**Supplementary Information**

*Supplementary Figure 1*: Raw images of cell-laden hydrogel after 48 hours of growth showing (a) chlorophyll fluorescence (b) BODIPY 493/503 stained lipid bodies
Supplementary Figure 2: Fluorescein characterization of gradient generator at approximately 100hrs. Note that the diffusion coefficient of fluorescein is approximately a quarter of that of ammonium.

Supplementary Figure 3: Light Intensity dependence of pixel value. This curve is used to select the appropriate pixel value to obtain the desired light intensity.
Calculations for diffusion time:

\[ t \approx \frac{x^2}{2D} = \frac{(20 \text{ cm})^2}{2 \left( \frac{\sim 2 \text{ cm}^2 \times 10^{-5}}{s} \right)} \approx 28 \text{ hours} \]

**Supplementary Figure 4**: Smoothed growth data.