

Supplementary Information

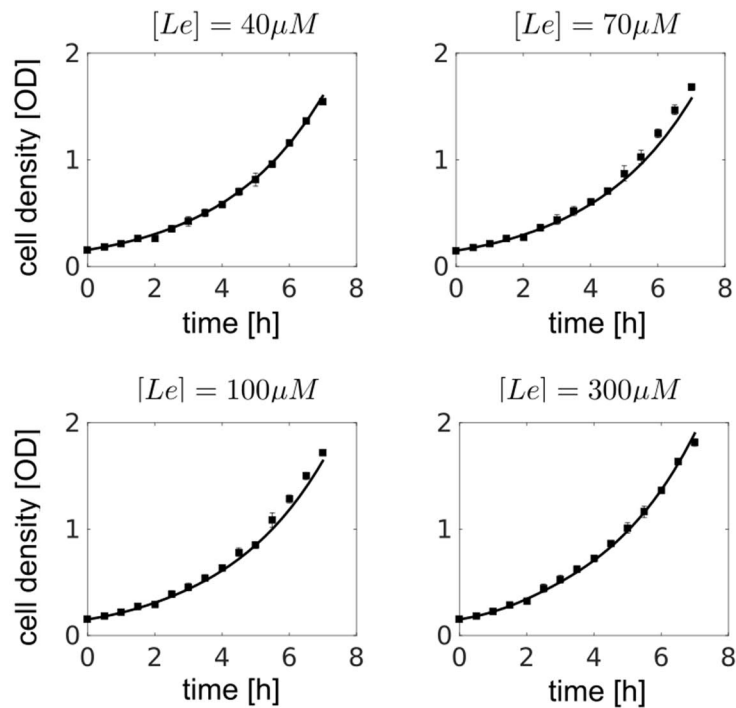


Fig. S1 Parameter estimation. Cells grown on succinate are induced with increasing amounts of lactose and the transient change in cell density have been measured (symbols) together with LacZ activity (cf. Fig. 2). Error bars represent sd from 3 independent experiments. The solid lines represent the best (least square) fit of the model equations (Eqs. 1-6). The corresponding parameter values are shown in Table 2.

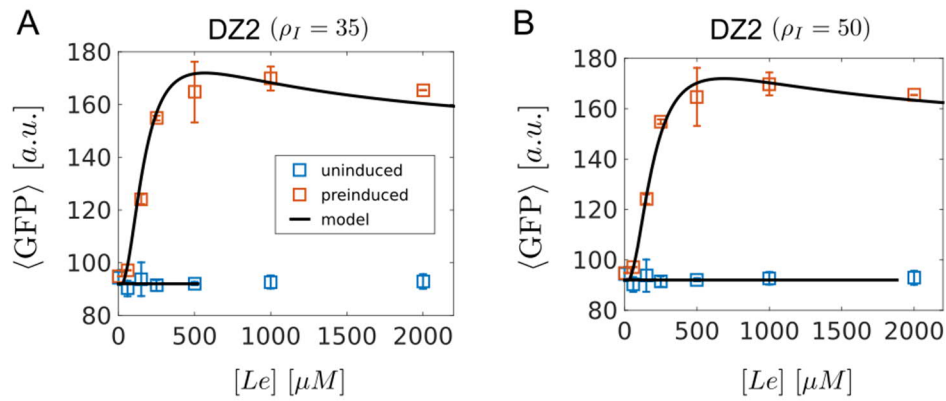


Fig. S2: Alternative fits of the mean GFP expression levels for induction of DZ2. Symbols have the same meaning as in Fig. 5B. Solid lines are model fits for a lower (A) and a higher (B) LacI overexpression factor compared to that in Fig. 5B. While the upper branch is equally well described by both stimulus-response curves the extent of the bistable region (lower solid line) increases with the LacI overexpression factor ρ_I .

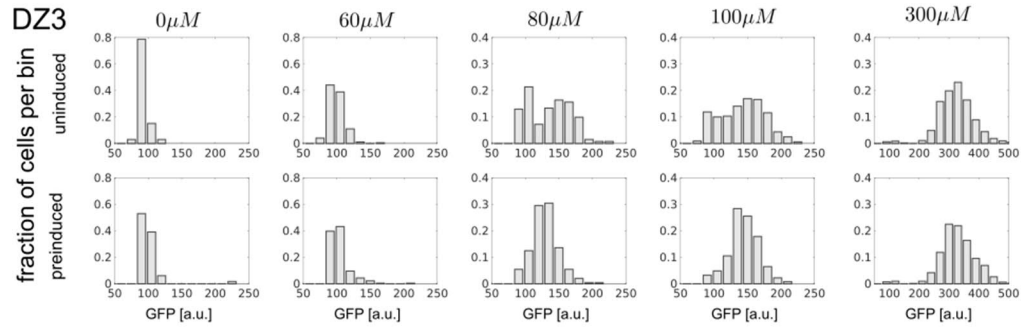


Fig. S3 Fluorescence distributions of DZ3 after 17h incubation with lactose. Distributions for uninduced cells appear bimodal in the range $[Le] = 80 - 100\mu M$. In contrast, distributions for preinduced cells are unimodal at all concentrations tested. Uninduced (preinduced) cells were grown in the presence of 0.2% succinate (3mM lactose) before they were resuspended into medium with defined lactose concentration as indicated above the panel.

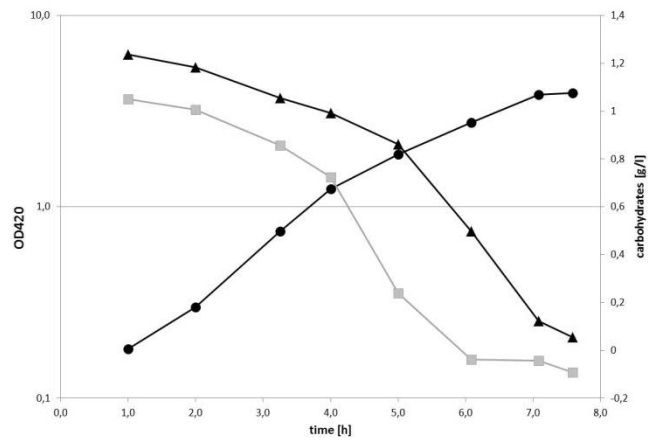


Fig. S4: Lactose and succinate consumption of AM1. Strain AM1 was grown in minimal medium with lactose plus succinate as sole carbon sources. As can be seen both carbohydrates are taken up in parallel.

Table S1: Constants for unit conversion

	molar mass	value	mass fraction	value
lactose allolactose	m_L m_A	$342,29 \frac{g_{L/A}}{mol}$	mp_L mp_A	$1.89 \cdot 10^{-9} \frac{g_{L/A}}{gdw} \frac{1}{mlc_{L/A}}$
LacY	m_Y	$46.517 \frac{g_Y}{mol}$	mp_Y	$2.57 \cdot 10^{-7} \frac{g_Y}{gdw} \frac{1}{mlc_Y}$
LacZ	m_Z	$464.000 \frac{g_Z}{mol}$	mp_Z	$2.57 \cdot 10^{-6} \frac{g_Z}{gdw} \frac{1}{mlc_Z}$

$mp_X = m_X / (N_A \cdot gdw)$ denotes relative mass of a single molecule of species $X = L, A, Y, Z$ with respect to the total cell dry weight. $N_A = 6.022 \cdot 10^{23}$ particles /mol. mlc_X denotes number of molecules of species X.

Table S2: Maximal growth rates of AM1 and DZ1 on lactose, succinate and lactose plus succinate.

strain	μ_{Lac} [h ⁻¹]	μ_{Suc} [h ⁻¹]	$\mu_{Lac+Suc}$ [h ⁻¹]
AM1	0.57	0.42	0.64
DZ2	0.43	0.39	0.47

Growth assays were performed in minimal medium containing 2g/l of the respective carbon source(s).