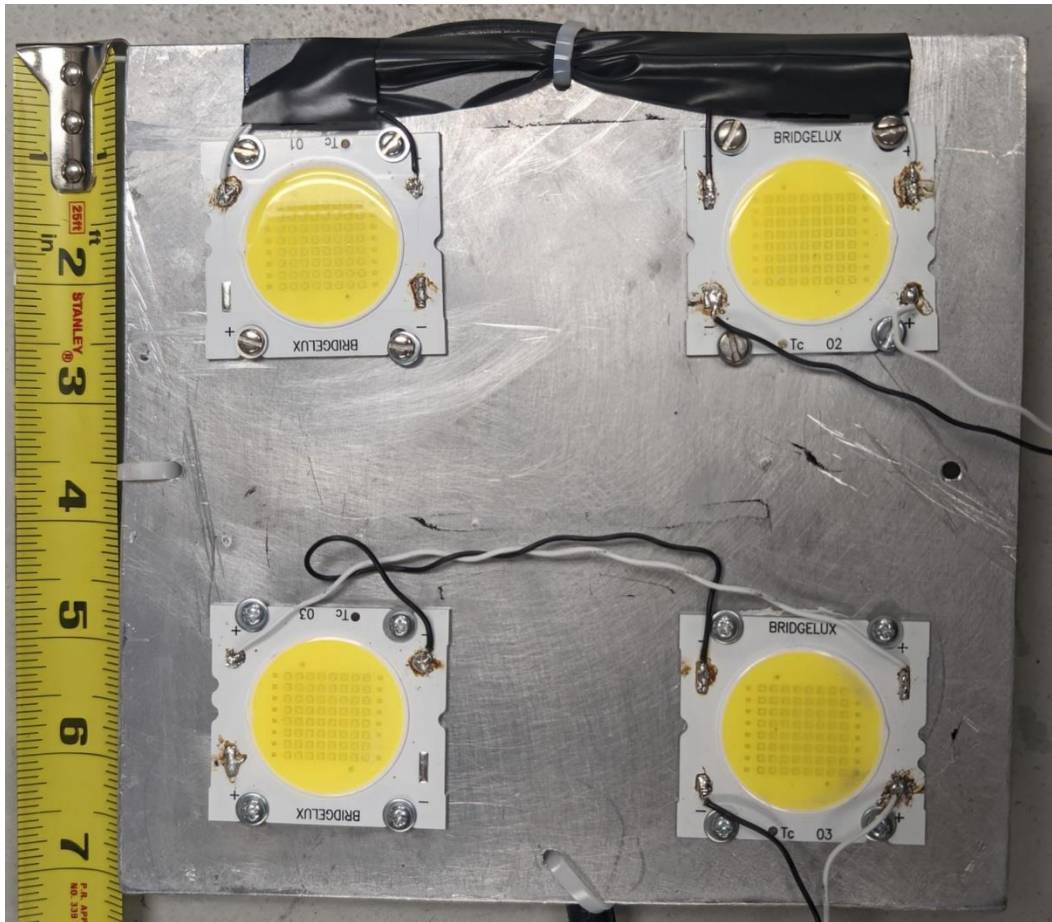
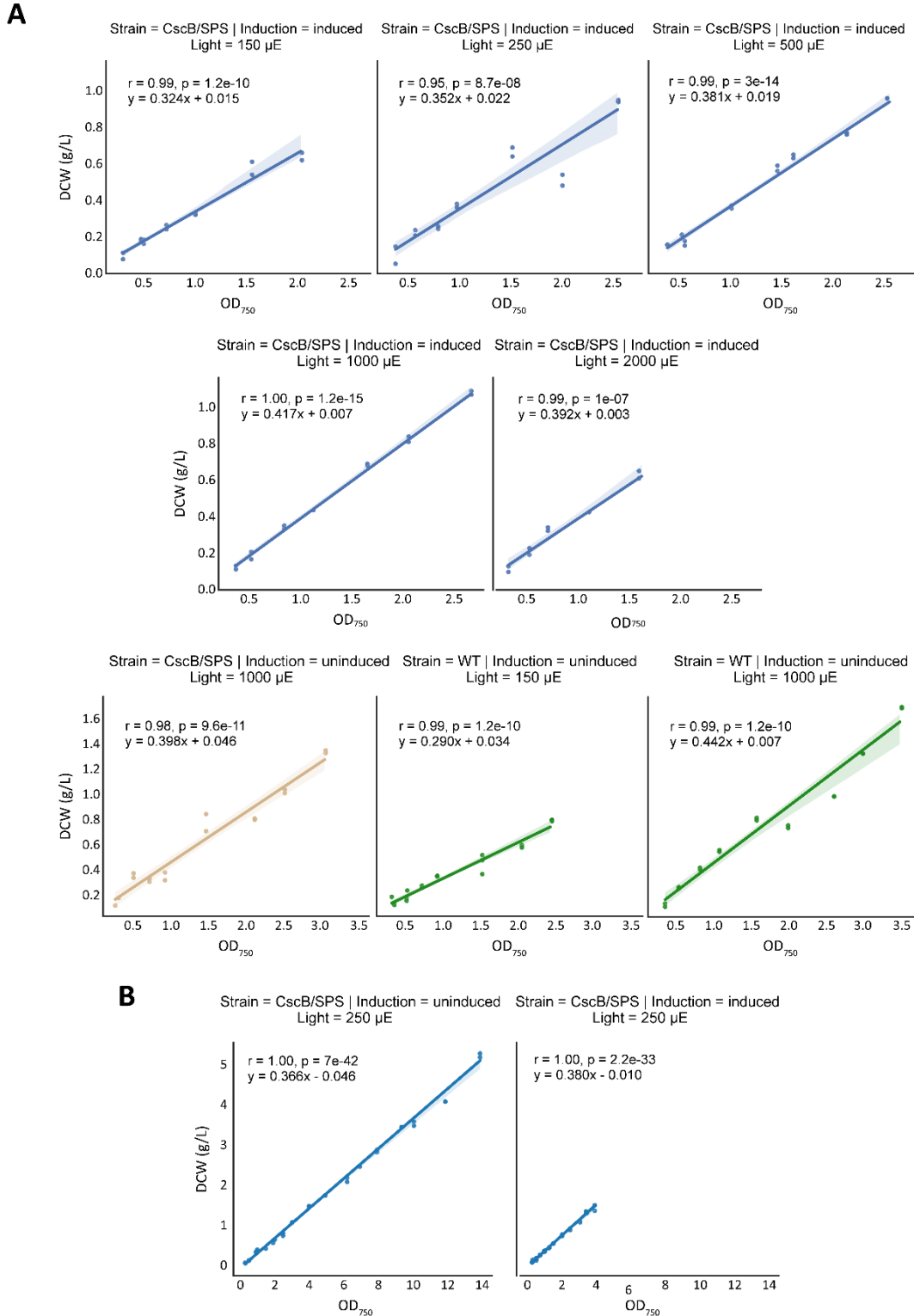
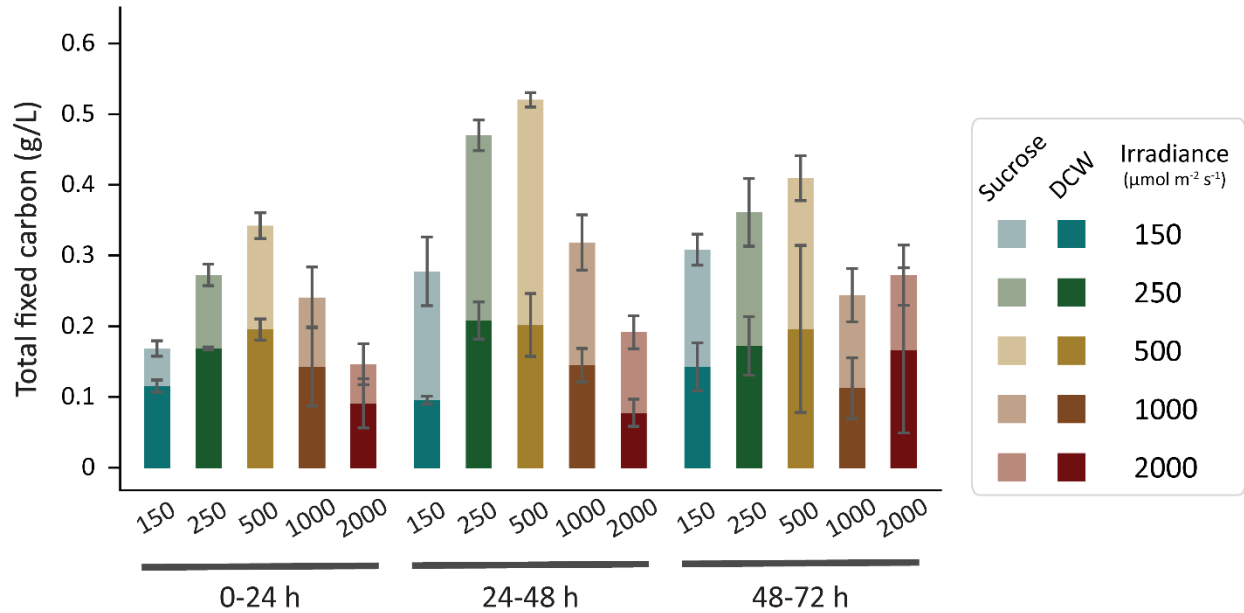


*Supplementary Material**Supplementary Figures*

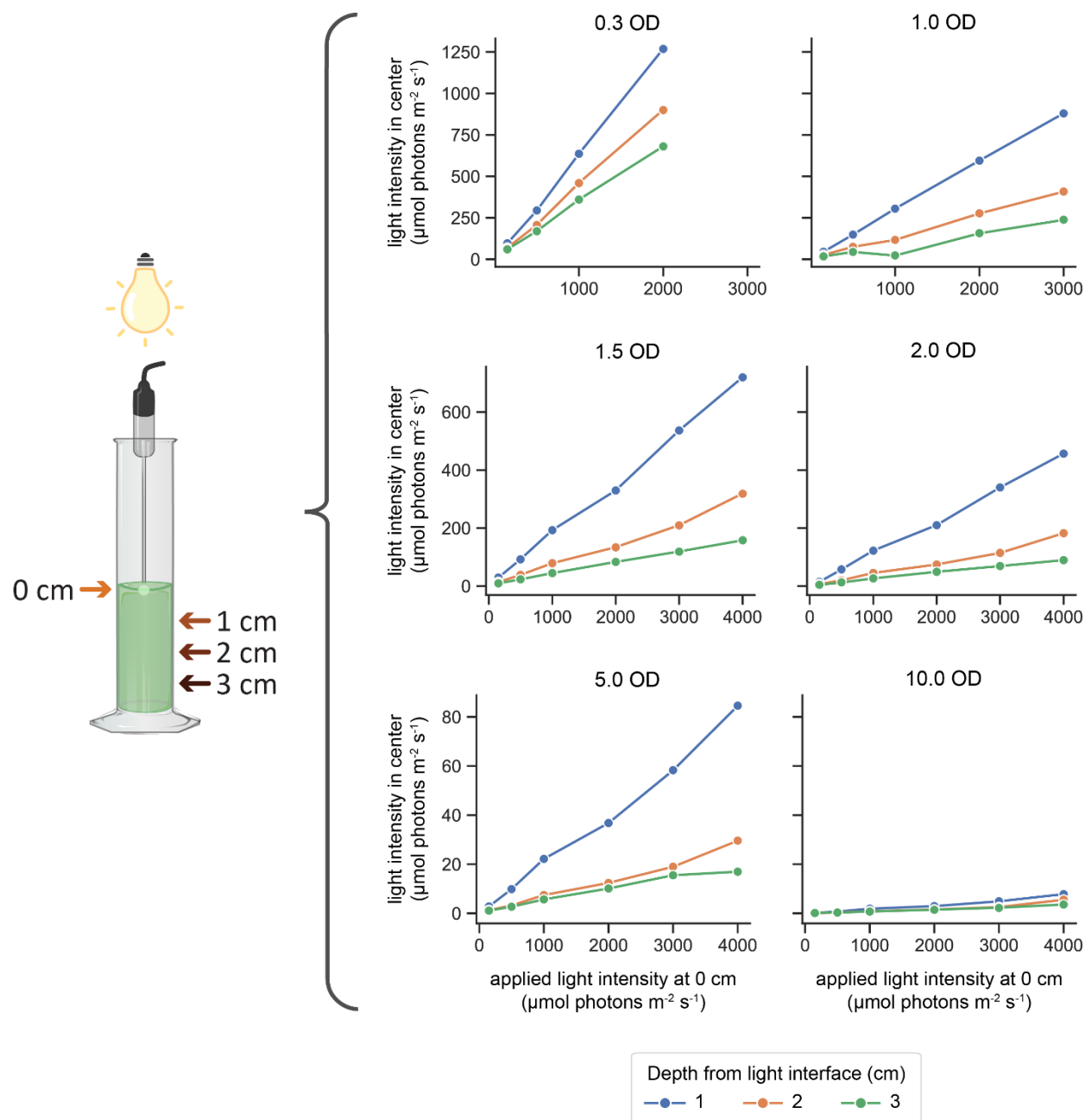
**Supplementary Figure 1.** Custom lighting array consisting of four COB LED lights (BXRA-56C5300-H, Bridgelux, USA) mounted on an aluminum panel two inches apart and connected to a power supply (LS35-24, TDK-Lambda, Japan). The panel was attached to a ring clamp, and the clamp fastened to a ring stand. Light intensity can be set by adjusting the distance of the panel to the HDC, or by modulating the voltage of the power supply.



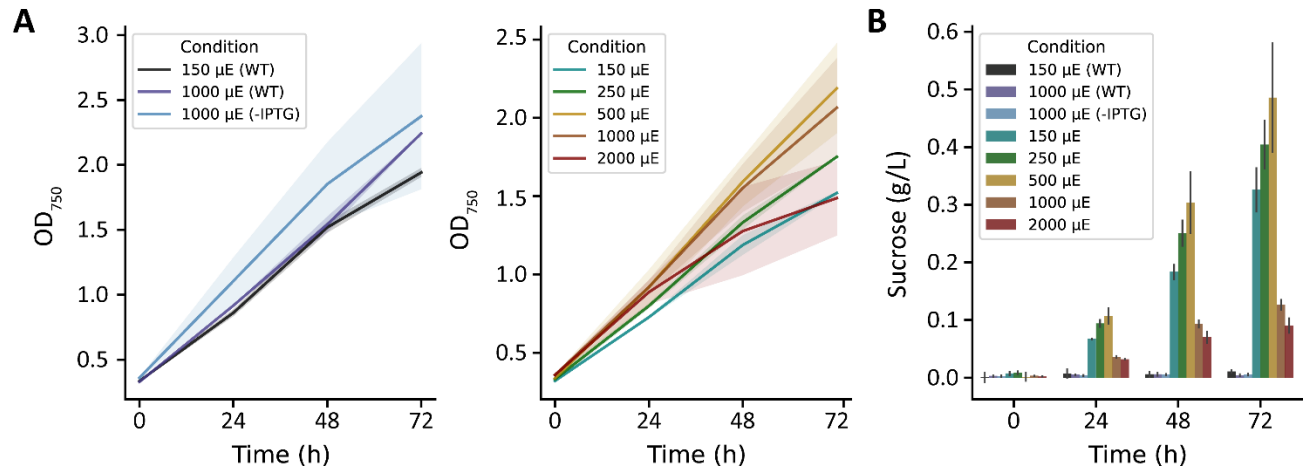
**Supplementary Figure 2.** Relationship between dry cell weight (DCW, g/L) and OD<sub>750</sub> in different growth conditions and cultivators. **(A)** WT, and uninduced and induced *cscB/sps* cultured in the MC-1000 under various light intensities. **(B)** Uninduced and induced *cscB/sps* grown in the CellDEG HDC system with 250  $\mu$ mol photons  $m^{-2} s^{-1}$  and 2% CO<sub>2</sub>.



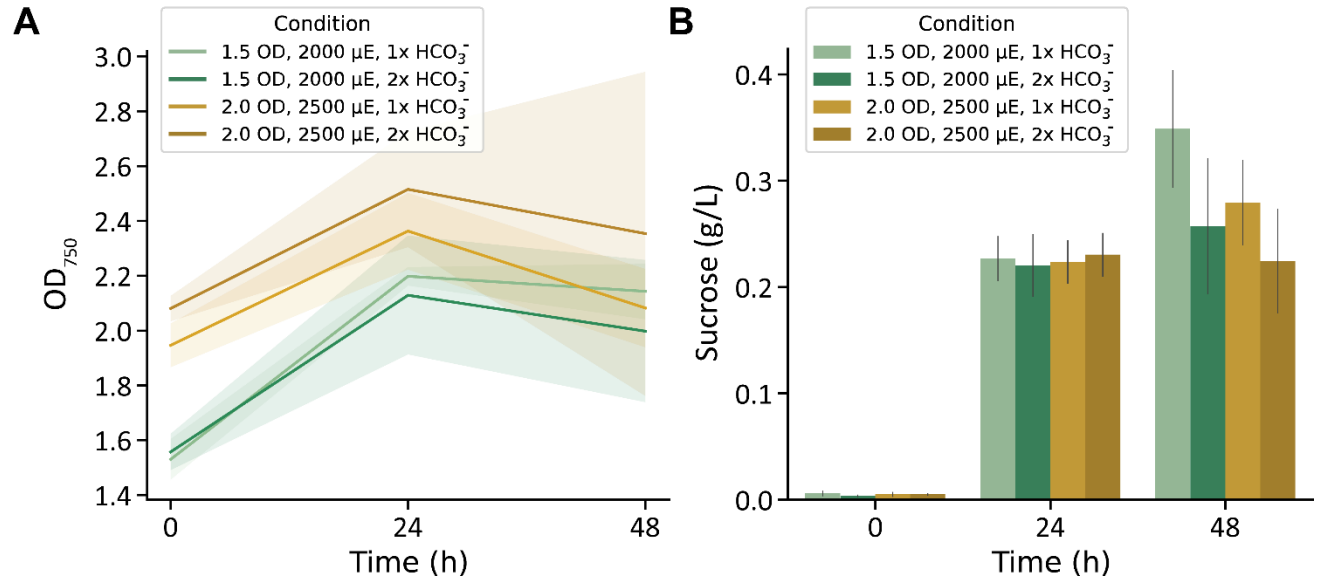
**Supplementary Figure 3.** Total fixed carbon as shown by sucrose and dry cell weight accumulated per day in cultures grown in the MC-1000 under varying irradiances. Error bars denote standard deviation.



**Supplementary Figure 4.** Light perceived in the center of a culture at varying  $\text{OD}_{750}$ , distance from the light interface, and irradiance. Measurements are averaged values from a 15-second interval.



**Supplementary Figure 5.** Growth and sucrose production of WT and *cscB/sps*-expressing *S. elongatus* grown in the MC-1000 under various light intensities and 0 mM  $\text{HCO}_3^-$ . **(A)** OD<sub>750</sub> and **(B)** sucrose production of cultures. Error bars denote standard deviation.



**Supplementary Figure 6.** (A) Growth as OD<sub>750</sub> and (B) sucrose production of *cscB/sps*-expressing *S. elongatus* of cultures started at high cell densities (1.5 and 2 OD<sub>750</sub>). Error bars denote standard deviation.