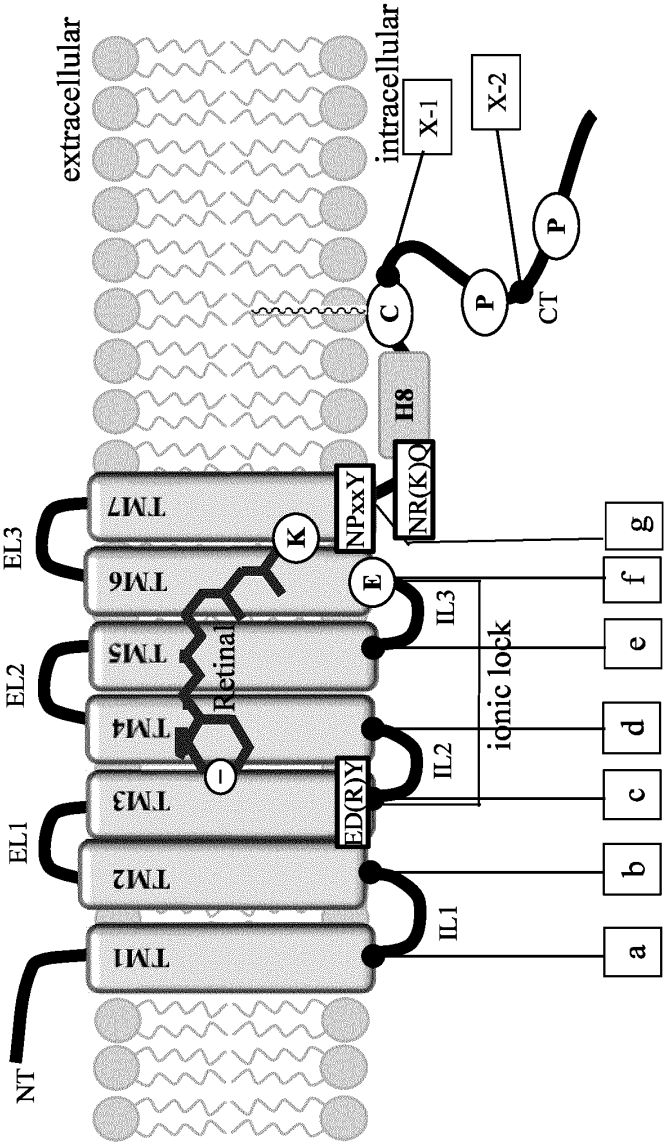

extracellular
intracellular
NT
TM1
TM2
TM3
TM4
TM5
TM6
TM7
EL1
EL2
EL3
IL1
IL2
IL3
H8
C
CT
X-1
X-2
P
P
K
E
Retinal
NPxxY
ED(R)Y
NR(K)Q
ionic lock
a
b
c
d
e
f
g

Figure 1

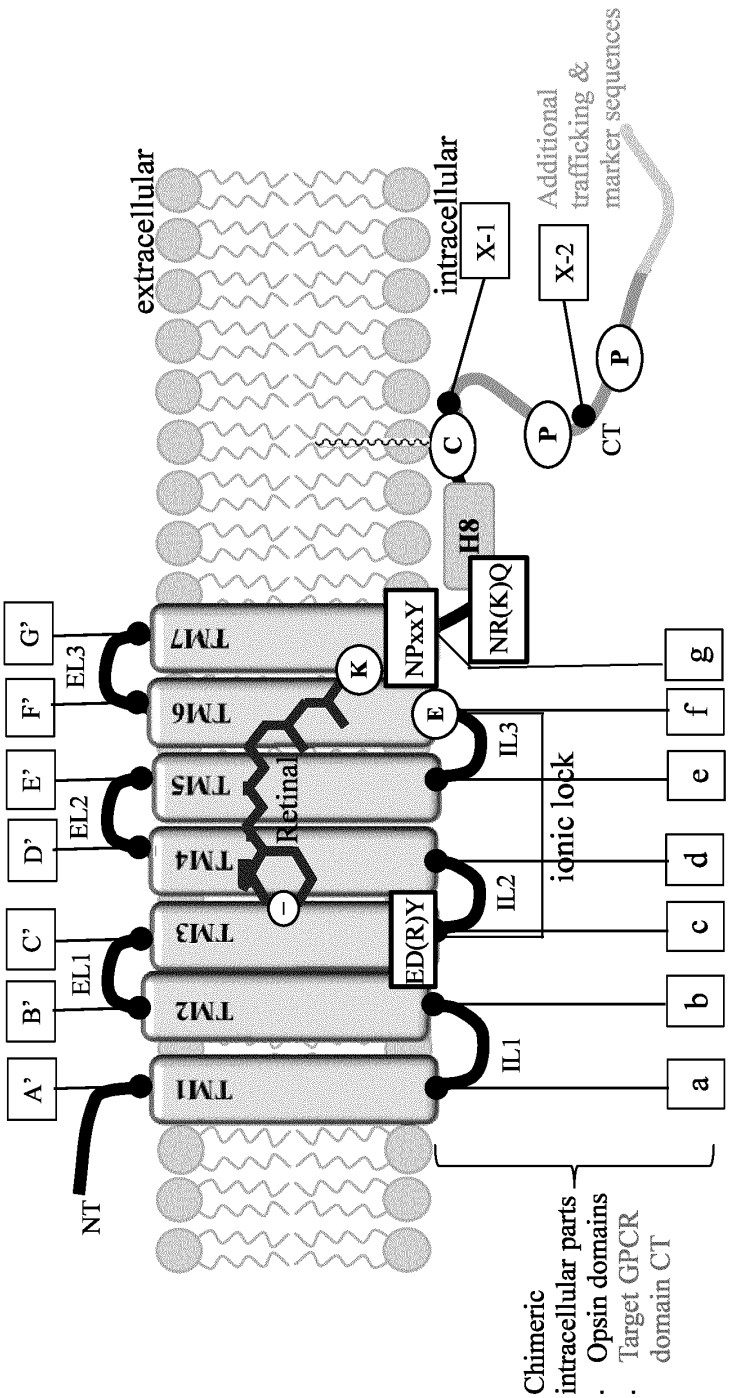

extracellular
intracellular
Additional trafficking & marker sequences
X-1
X-2
P
P
CT
C
H8
NR(K)Q
NPxxY
K
E
ED(R)Y
Retinal
TM1
TM2
TM3
TM4
TM5
TM6
TM7
NT
A'
B'
C'
D'
E'
F'
G'
EL1
EL2
EL3
IL1
IL2
IL3
ionic lock
a
b
c
d
e
f
g
Chimeric intracellular parts
. Opsin domains
. Target GPCR domain CT

Figure 2

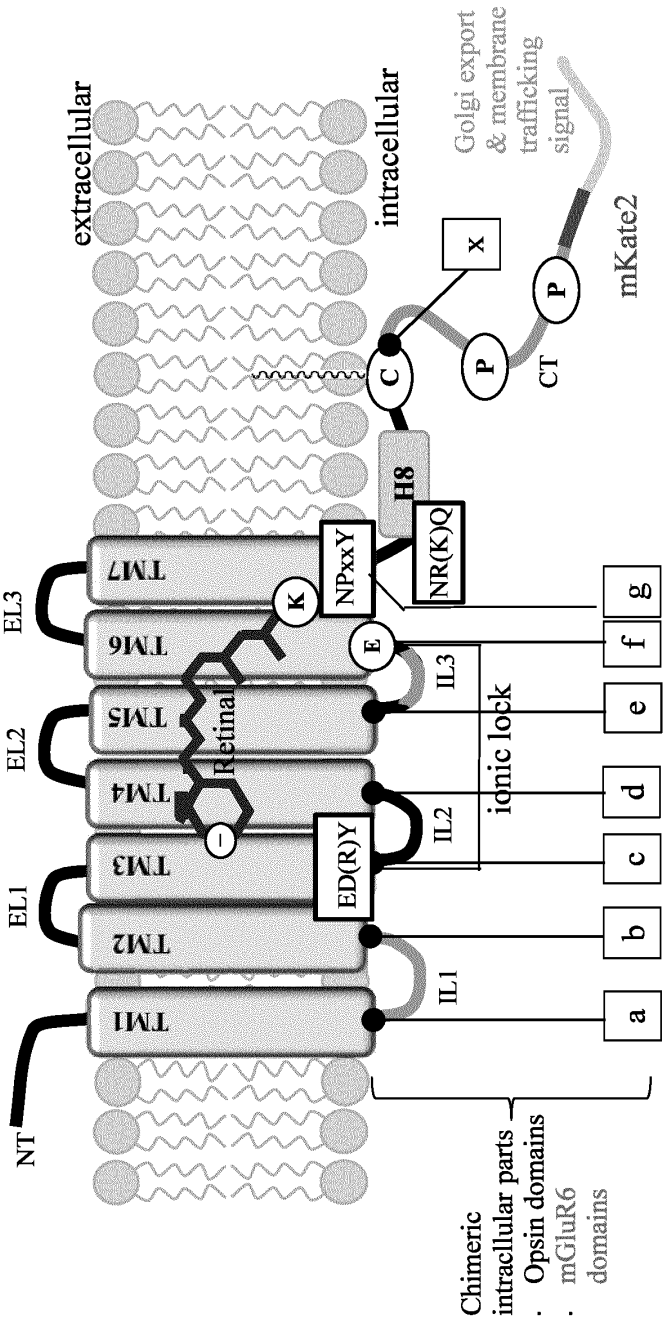

extracellular
intracellular
NT
TM1
TM2
TM3
TM4
TM5
TM6
TM7
EL1
EL2
EL3
IL1
IL2
IL3
ED(R)Y
NPxxY
NR(K)Q
H8
Retinal
K
E
C
P
x
CT
Golgi export & membrane trafficking signal
mKate2
ionic lock
a
b
c
d
e
f
g
Chimeric intracllular parts
. Opsin domains
. mGluR6 domains

Figure 3A

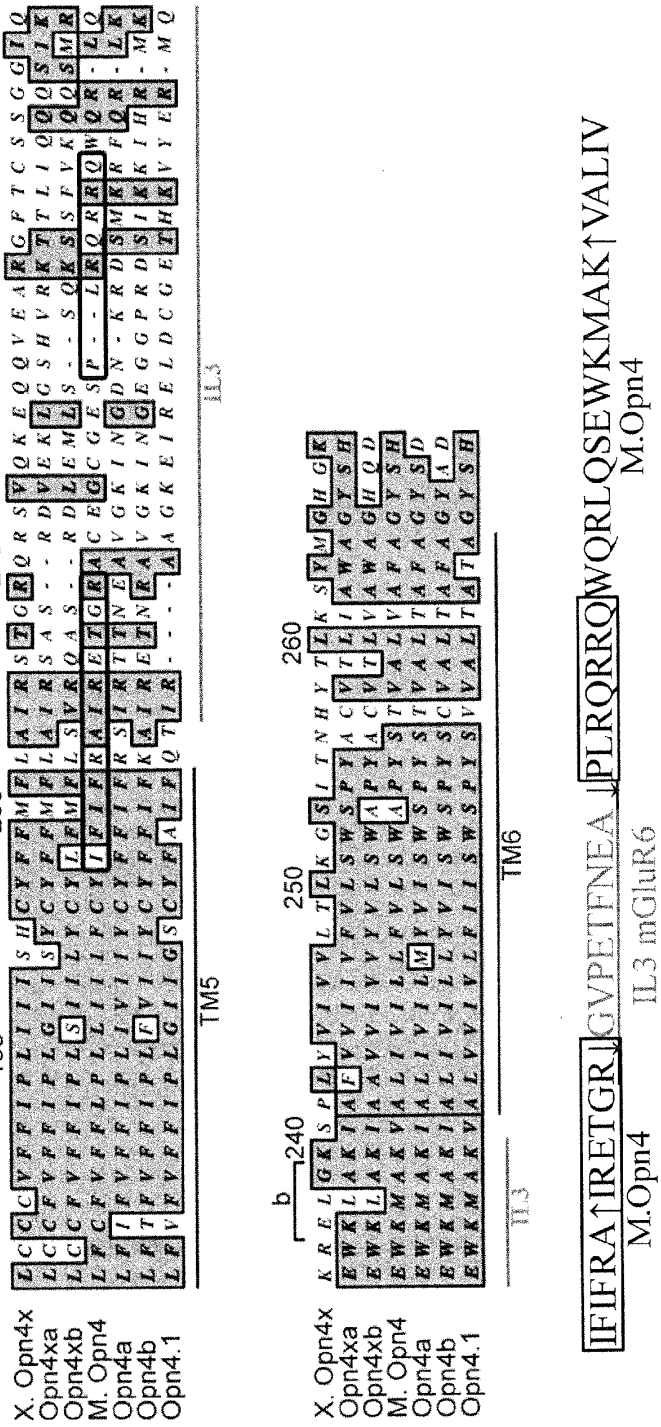

X. Opn4x
Opn4xa
Opn4xb
M. Opn4
Opn4a
Opn4b
Opn4.1
190
200
210
220
230
TM5
IL3
b
240
250
260
TM6
IL3
IFIFRA↑IRETGRJGVPETFNEA↓PLRQRRQWQRLQSEWKMAK↑VALIV
M.Opn4
IL3 mGluR6
M.Opn4

Figure 3B

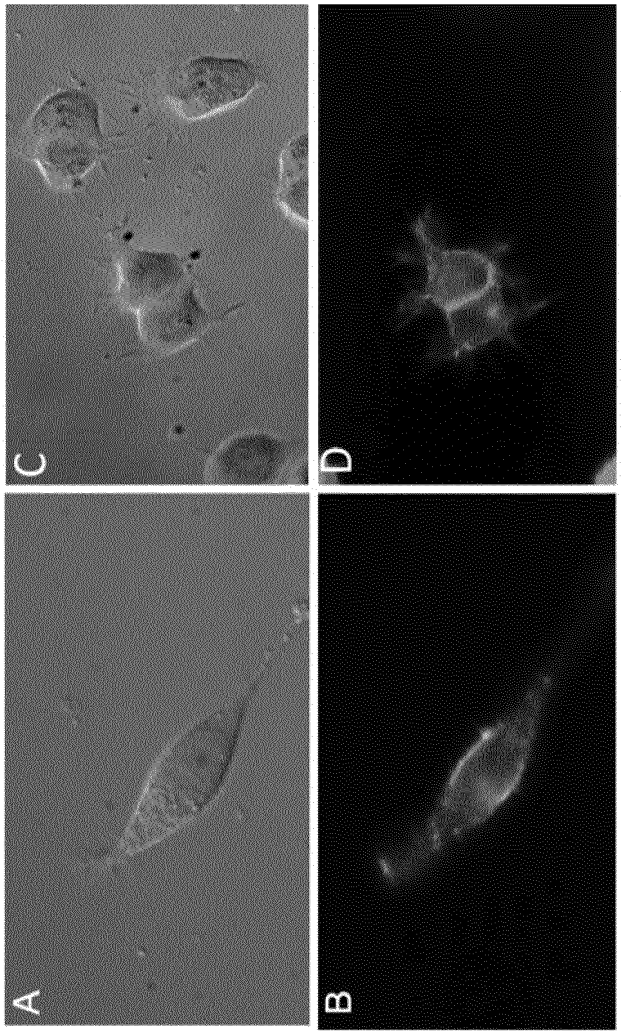


Figure 4

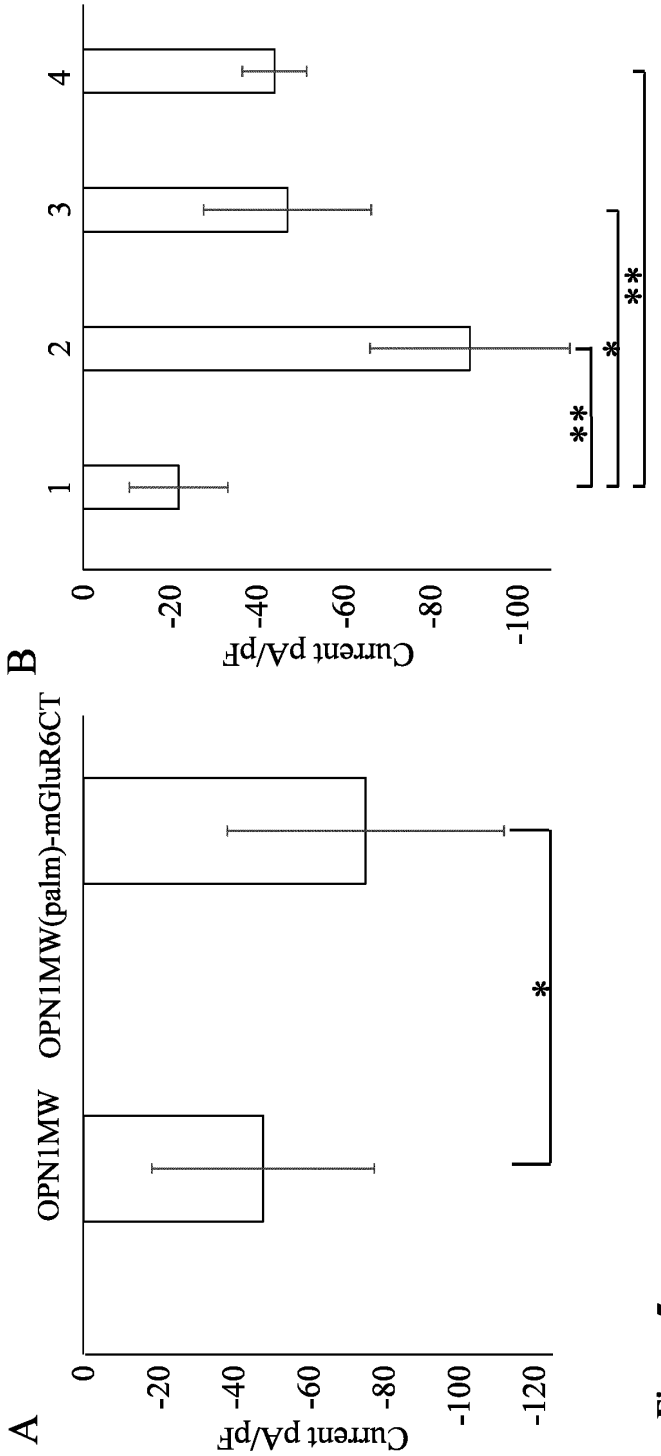

A
OPN1MW
OPN1MW(palm)-mGluR6CT
Current pA/pF
0
-20
-40
-60
-80
-100
-120
*
B
Current pA/pF
0
-20
-40
-60
-80
-100
1
2
3
4
**
*
**

Figure 5

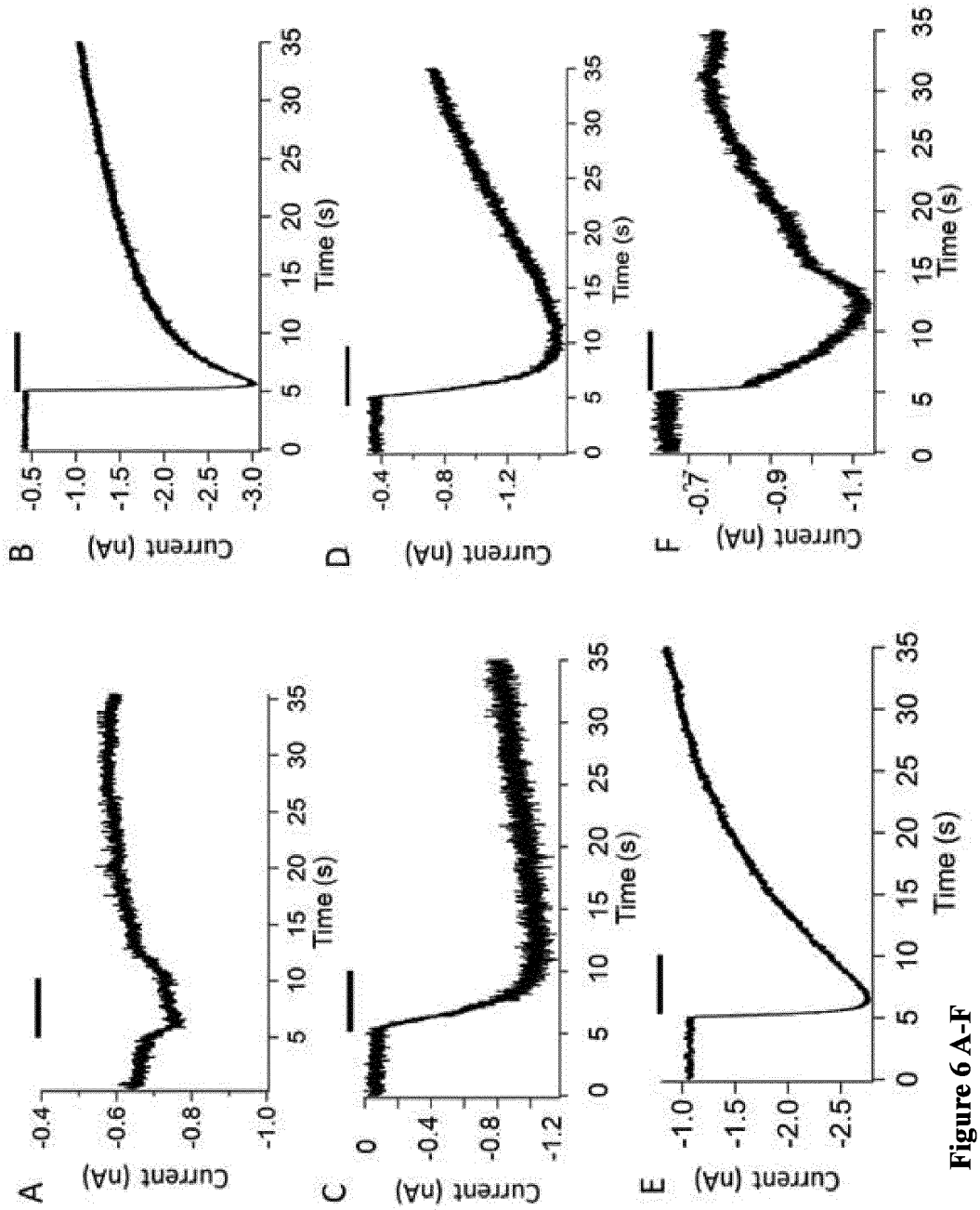


Figure 6 A-F

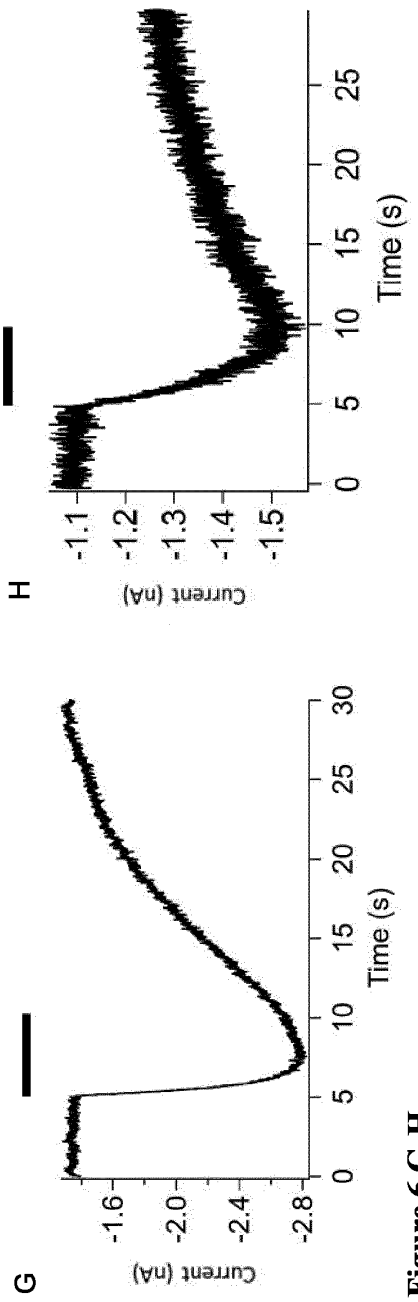

G
Current (nA)
-1.6
-2.0
-2.4
-2.8
0
5
10
15
20
25
30
Time (s)
H
Current (nA)
-1.1
-1.2
-1.3
-1.4
-1.5
0
5
10
15
20
25
Time (s)

Figure 6 G-H

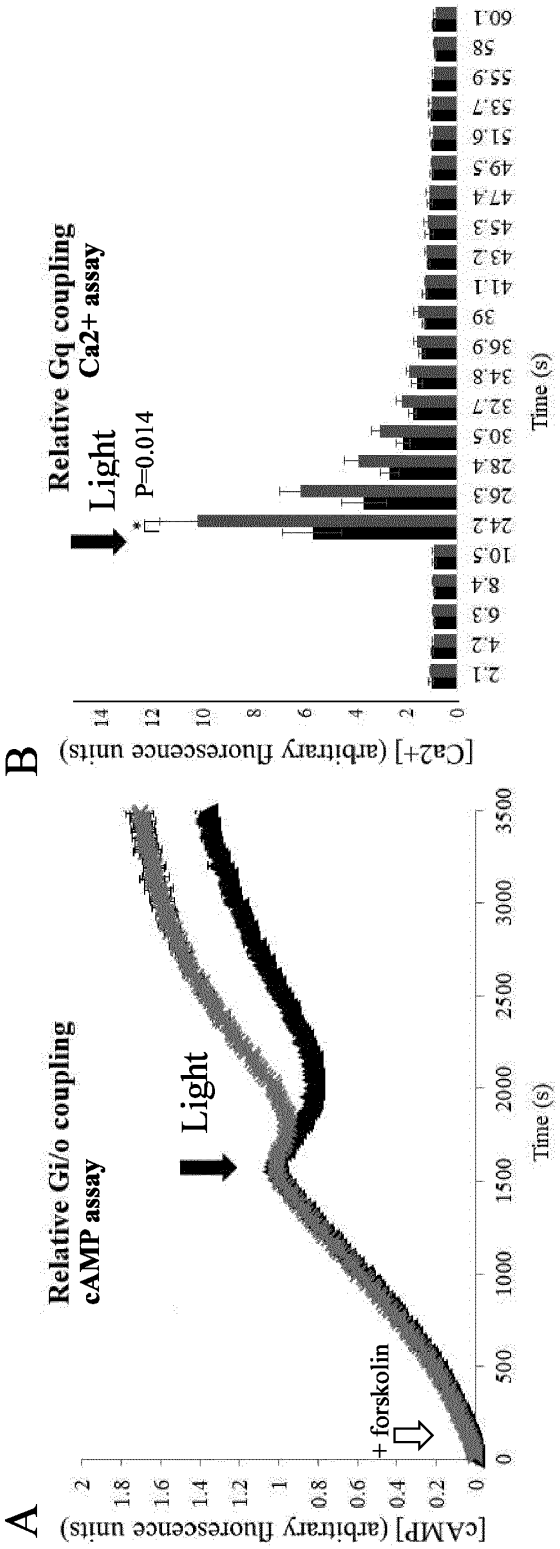

A
Relative Gi/o coupling
cAMP assay
Light
+ forskolin
[cAMP] (arbitrary fluorescence units)
Time (s)
B
Relative Gq coupling
Ca2+ assay
Light
P=0.014
[Ca2+] (arbitrary fluorescence units)
Time (s)

Figure 7 A-B

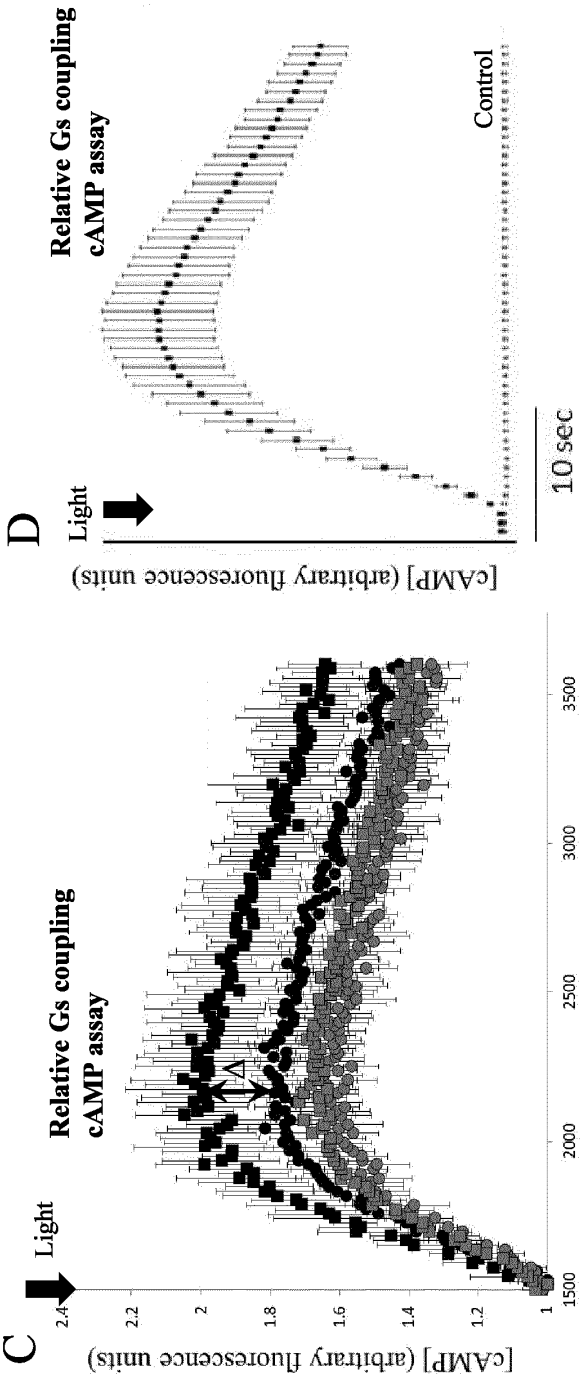

D
Relative Gs coupling
cAMP assay
Light
Control
10 sec
[cAMP] (arbitrary fluorescence units)
C
Relative Gs coupling
cAMP assay
Light
[cAMP] (arbitrary fluorescence units)
Time (s)
E
100 µm
Vm (mV)
Control
Light

Figure 7 C-E

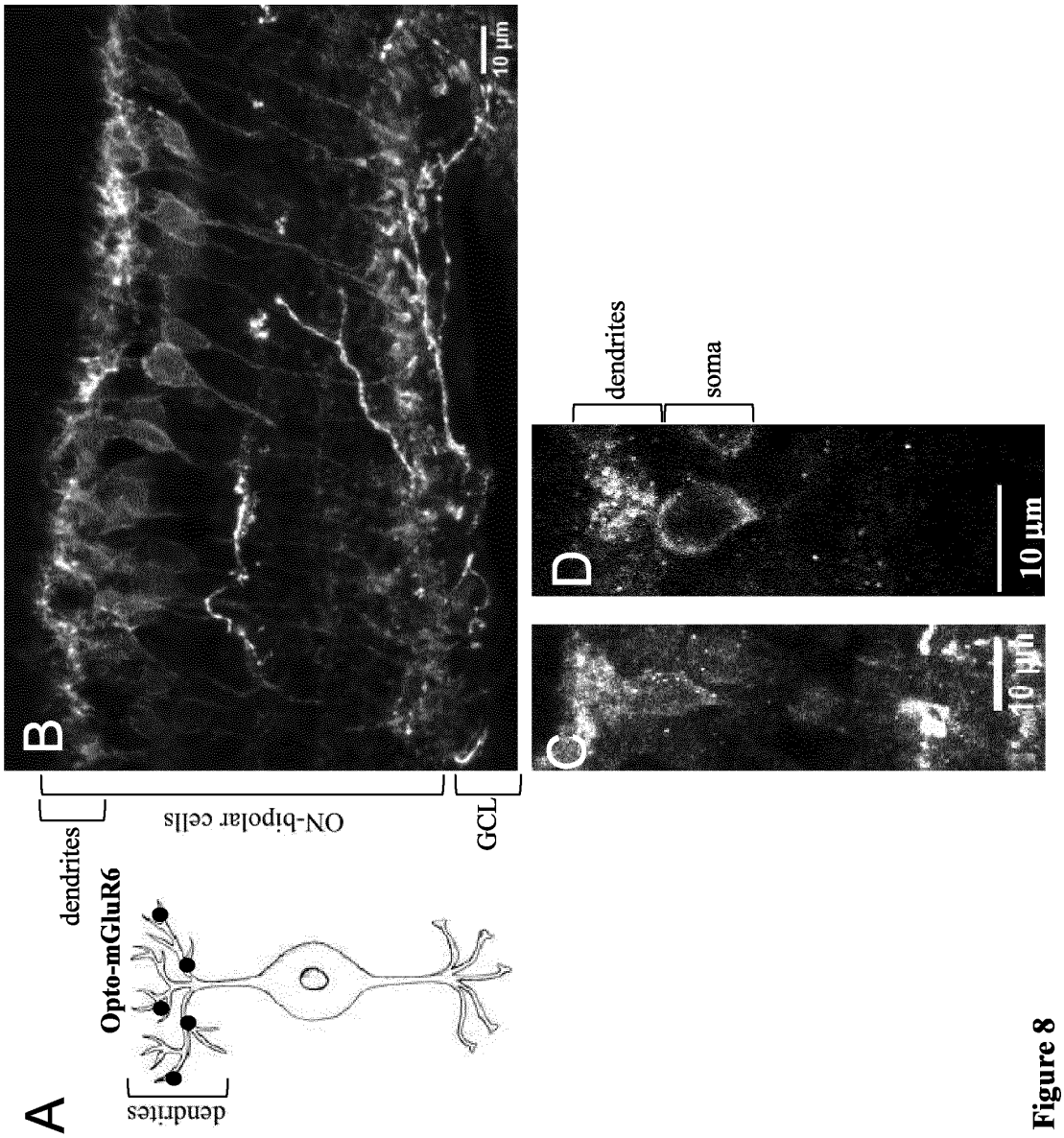

A
dendrites
Opto-mGluR6
B
10 µm
dendrites
ON-bipolar cells
GCL
C
10 µm
D
dendrites
soma
10 µm

Figure 8

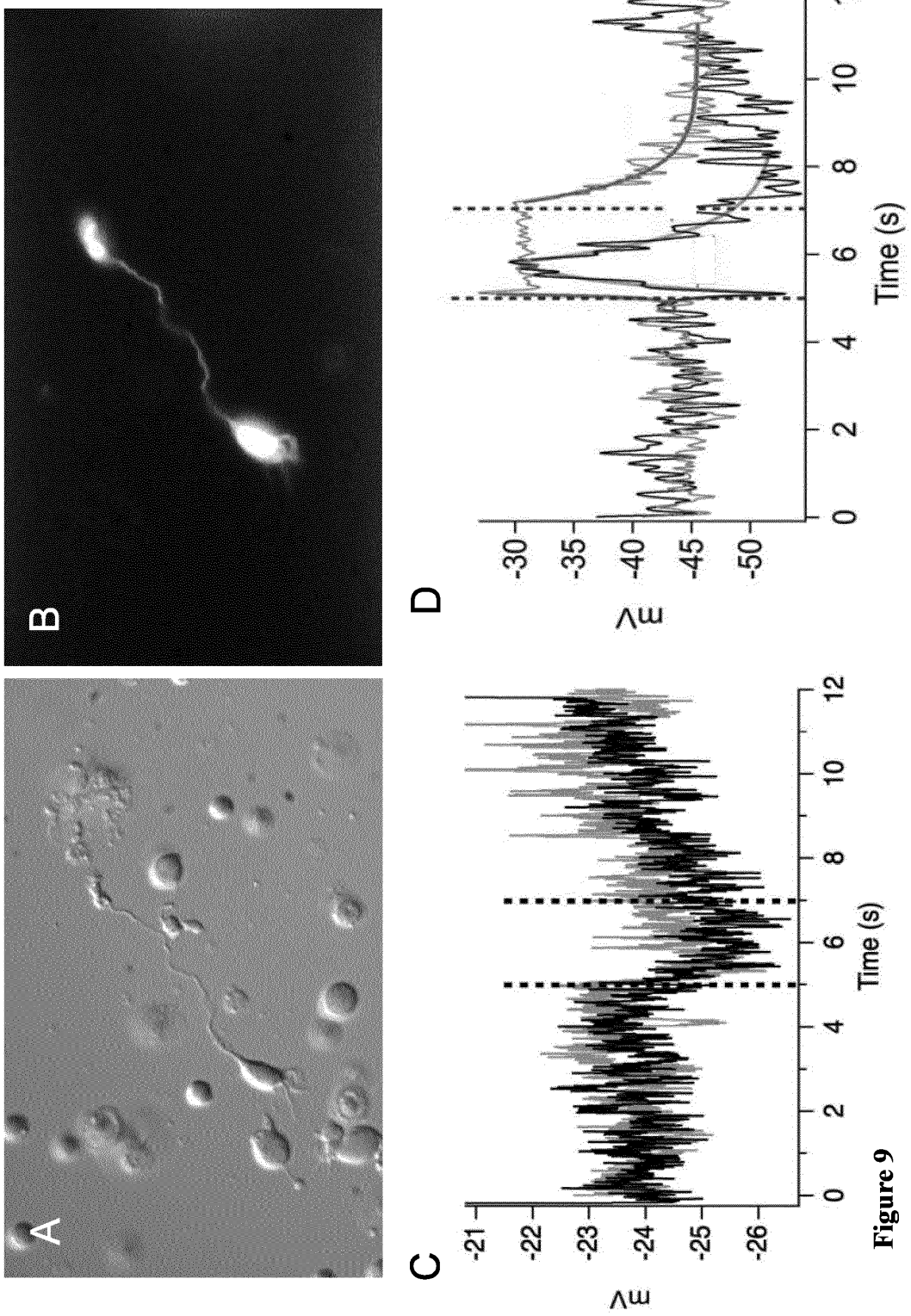


Figure 9

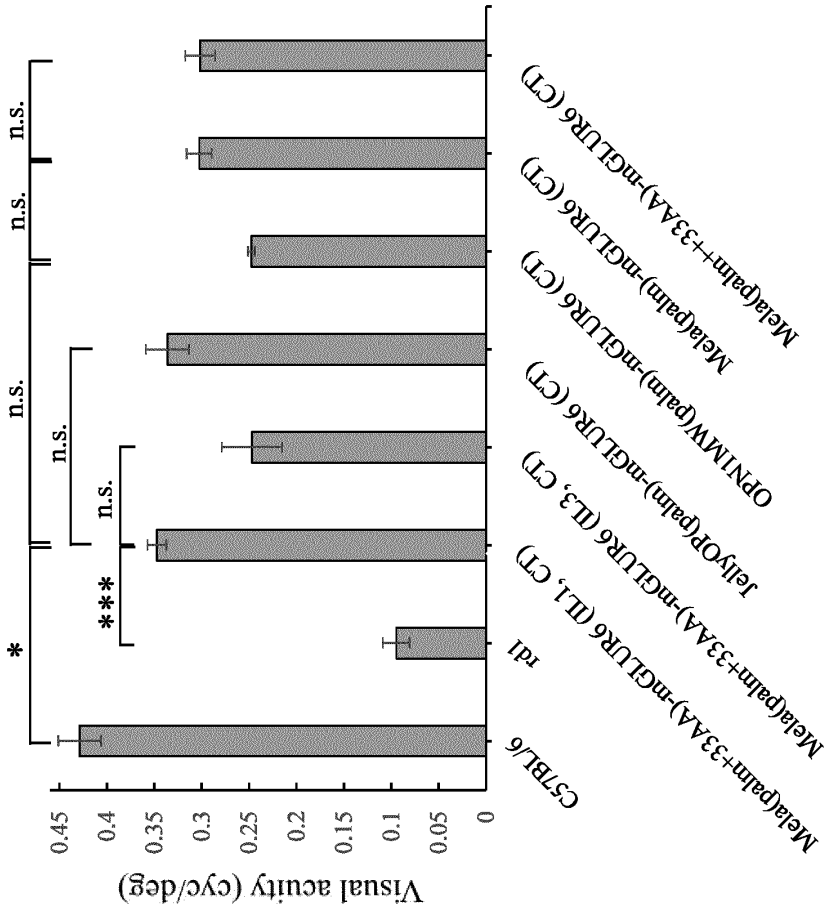

Visual acuity (cyc/deg)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
C57BL/6
rd1
Mela(palm+33AA)-mGLUR6 (IL1, CT)
Mela(palm+33AA)-mGLUR6 (IL3, CT)
jellyOP(palm)-mGLUR6 (CT)
OPN1MW(palm)-mGLUR6 (CT)
Mela(palm)-mGLUR6 (CT)
Mela(palm+33AA)-mGLUR6 (CT)
*
***
n.s.
n.s.
n.s.
n.s.

Figure 10

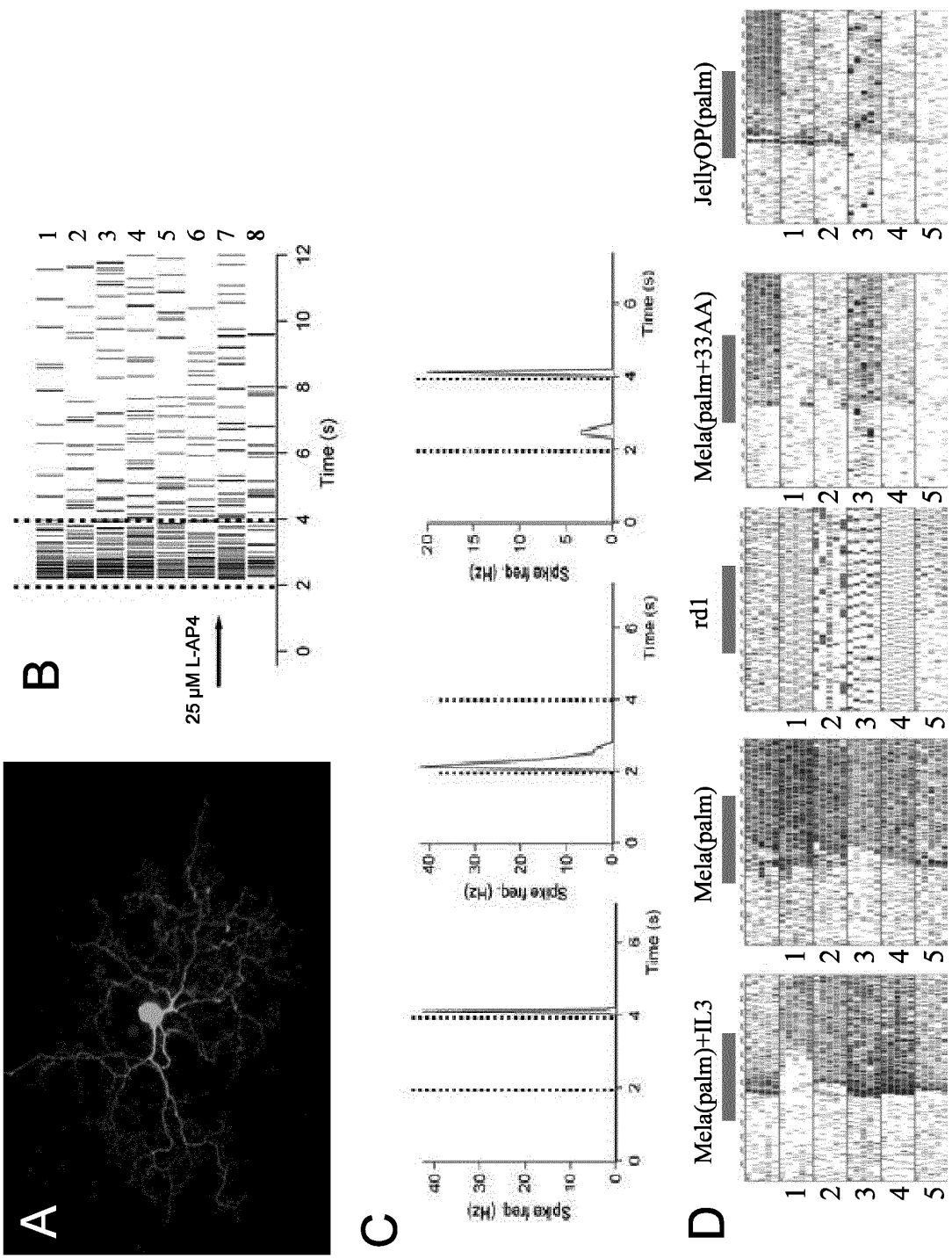

A
B
25 µM L-AP4
Time (s)
C
Spike freq. (Hz)
Time (s)
D
Mela(palm)+IL3
Mela(palm)
rd1
Mela(palm+33AA)
JellyOP(palm)

Figure 11

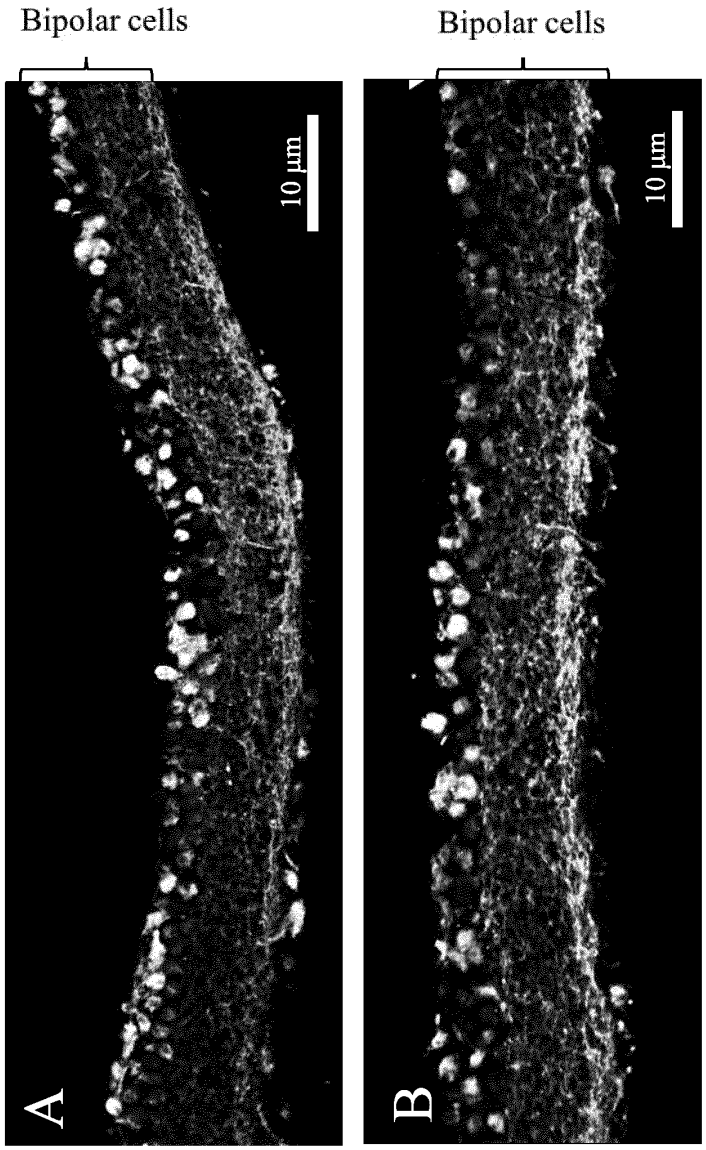


Figure 12

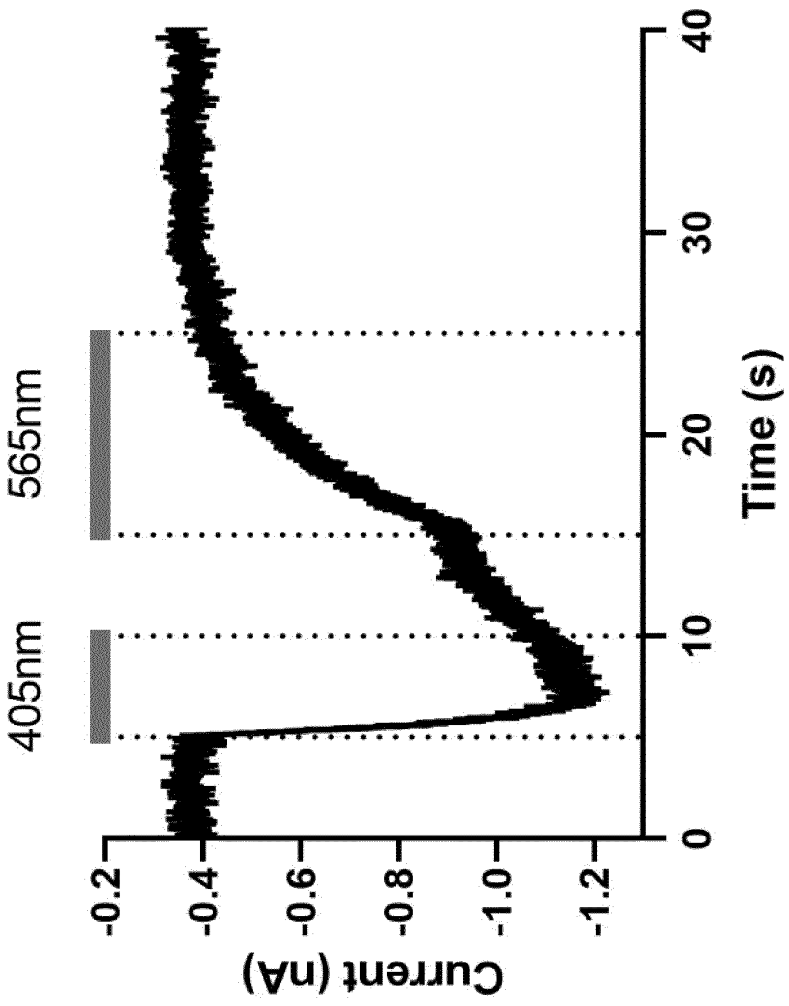


Figure 13