

Movie 1. Isolated *Octopus bimaculoides* skin senses light and chromatophores embedded in the skin expand in response to light. This movie shows an isolated piece of *O.bimaculoides* skin pinned in a dish. The video was recorded using an infrared camera. Recording starts with red light illumination and a white light is turned on after 5 seconds to illuminate the skin sample. The chromatophores in the skin expand fully after ~6 seconds.

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1
eye_1      ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
eye_2      ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
skin_1     ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
skin_2     ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
skin_3     ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
skin_4     ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
skin_5     ----- --CTGTCG GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA
O._bim_rhodopsin  ATTTGTTG GTCTGTGC GCCCCGTC TTCAACTG GGGAGCAT ACGTCCCT GAAGGTAT TCTTACAT CTTGCTCT TTTGATTA CCTGTCTA

89
eye_1      CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
eye_2      CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
skin_1     CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
skin_2     CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
skin_3     CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
skin_4     CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
skin_5     CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA
O._bim_rhodopsin  CTGATTCT AGTACCAG ATCTTTCA TCTTGTGC ATGTACTT CTGTGGTT TCATGCTG CCCATAAT TATCATCG CTTTCTGT TACTTCAA

177
eye_1      CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
eye_2      CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
skin_1     CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
skin_2     CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
skin_3     CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
skin_4     CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
skin_5     CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT
O._bim_rhodopsin  CATTGTCA TGCTGTGA TCCAACCA TGAAAAGG AAATGGCT GCCATGGC TAAGAGGT TGAACGCC AAAGAATT GCGTAAGG CCCAGGCT

265
eye_1      GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
eye_2      GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
skin_1     GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
skin_2     GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
skin_3     GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
skin_4     GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
skin_5     GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG
O._bim_rhodopsin  GGCCAGAG CGCTGAAA TGAAACTC GCCAAAAT CTCAATGG TAATTATT ACCCAATT CATGCTCT CCTGGTCT CCATACGC CATCATCG

353
eye_1      CTCCTTCT TGCAA--- ----- ----- ----- ----- ----- ----- -----
eye_2      ----- ----- ----- ----- ----- ----- ----- -----
skin_1     CTC----- ----- ----- ----- ----- ----- ----- -----
skin_2     CTCCTTCTT GCAA---- ----- ----- ----- ----- ----- -----
skin_3     CTCCTTCTT GCAAAA--- ----- ----- ----- ----- ----- -----
skin_4     CTCCTTCTT GCAAAA--- ----- ----- ----- ----- ----- -----
skin_5     ----- ----- ----- ----- ----- ----- ----- -----
O._bim_rhodopsin  CTCCTTCTT GCACAGTT TGGGCCAG CTGAATGG GTTACTCC TTATGCAG CTGAATTG CCTGTCCT GTTTGCT

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Fig. S1. Alignment of opsin nucleotide sequences from *O. bimaculoides* eyes and skin. Opsin PCR products (approx. 340 base pairs) amplified using cDNA libraries made from mRNA extracted from the eyes ($n=2$) and skin ($n=5$) of *O. bimaculoides*. These sequences are aligned to an *O. bimaculoides* rhodopsin sequence from GenBank (accession number AY545172.1). Yellow boxes highlight potential nucleotide differences between the samples and the reference.

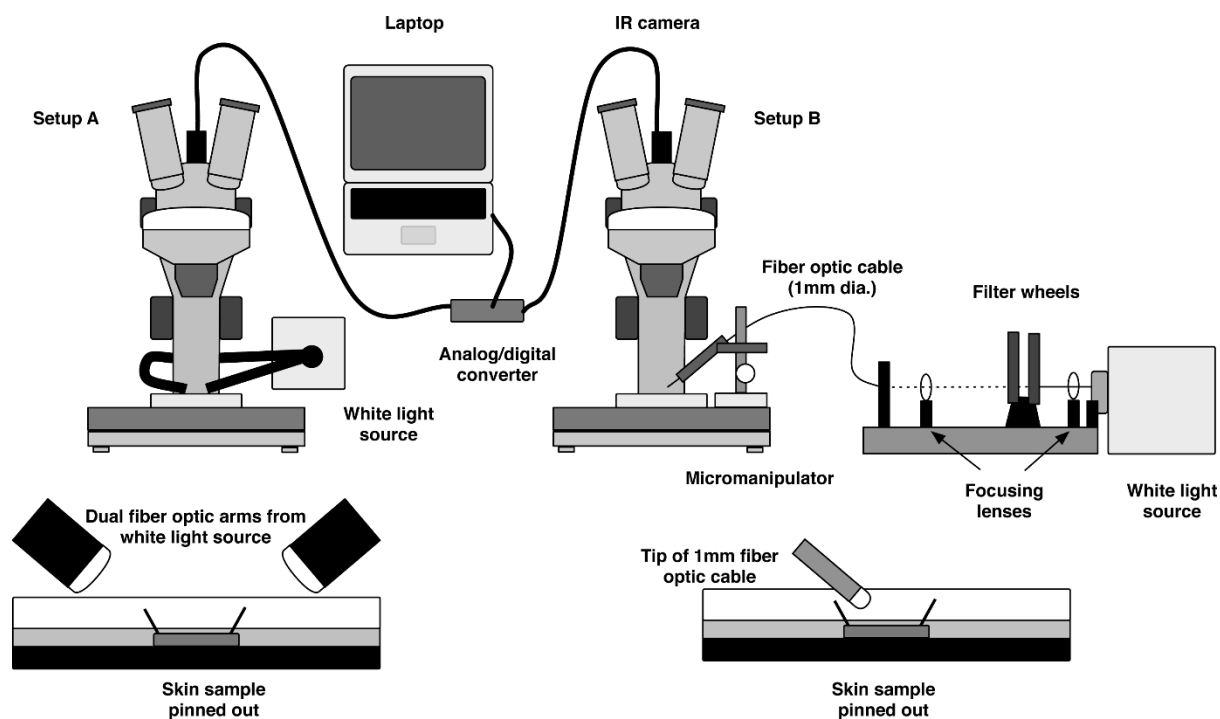


Fig. S2. The setup for all LACE experiments. Setup A was used for the initial white light LACE trials, while Setup 2 was used for the LACE action spectrum. Underneath each experimental setup is a closeup of the experimental geometry of the skin samples to the lights.

Table S1. Mean size of *O. bimaculoides* chromatophores before and after LACE.

The chromatophore areas from each sample are the means of at least three trials.

These data are plotted in Fig. S1.

Sample	Pre-LACE area (pixels)	Post-LACE area (pixels)
Adult 1	4290.67	24963.00
Adult 2	6031.33	16613.33
Hatchling 1	502.25	766.69
Hatchling 2	356.56	432.14
Hatchling 3	302.88	1199.38
Hatchling 4	664.15	1155.13
Hatchling 5	1297.31	2679.15
Hatchling 6	922.29	2525.00
Hatchling 7	380.89	451.33
Hatchling 8	855.80	1337.57

Table S2. Lace latency action spectrum for 4 individual octopus skin samples.

Wavelength (nm)	LACE latency (s)		
375	40	660	33
400	36.33	375	29
405	14.33	400	23.33
420	21.67	405	21.67
430	18.67	420	16.33
440	27.67	430	9.33
450	19.33	440	9.67
460	23	450	7
470	19.67	460	12.67
480	23.67	470	8.33
488	20.67	480	22
500	31.33	488	29.33
510	27	500	12.33
520	23.33	510	6.67
532	32.67	520	12
540	29.33	532	19.67
560	27	540	30.33
580	40	560	30
600	33.67	580	24.33
620	40	600	30
640	40	620	30
660	40	640	29.67
375	45	660	30
400	31.33	375	45
405	35.33	400	17
420	45	405	18.67
430	35.33	420	22.33
440	33.67	430	18
450	18.33	440	22
460	18	450	10.67
470	8.67	460	14.33
480	4.33	470	6.67
488	11	480	15.33
500	17.67	488	18
510	7	500	23
520	22.33	510	12.67
532	34.67	520	31
540	39.33	532	23
560	30.67	540	27
580	45	560	45
600	34.67	580	43.33
620	32.33	600	31.33
640	32.67	620	41.33
		640	32.67
		660	31.33

LACE latency is amount of time remaining (out of 45 s) after the start of LACE.