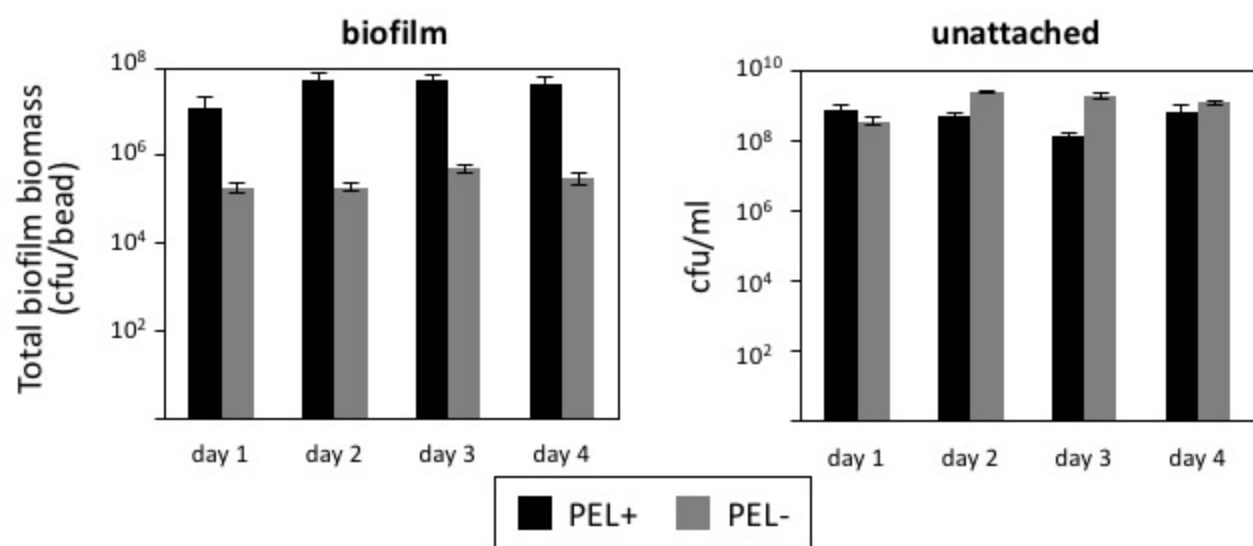
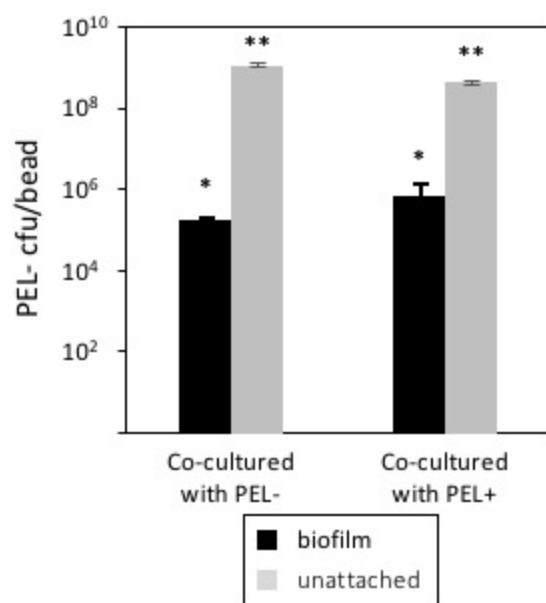
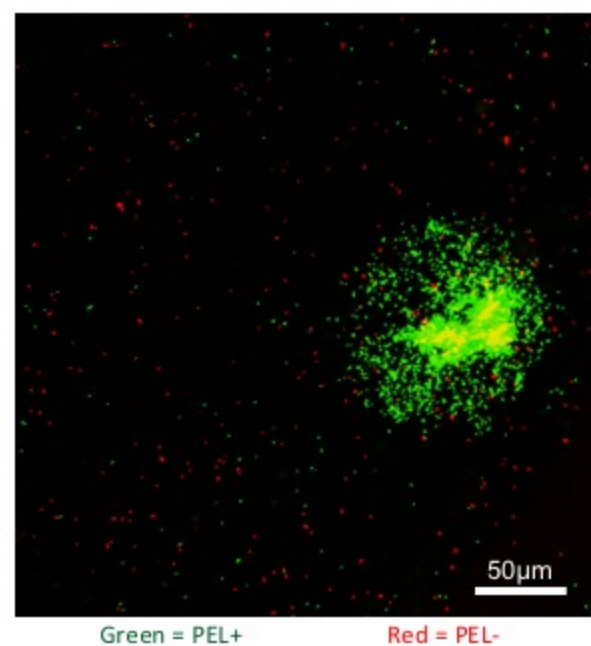
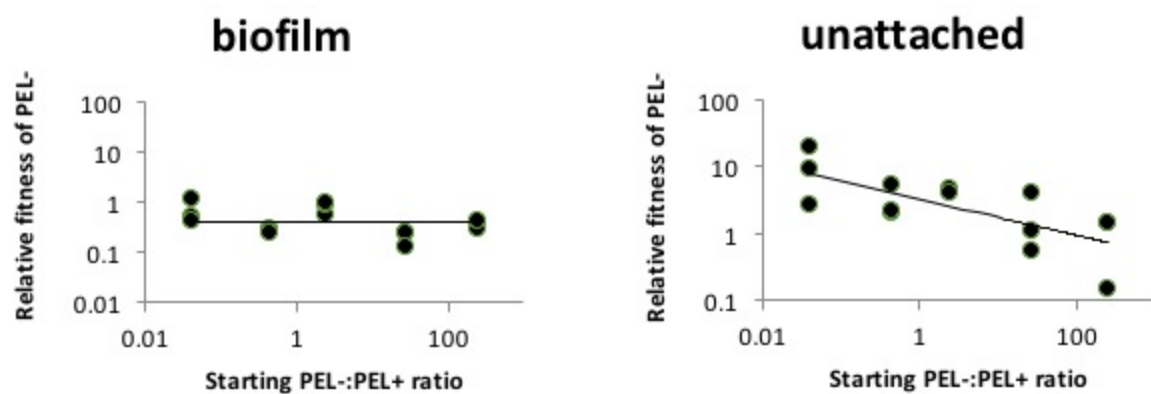


A**B****C****D**

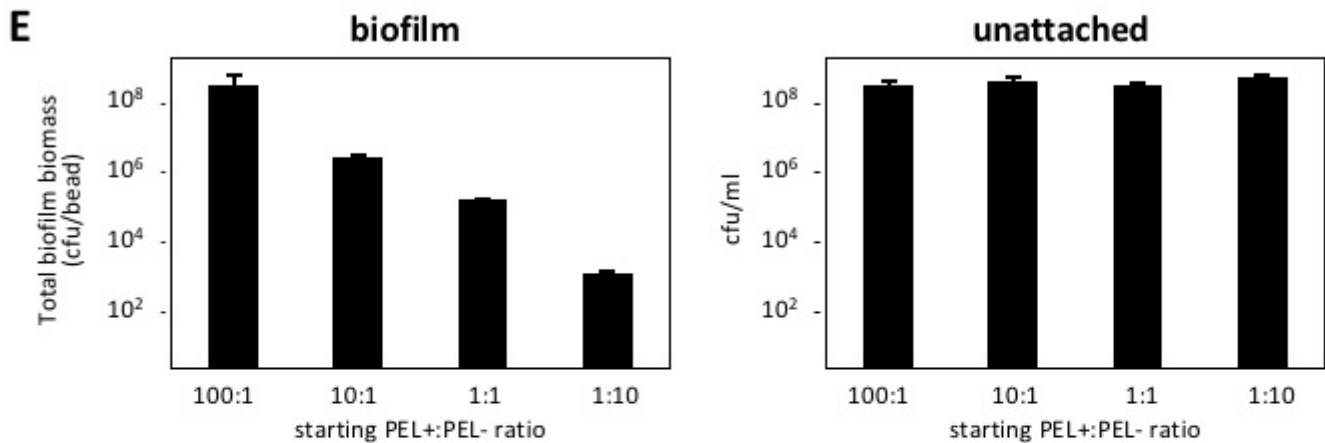


FIG S6 PEL polysaccharides are private goods. (A) Similar to PSL (Fig. 1a), PEL- strain is significantly defective in biofilm formation compared to PEL+ ($F_{(1,24)} = 27.3, p < 0.0001, n = 4$), but no major differences are seen between their growths in the unattached fractions ($F_{(1,24)} = 46.56, p < 0.0001, n = 4$). (B) Unlike PSL, co-cultures of PEL- strains with PEL+ strains do not increase the amount of PEL- strains in neither biofilm nor unattached populations, signifying the unavailability of PEL polysaccharides to non-producing cells. * and ** $p > 0.02$. (C) Confocal micrograph image of surface attached populations of PEL-/PEL+ 1:1 co-cultures. PEL- cells (red) do not co-aggregate with PEL+ cells (green). (D) There is no frequency-dependent fitness changes for PEL-/PEL+ co-cultured biofilm ($t(13) = -0.802, p = 0.4371$), and the relative fitness is consistently slightly below 1, indicating a steady disadvantage of not expressing PEL in the biofilm. There is a frequency-dependent fitness changes in the unattached population ($t(13) = -1.435, p = 0.175$), perhaps caused by complex regulatory system of PEL and the involvement of quorum sensing⁸. (E) Due to PEL not socially affecting co-culture communities, there is a steady decline of biofilm biomass as PEL+ becomes rarer ($F_{(1,8)} = 1, p = 0.441099, n = 3$), but no change is seen in the maximum cell numbers in the unattached population ($F_{(1,8)} = 1.46, p = 0.296592, n = 3$) regardless of the starting ratios of the strains.