Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information

Energy transfer from WT-LH2 to *ΔcrtB* RCLH1 under physiological conditions

In contrast to the data in Fig. 5, obtained with surface-patterned LH complexes that were partially dehydrated and then sealed under a protective Argon atmosphere, the data for Fig S1 were obtained with surface-attached complexes sealed in Argon-sparged imaging buffer. Fig. S1A shows merged wide field false colour fluorescence image of complexes illuminated by a 470 nm LED recorded in epifluorescence mode. The green lines correspond to fluorescence emission filtered by a 857/30 nm bandpass filter, which indicates the distribution of LH2 complexes. The red squares correspond to fluorescence filtered by a 900/32 nm bandpass filter, which identifies the location of *ΔcrtB* RCLH1 complexes. In the absence of coupled LH2 complexes the *ΔcrtB* RCLH1 complexes cannot harvest energy because of the absence of carotenoids and the 470 nm excitation, so only the *ΔcrtB* RCLH1 complexes in the intersecting cross-over area fluoresce because nearby LH2 complexes deliver excitation energy. This is confirmed when analysing the fluorescence spectral images when the sample is excited with a 485 nm laser. The fluorescence intensity images at 857 nm and 890 nm

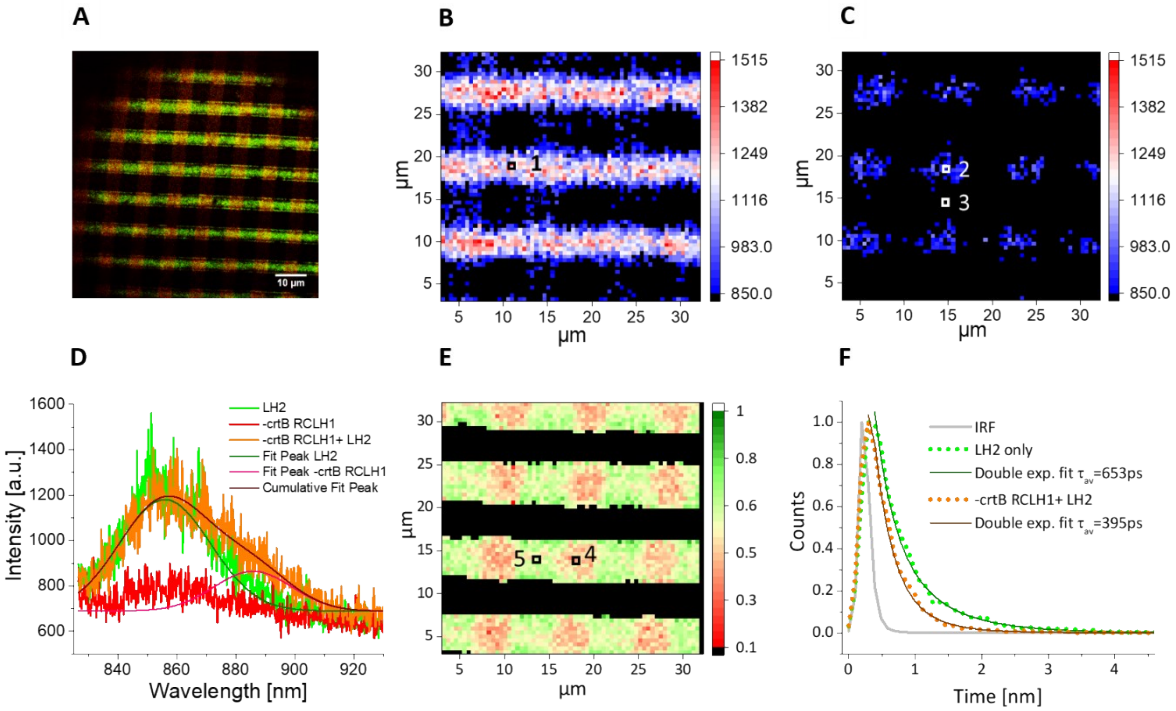

Fig. S1. Spectral and lifetime fluorescence data of cross-patterned LH2 and *ΔcrtB* RCLH1 complexes on a functionalised glass substrate imaged under physiological conditions (in imaging buffer). A – False colour fluorescence image (470 nm wide field excitation), showing the LH2 (green) and *ΔcrtB* RCLH1 (red) lines, filtered by 857/30 nm and 900/32 nm bandpass filters, respectively. B - Spectral map showing the emission intensity at 860 nm (LH2 emission); the excitation source is 485 nm pulsed laser, scan size 32 µm. C - Simultaneously recorded spectral map showing the emission intensity at 890 nm (*ΔcrtB* RCLH1 emission), scan size 32 µm. There is increased emission in the areas where LH2 is present as the energy transfer donor. The positions of three pixels used for acquiring spectral data are marked. D – Individual emission spectra recorded in the pixels of the images in panels A and B marked with 1 (LH2 only, green line), 2 (cross-over area, orange line) and 3 (*ΔcrtB* RCLH1 only, red line), respectively. E- Intensity-averaged lifetime image obtained at 485 nm excitation and 857 nm emission (LH2 emission), clearly showing a decrease in the lifetime in the cross-over areas, where the two complexes are in close proximity, scan size 32 µm. F – Individual decay curves recorded in the pixels of the lifetime image in panel E marked with 4 (orange, average lifetime of 395 ps) and 5 (green, average lifetime of 653 ps), respectively.

are shown in (Figs. S1, B and C, respectively) reveal *ΔcrtB* RCLH1 emission arising only from the cross-over areas of the pattern.

The fluorescence lifetime results also provided evidence for energy transfer between LH2 and *ΔcrtB* RCLH1. Fig. S1, E represents the amplitude weighted average lifetime image of LH2 at 857 nm with typical lifetime decay curves are shown in Fig. S1, F. Lifetime decay curves were fitted by a bi-exponential decay function, where the green curve represents lifetime decay in LH2 only area (marked 5) and the orange curve represents the lifetime decay in the cross-over area (marked 4). In the LH2 only area, the measured lifetime is around 640 ps (a faster component of 550ps and a slower component of 750 ps). In the cross-over area, the lifetime of LH2 emission is shortened to 440 ps (a faster component of 320ps and a slower component of 500 ps). Such a decrease in LH2 lifetime in the cross-over area indicates that EET indeed occurs between LH2 and *ΔcrtB* RCLH1.

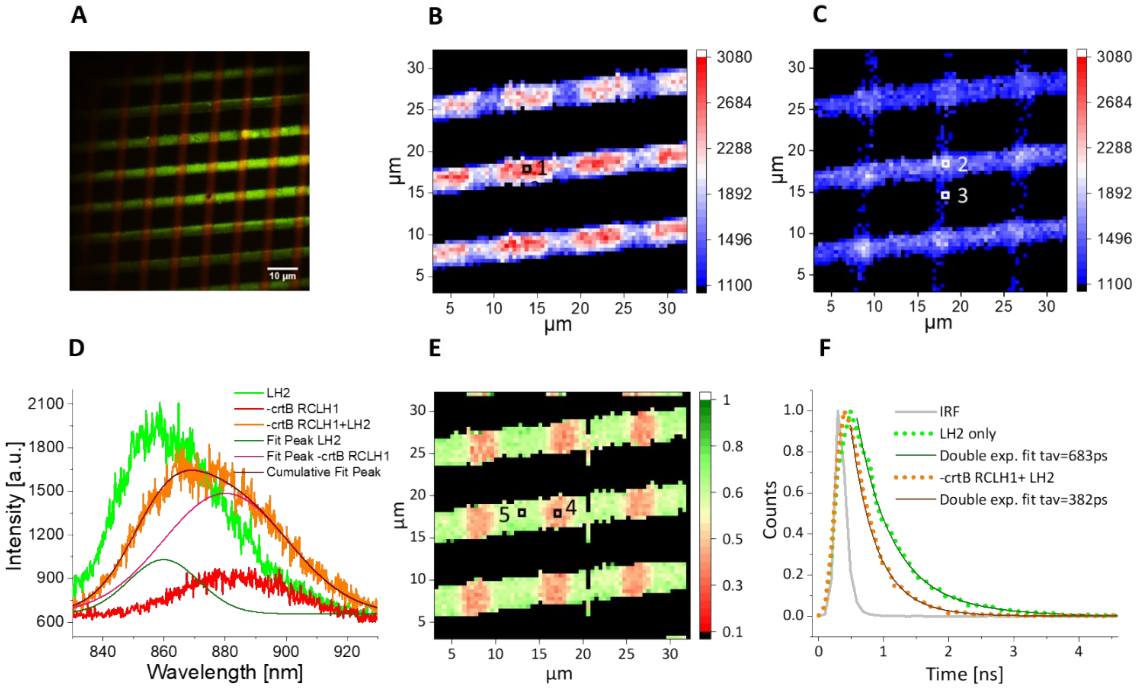

Fig. S2. Spectral and lifetime fluorescence data of cross-patterned LH2 and *ΔcrtB* RCLH1 complexes on a functionalised glass substrate obtained 60 days after the sample preparation showing a long-term stability of the cross-patterned LH2 and *ΔcrtB* RCLH1 complexes. The sample was sealed in Argon protective atmosphere and stored at 4°C. A - False colour fluorescence image (470 nm wide field excitation) showing the LH2 (green) and *ΔcrtB* RCLH1 (red) lines, filtered by 857/30 nm and 900/32 nm bandpass filters, respectively. B - Spectral map showing the emission intensity at 860 nm (LH2 emission); the excitation source is a 485 nm pulsed laser, scan size 32 µm. C – Simultaneously acquired spectral map showing the emission intensity at 890 nm (*ΔcrtB* RCLH1 emission), scan size 32 µm. **D** – Individual emission spectra recorded in the pixels of the images in panels A and B marked with 1 (LH2 only, green line), 2 (cross-over area, orange line) and 3 (*ΔcrtB* RCLH1 only, red line), respectively. The spectral deconvolution shows a clear drop in the LH2 emission (olive peak fit) and an increase in the *ΔcrtB* RCLH1 emission (pink peak fit), compared to the LH2 emission and the *ΔcrtB* RCLH1 emission outside the cross-over area. E- Intensity-averaged lifetime image obtained at 485nm excitation and 857nm emission (LH2 emission), clearly showing a decrease in the lifetime in the cross-over areas, where the two complexes are in close proximity, scan size 32 µm. F – Individual decay curves recorded in the pixels of the lifetime image in panel E marked with 4 (orange, average lifetime of 382 ps) and 5 (green, average lifetime of 683 ps), respectively.