

**Figure S1. After 6 hours, expression of GFP and mCherry reach a level of expression and noise.** Strain Y197 growing in mid-log phase ( $OD_{600} < 0.5$ ) in SCD + 100nM  $\beta$ -estradiol was measured every 90 minutes. Error bars are standard error of the mean for three biological replicates.

**Figure S2. The PUF3-COX17 negative feedback loop results in a change noise strength but not noise.** Changes in noise strength estimate changes in the number of proteins produced during each transcriptional burst (burst size, gamma fit parameter B) while  $1/\text{noise}$  estimates the frequency of these transcriptional bursts (burst frequency, gamma fit parameter A). Shown are noise and noise strength graphed against either expression or B-estradiol, for both GFP and mCherry. GFP behaves similarly in all three strains. mCherry noise behaves similarly for both Puf3 strains. However, noise strength shows large induction-dependent differences between PUF3-PUF3<sub>3'UTR</sub> and PUF3-COX17<sub>3'UTR</sub>, suggesting that the negative feedback loop affects burst size. **(A,B)** Data for 8 hours of growth in SCD+ $\beta$ -estradiol. **(C)** Data for 12 hours of growth in SCD+ $\beta$ -estradiol.

**Figure S3. The PUB1 positive feedback loop results in higher noise after 12 hours of growth in SCD+ $\beta$ -estradiol.** Y197 and *pub1::Z<sub>3</sub>EVpr-mCherry-Pub1* were grown in SCD+ $\beta$ -estradiol for 12 hours in mid-log phase, and GFP and mCherry were measured using flow cytometry. Shown are all points from three biological replicates. Similar to the result after 8 hours, *pub1::Z<sub>3</sub>EVpr-mCherry-Pub1* always has higher noise than Y197. **(A)** Z<sub>3</sub>EVpr-GFP **(B)**Z<sub>3</sub>EVpr-mCherry **(C)** Representative Z<sub>3</sub>EVpr-GFP distributions.