

Electronic supplementary information (ESI)

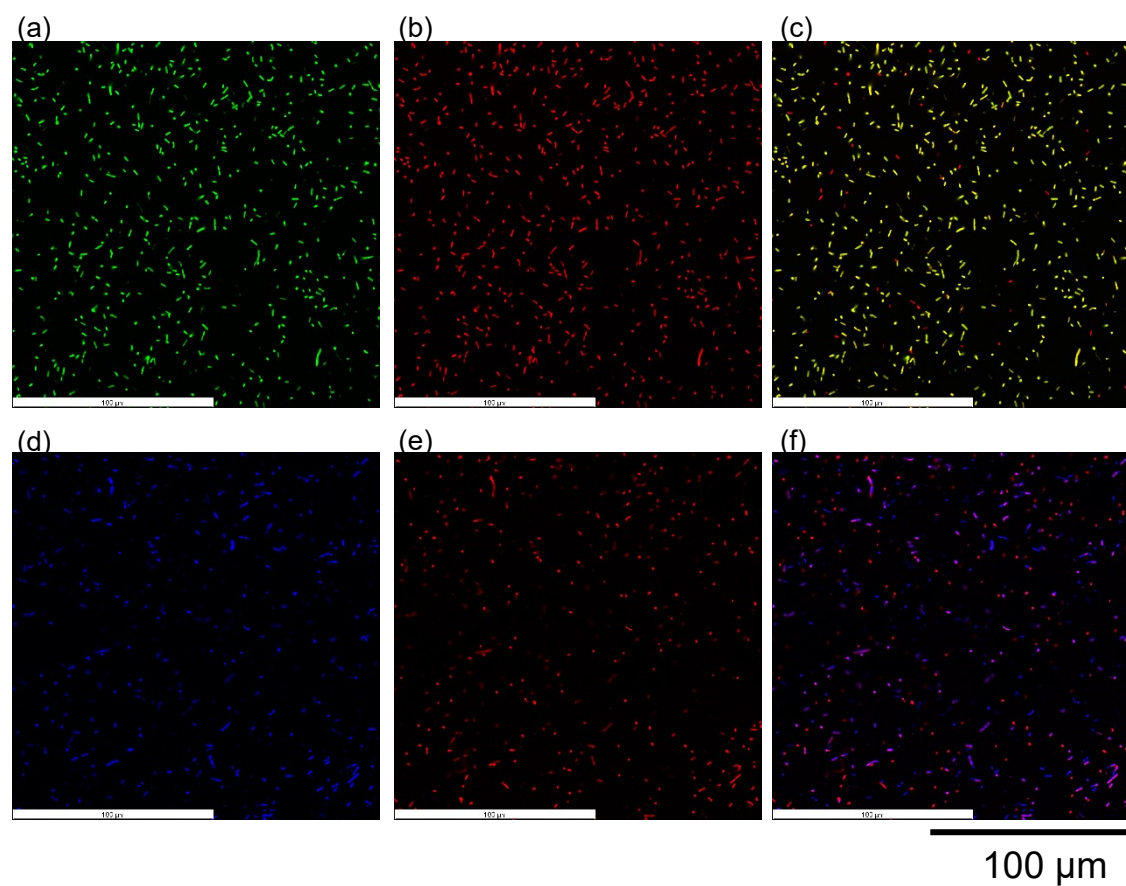


Figure S1. Multicolor confocal fluorescence microscope images of *L. plantarum* and *E. coli* in co-culture on the flat scaffold stained with (a) acridine orange (AO) and (b) SYTO85, respectively, as well as (c) the merged image. Because the wavelengths are close to each other, the colors sometimes overlap, making it difficult to distinguish between the species. To further separate the wavelengths, *L. plantarum* and *E. coli* were stained with Hoechst 33342 (d) and SYTO85 (e), respectively. (f) shows the merged image of (d) and (e).

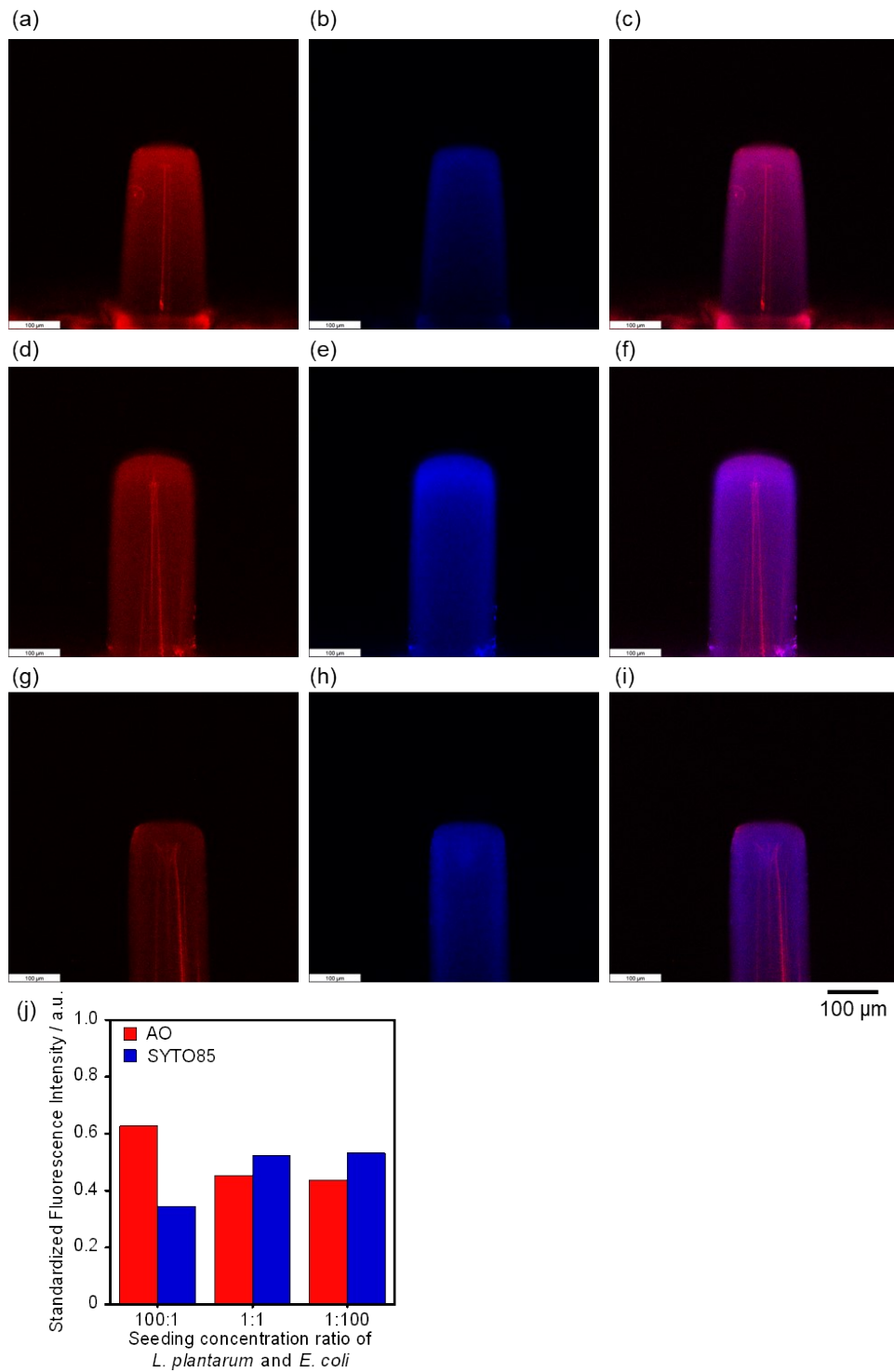


Figure S2. Multicolor confocal fluorescence microscope images of *L. plantarum* and *E. coli* in co-culture on the villus-like 3D scaffold with (a, d, g) acridine orange (AO) and (b, e, h) SYTO85, respectively, as well as (c, f, i) the merged image. The seeding concentration ratio of *L. plantarum* and *E. coli* was (a, b, c) 100:1, (d, e, f) 1:1, and (g, h, i) 1:100.

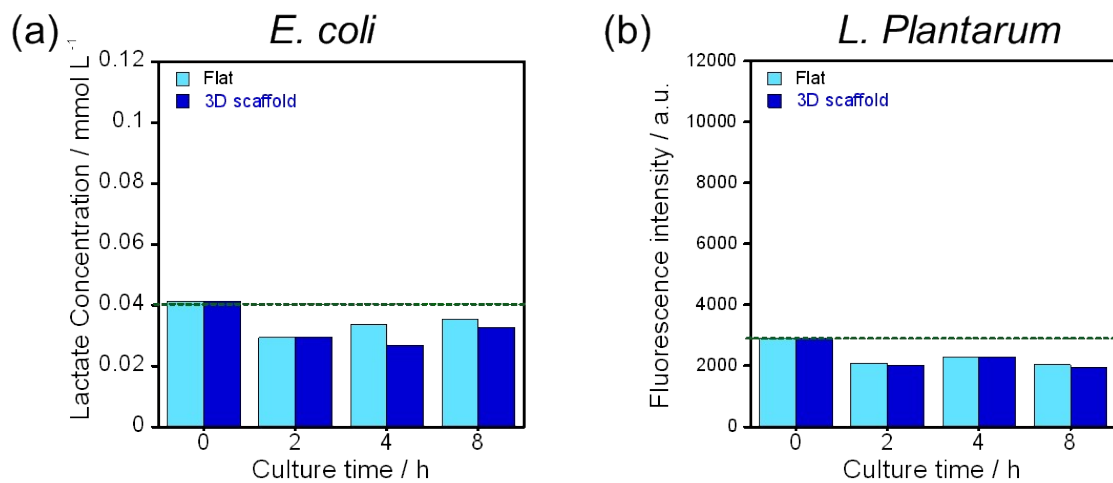


Figure S3. Crossover study of *E. coli* and *L. plantarum* metabolic activities. Effluents of *E. coli* (a) and *L. plantarum* (b) under the dynamic perfusion operation in flat (light blue) and 3D scaffold (dark blue) were analyzed. Concentrations of lactic acid (a) and fluorescence intensity of 4-methylumbelliferone (b) produced by β -glucuronidase (GUS) digestion of the substrate, 4-Methylumbelliferyl β -D-Glucuronide Hydrate, for quantitative measurements of *E. coli* and *L. plantarum* metabolic activities, respectively. The values of negative controls which contain only the medium were in green broken lines.