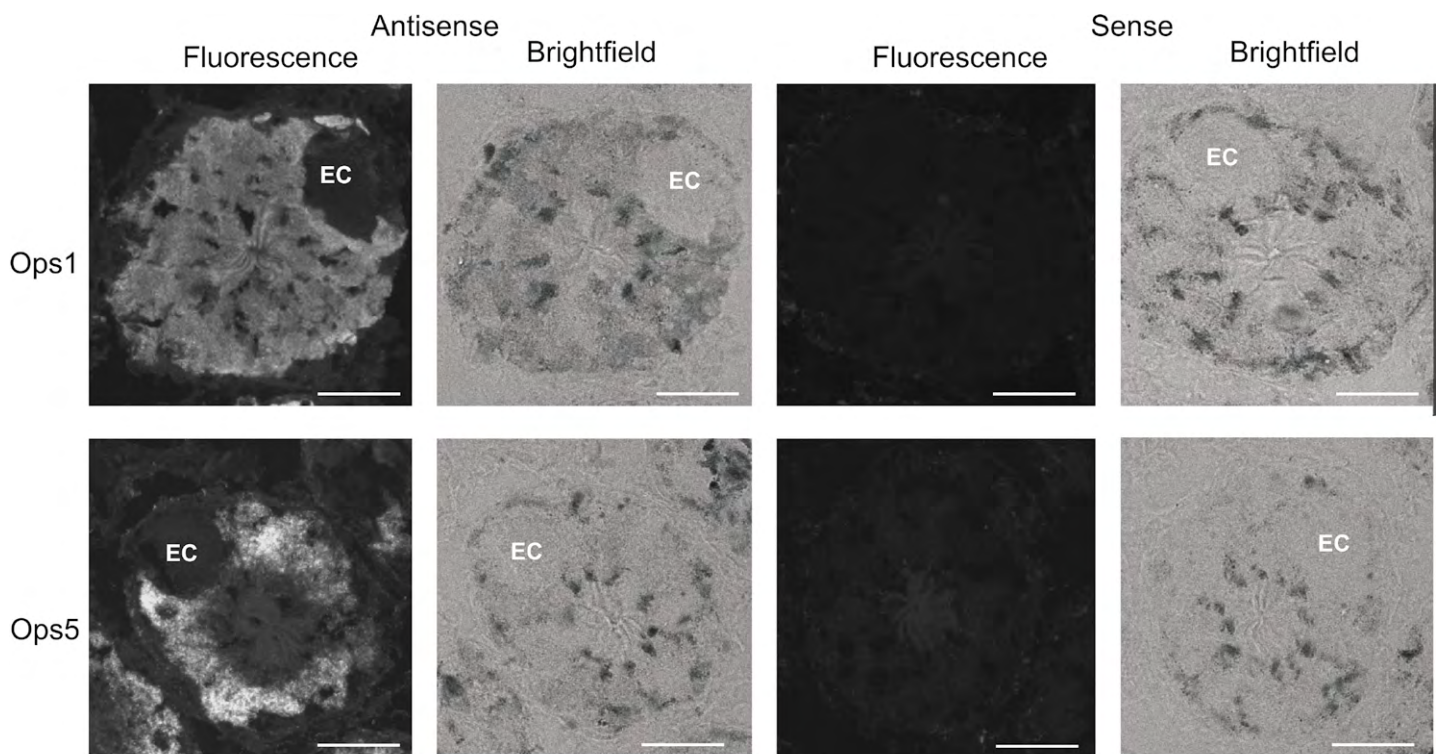
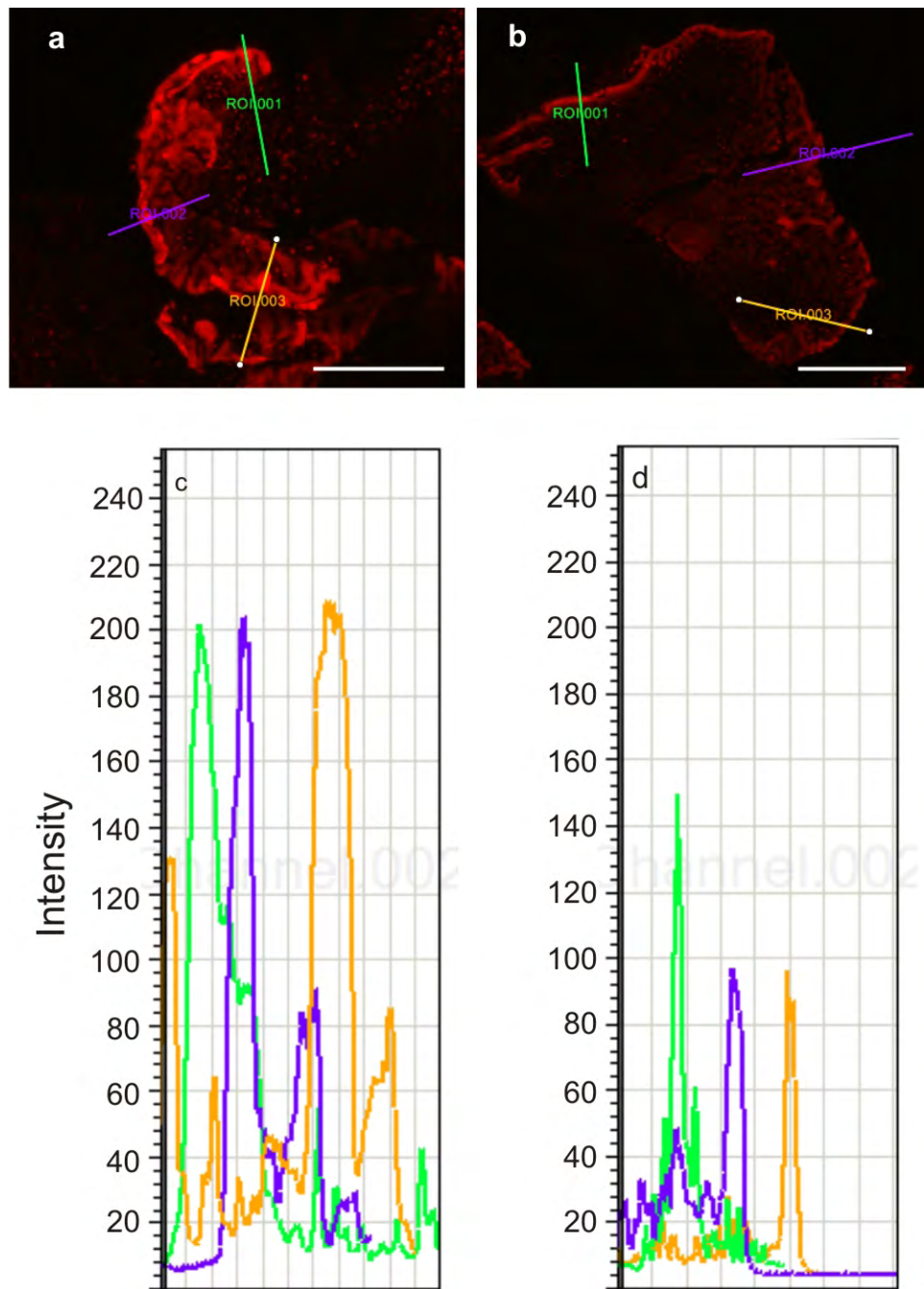


**Fig. S1. LpUVOps1-ir is present in rhabdoms of both types of small VE photoreceptors.** Sections of VE were incubated with LpUVOps1 (1:500). (a) LpUVOps1-ir in a small photoreceptor in which the rhabdom forms a cap at one end of the cell. (b) LpUVOps1-ir in a small photoreceptor in which the rhabdom is internal. Fig. 9F in the main text also shows a small photoreceptor with an internal LpOps1-ir rhabdom. Images are maximum projections of 7  $\mu\text{m}$  stacks. Scale bars, 25  $\mu\text{m}$ .



**Fig. S2. LpOps1 and LpOps5 transcripts are detected in LE retinal cells but not eccentric cells.** LE cross-sections incubated with antisense and sense probes for LpOps1 (Ops1) and LpOps5 (Ops5) were visualized with confocal microscopy as Cy3 fluorescence. Images are of 13–15  $\mu\text{m}$  stacks through individual ommatidia. Corresponding brightfield images are of an optical section near the middle of each stack. The locations of eccentric cell bodies (EC) are indicated. Scale bars, 50  $\mu\text{m}$ .



**Fig. S3. Quantification of immunoreactivity at rhabdoms.** Shown are examples of how the intensity of LpOps5-ir was quantified at rhabdoms of giant VE photoreceptors fixed during the day in the light. Images are of maximum projections of LpOps5-ir in rhabdoms of giant VE photoreceptors located (a) along the root and (b) in the EO of the same ventral optic nerve. Images were collected during a single confocal session with identical settings. Using the line-tool of the Leica SP5 software, maximum projections of confocal images of rhabdoms were scanned for regions of most intense immunoreactivity. The immunoreactive intensities at these regions were then recorded from the graphs shown. (c) LpOps5-ir where the three lines crossed the rhabdom shown in a. (d) LpOps5-ir where the three lines crossed the rhabdom shown in b. This same approach was used to determine the maximum intensity of LpUVOps1 in small VE photoreceptors and LpUVOps1-ir and arrestin-ir in rhabdoms of ME photoreceptors. Scale bars, 25 μm.

**Table S1. Primers used to clone LpUVOps1**

| Oligo name  |                        | (5' to 3')  |
|-------------|------------------------|---|
| 6387567 F1  | Transcriptome fragment | GGAGCCATTGCAACAAGAAA                                |
| 6189070 R2  | Transcriptome fragment | GCTGGTAGTAGCGCAAAGG                                 |
| 6387567 R1  | Transcriptome fragment | AAATTAGCTGGTGTCCGCAGC                               |
| 6189070 F2  | Transcriptome Fragment | GTCTGCATTTTGCAACGCTGT                               |
| Cap         | 5' RACE                | AAGCAGTGGTATCAACGCAGAGT                             |
| Lu4TRSA     | 3' RACE                | CGACGTGGACTATCCATGAACGCACGCAGTCGGTACTTTTTTTTTTTTTTT |
| NS Lu4      | 3' RACE                | TCGAGCGGCCCGCCCGGCAGGTCGACGTGGACTATCCATGAACGCA      |
| LpUVOps1 F5 | 5' UTR                 | GCAGAGTACCTGGGGATTGTGTCTG                           |
| LpUVOps1 R3 | 3' UTR                 | GTTTACCTACGGAAGATACTAGTGGCG                         |

**Table S2. Accession numbers of opsins used to construct Fig. 3**

|                         |               |  |
|-------------------------|---------------|--|
| Spider Rh1              | AB251846      | <i>Hasarius adansoni</i>                     |
| Spider Rh2              | AB251847      | <i>Hasarius adansoni</i>                     |
| LpOps1                  | L03781        | <i>Limulus polyphemus</i>                    |
| LpOps2                  | L03782.1      | <i>Limulus polyphemus</i>                    |
| Crustacean LWS          | S53494        | <i>Procambarus clarkia</i>                   |
|                         | GQ221725      | <i>Neogonodactylus oersterdii</i> isolate #1 |
|                         | DQ852587      | <i>Homarus gammarus</i> clone KC2162-c1      |
|                         | DQ852581      | <i>Holmesimysis costata</i> clone MP-Hcos-c1 |
|                         | ABH00987      | <i>Litopenaeus vannamei</i>                  |
| Insect                  | O01668        | <i>Drosophila melanogaster Rh6</i>           |
|                         | NM00101163902 | <i>Apis mellifera</i>                        |
|                         | AAA28733      | <i>Drosophila melanogaster Rh1</i>           |
|                         | P08099        | <i>Drosophila melanogaster Rh1</i>           |
|                         | NP001071293.1 | <i>Apis mellifera</i>                        |
| Crab opsin1             | ADQ04809.1    | <i>Uca pugilator</i>                         |
|                         | GQ228846.1    | <i>Uca vomeris</i>                           |
|                         | Q25157        | <i>Hemigrapsus sanguineus</i>                |
| Crab opsin2             | ADQ01810.1    | <i>Uca pugilator</i>                         |
|                         | GO228847.1    | <i>Uca vomeris</i>                           |
|                         | Q25158        | <i>Hemigrapsus sanguineus</i>                |
| <i>Triops</i> RhA       | AB293428.1    | <i>Tripos granarius</i>                      |
| LpOps5                  | FJ791252      | <i>Limulus polyphemus</i>                    |
| <i>Branchinella</i> RhB | AB298794      | <i>Branchinella kugenumaensis</i>            |
| <i>Triops</i> RhD       | AB293431      | <i>Tripos granarius</i>                      |
| <i>Triops</i> RhB       | AB293429.1    | <i>Tripos granarius</i>                      |

|                          |               |                                    |
|--------------------------|---------------|------------------------------------|
| <i>Triops</i> RhE        | AB293432      | <i>Tripos granarius</i>            |
| <i>Branchinella</i> RhC  | AB293437      | <i>Branchinella kugenumaensis</i>  |
| <i>Branchinella</i> RhD  | AB293438.1    | <i>Branchinella kugenumaensis</i>  |
| Spider Rh3               | AB251848      | <i>Hasarius adansoni</i>           |
|                          | AB25185       | <i>Plexippus paykulli</i>          |
| <i>Limulus</i> UVOps1    | AEL29244      | <i>Limulus polyphemus</i>          |
| <i>Uca pugilator</i> Rh3 | ADQ01800.1    | <i>Uca pugilator</i>               |
| <i>Drosophila</i> Rh3    | P04950        | <i>Drosophila melanogaster Rh3</i> |
| <i>Drosophila</i> Rh4    | P08255        | <i>Drosophila melanogaster Rh4</i> |
| <i>Vanessa</i> UV        | AF414074      | <i>Vanessa cardui</i>              |
| <i>Tribolium</i> UV      | ABW06837      | <i>Tribolium castaneum</i>         |
| <i>Apis</i> UV           | NP001011605.1 | <i>Apis mellifera</i>              |
| <i>Drosophila</i> Rh5    | P91657        | <i>Drosophila melanogaster Rh5</i> |
| <i>Apis</i> Blue         | AAC13417.1    | <i>Apis mellifera</i>              |
| <i>Daphnia</i> Blue      | EFX75461.1    | <i>Daphnia pulex</i>               |
| <i>Tripos</i> RhC        | AB293430      | <i>Tripos granarius</i>            |
| <i>Branchinella</i> Rha  | AB293436      | <i>Branchinella kugenumaensis</i>  |
| <i>Daphnia</i> UV        | EFX 81332.1   | <i>Daphnia pulex</i>               |
| Mouse melanopsin         | EU303118      | <i>Mus Musculus</i>                |
| Cephalopod opsin         | AF000947      | <i>Sepia officinalis</i>           |
|                          | P24603        | <i>Loligo forbesii</i>             |