	3509652	627	1	1	0	0	0	74%
E30	Mef2c	PV	77%	intergenic	chr13	83503268	83504033	765	0	0	0	0	0	-
E31	Mef2c	PV	63%	intronic	chr13	83507235	83507457	222	0	0	0	0	0	68%
E32	Mef2c	PV	70%	intronic	chr13	83515122	83515409	287	0	0	0	0	0	70%
E33	Mef2c	PV	82%	intronic	chr13	83518268	83519179	911	1	1	1	1	1	-
E34	Pthlh	PV	48%	intronic	chr6	147263395	147263584	189	1	1	1	1	1	68%
E35	Pthlh	PV	86%	intergenic	chr6	147266874	147267390	516	0	0	0	0	0	69%

FIG. 15A-2

RE	Gene	Target	Specificity	Position	Mouse_mm10_Chr	Mouse_mm10_Start	Mouse_mm10_Stop	Size (bp)	Human_hg38_Chr	Human_hg38_Start	Human_hg38_Stop	Human_hg38_size_(bp)	Percentage of conservation Mouse vs Human
E1	Scn1a	PV	22%	intergenic	chr2	66256056	66257335	1279	chr2	165953030	165954796	1766	69%
E2	Scn1a	PV	90%	intronic	chr2	66364036	66364653	617	chr2	166084035	166084884	849	71%
E3	Scn1a	PV	57%	intronic	chr2	66383190	66384021	831	chr2	166090876	166091720	844	67%
E4	Scn1a	PV	14%	intronic	chr2	66387764	66388024	260	chr2	166094366	166094633	267	78%
E5	Scn1a	PYR	20%	intronic	chr2	66392447	66393109	662	chr2	166103693	166104587	894	72%
E6	Scn1a	VIP	88%	intronic	chr2	66401767	66402372	605	chr2	166118214	166118879	665	72%
E7	Scn1a	PV	33%	intronic	chr2	66407834	66410263	2429	chr2	165892760	165897884	5124	74%
E8	Scn1a	PV	61%	intronic	chr2	66439814	66441457	1643	chr2	166148156	166149792	1636	75%
E9	Scn1a	PV	47%	intergenic	chr2	66441748	66442268	520	chr2	166150066	166150702	636	72%
E10	Scn1a	PV	23%	intergenic	chr2	66450594	66451140	546	chr2	166160023	166160609	586	75%
E11	Pvalb	PV	90%	intronic	chr15	78204152	78204655	503	chr22	36816984	36817612	628	78%
E12	Pvalb	PV	59%	intronic	chr15	78204583	78204784	201	chr22	36817484	36817720	236	74%
E13	Pvalb	PV	67%	intronic	chr15	78205234	78205766	532	chr22	36818134	36818727	593	73%
E14	Acan	PV	94%	intergenic	chr7	79052127	79052622	495	chr15	88802240	88802877	637	72%
E15	Acan	PV	79%	intergenic	chr7	79053118	79053435	317	chr15	88803290	88803678	388	84%
E16	Acan	PV	58%	intronic	chr7	79056553	79057054	501	chr15	88807290	88807962	672	82%
E17	Acan	PV	54%	intronic	chr7	79079999	79080472	473	chr15	88833390	88833984	594	86%
E18	Tmem132c	PV	57%	intronic	chr5	127243448	127244121	673	chr12	128377753	128378783	1030	70%

FIG. 16A-1

RE	Gene	Target	Specificity	Position	Mouse_mm10_Chr	Mouse_mm10_Start	Mouse_mm10_Stop	Size (bp)	Human_hg38_Chr	Human_hg38_Start	Human_hg38_Stop	Human_hg38_size_(bp)	Percentage of conservation Mouse vs Human
E19	Tmem132c	PV	57%	intronic	chr5	127257256	127257594	338	chr12	128289803	128290279	476	78%
E20	Tmem132c	PV	66%	intronic	chr5	127290515	127291016	501	chr12	128323153	128323718	565	77%
E21	Tmem132c	PV	71%	intronic	chr5	127300767	127301107	340	chr12	128332503	128332974	471	74%
E22	Tmem132c	PV	94%	intronic	chr5	127305150	127305592	442	chr12	128336003	128336491	488	75%
E23	Tmem132c	PV	64%	intronic	chr5	127323924	127324468	544	chr12	128365603	128366181	578	85%
E24	Tmem132c	PV	82%	intronic	chr5	127331966	127332522	556	chr12	128375853	128376606	753	74%
E25	Tmem132c	PV	73%	intronic	chr5	127355818	127356133	315	chr12	128408553	128408930	377	77%
E26	Lrrc38	PV	72%	intergenic	chr4	143348892	143349749	857	chr1	13388723	13390212	1489	70%
E27	Lrrc38	PV	66%	intronic	chr4	143361408	143362362	954	chr1	13469123	13470861	1738	71%
E28	Inpp5j	PV	83%	intergenic	chr11	3504821	3505244	423	chr22	31124894	31125629	735	77%
E29	Inpp5j	PV	94%	intergenic	chr11	3509025	3509652	627	chr22	31132544	31133831	1287	74%
E30	Mef2c	PV	77%	intergenic	chr13	83503268	83504033	765	chr5	88655733	88657379	1646	-
E31	Mef2c	PV	63%	intronic	chr13	83507235	83507457	222	chr5	88872683	88872997	314	68%
E32	Mef2c	PV	70%	intronic	chr13	83515122	83515409	287	chr5	88745133	88745535	402	70%
E33	Mef2c	PV	82%	intronic	chr13	83518268	83519179	911	chr5	88799783	88801354	1571	-
E34	Pthlh	PV	48%	intronic	chr6	147263395	147263584	189	chr12	27969472	27969690	218	68%
E35	Pthlh	PV	86%	intergenic	chr6	147266874	147267390	516	chr12	27973822	27974489	667	69%

FIG. 16A-2