

Figures

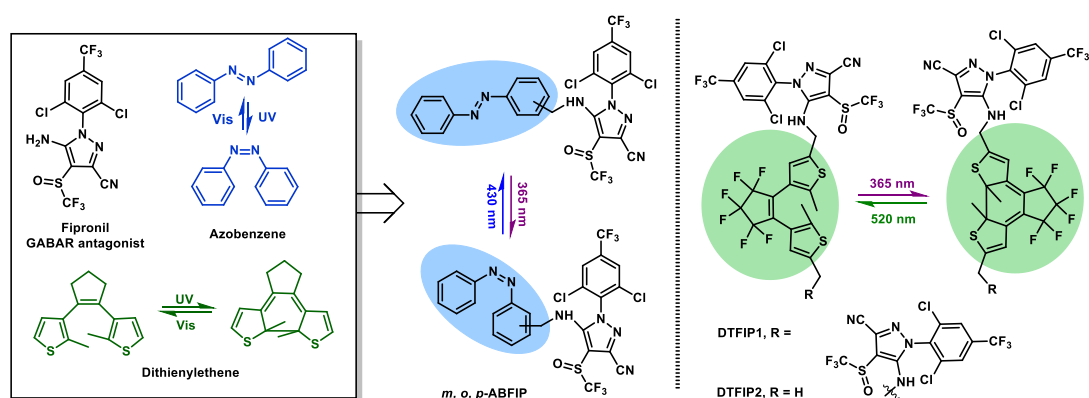


Figure 1. Design concept of photoswitchable azobenzene-fipronils (ABFIPs) and dithienylethene-fipronils (DTFIPs) as insect ionotropic GABAR ligands.

Note, ABFIPs are obtained by exterior modification of fipronil by azobenzene. DTFIPs are obtained by linking fipronil molecule with dithienylethene.

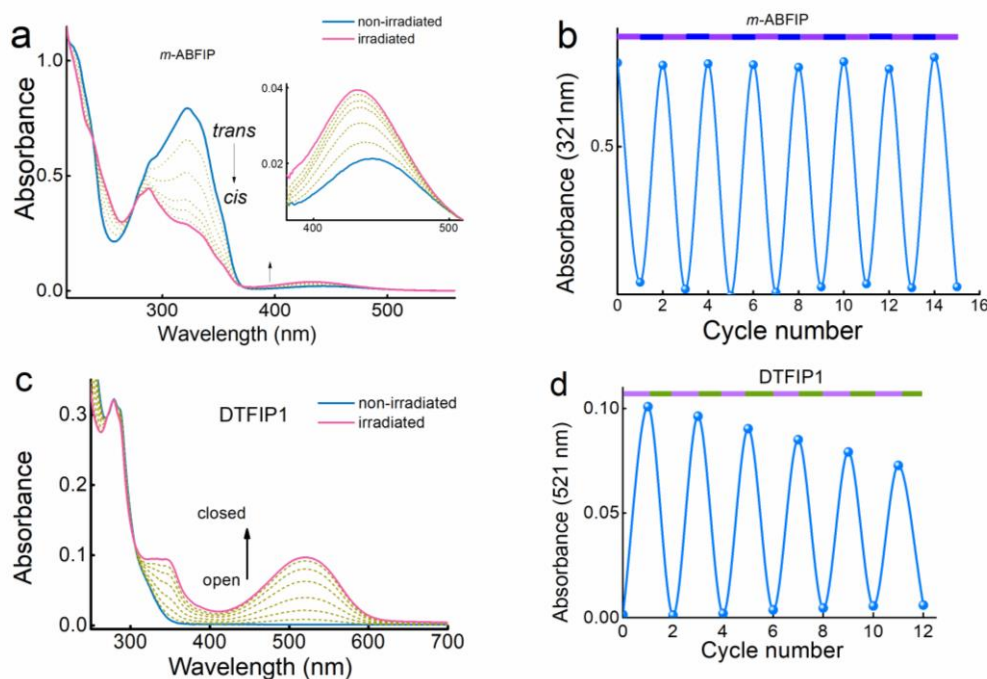


Figure 2. Photophysiochemical properties of ABFIPs and DTFIPs. (a) UV-Vis absorbance spectra evolution of *m*-ABFIP (0.02 μ M in acetonitrile) by irradiation with 365 nm light. (b) Cycle performance of *m*-ABFIP, change in absorption at 321 nm during alternative irradiation of a solution (0.02 μ M in acetonitrile) with 365 nm light for 1 min and 430 nm light for 1 min. (c) UV-Vis absorbance spectra evolution of DTFIP1 (0.02 μ M in acetonitrile) by irradiation with 320 nm light. (d) Cycle performance of DTFIP1, change in absorption at 322 nm during alternative irradiation of

a solution (0.02 μM in acetonitrile) with 365 nm light for 1 min and 520 nm light for 2 min.

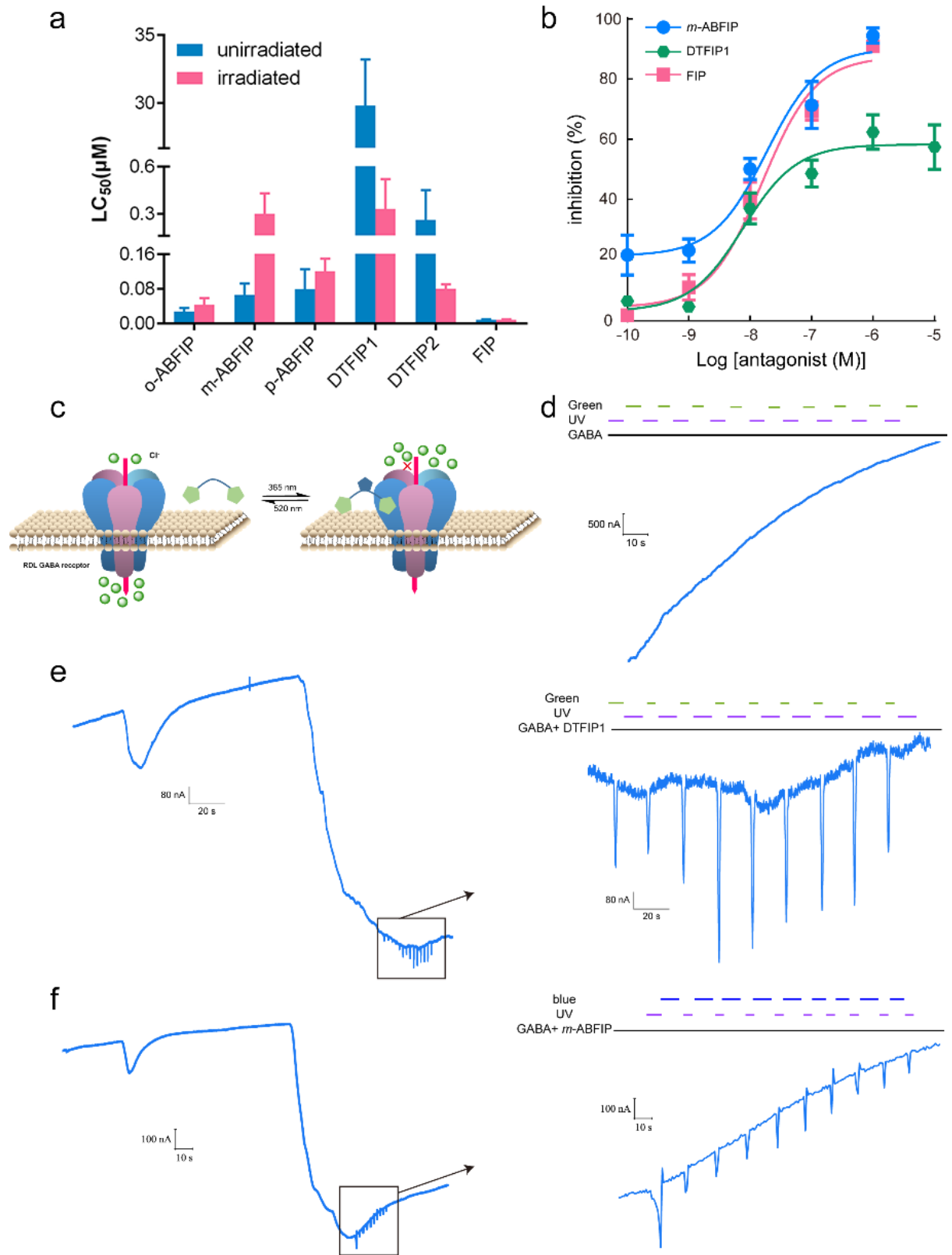


Figure 3. DIFIT1 and *m*-ABFIP enable optical control over ionotropic GABAR. (a) *In vivo* activity of PCLs in mosquito larvae indicating lethal concentrations killing 50% of the population

(LC₅₀) before and after irradiation. **(b)** Dose-response curve for inhibiting the normalized GABA current in homomeric *LsRDL*-type GABA receptors overexpressed in *Xenopus laevis* oocytes (IC₅₀, 7.8 nM for *m*-ABFIP and 18.5 nM for DTFIP1, n = 6). **(c)** Schematic illustration of photoisomerization of DTFIP1 upon irradiation stimulating reversible opening and closing of the chloride channel. **(d)** Current recordings of sole oocytes upon irradiation with UV and green light. **(e)** Real-time membrane current monitoring of *Xenopus laevis* oocytes expressing homomeric *LsRDL* GABA receptors using the TEVC configuration. Inward current is elicited by 3 μ M GABA and 1 μ M DTFIP1. Cycles of current increase and decrease were obtained by alternative irradiation of oocytes with UV (λ = 365 nm) and green light (λ = 520 nm) for 1 s each. **(f)** Photocurrent change recordings on oocytes treated with 3 μ M GABA and 1 μ M *m*-ABFIP by alternative irradiation with UV (λ = 365 nm) and blue light (λ = 430 nm) for 1 s each. Experiments were repeated independently six times using different oocytes.

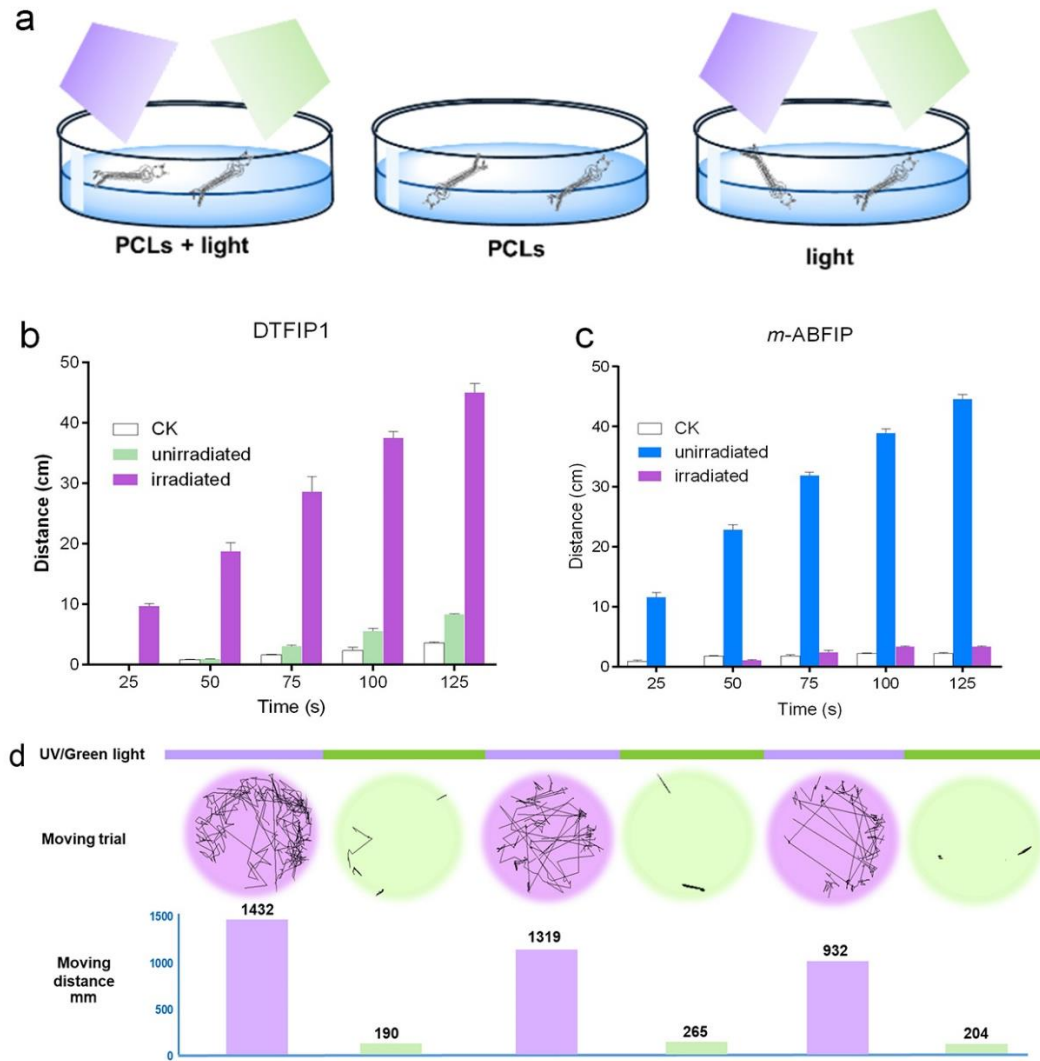


Figure 4. Optical control behavioral responses of mosquito larvae. (a) Schematic illustration of the behavioral experiments. Left: two mosquito larvae treated with PCL in petri dishes were alternatively irradiated with UV and green light. Middle and right: control experiments for larvae treated with PCL or light (5% DMSO aqueous solution) alone. (b, c) Moving distance of mosquito larvae treated with (b) DTFIP1 (5 μ M) and (c) *m*-ABFIP (0.6 μ M), with or without UV light irradiation (n=3). (d) Moving trajectory and moving distance of larvae treated with DTFIP1 (5 μ M) after 2 min alternative irradiation with UV (320 nm) and green light (520 nm) (n = 6).