Supporting Information

Coordinating cell polarization and morphogenesis through mechanical feedback

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**Physical parameters for course grained model.** These values are part of the dimensionless parameters of the course grained model.

| Parameter | Description                                      | Value                                      |
|-----------|--------------------------------------------------|--------------------------------------------|
| $P$       | Turgor pressure of budding yeast                 | $0.6 \pm 0.2 \text{ MPa}$ [1]             |
| $\rho_w$  | Density of 1,3-β glucans in cell wall            | –                                          |
| $\mu_0$   | Apical viscosity of cell wall                    | –                                          |
| $k_s$     | Rate of new wall synthesis                       | –                                          |
| $\rho_0$  | Membrane concentration of Bni1                   | –                                          |
| $k_D$     | Apical rate of endocytosis                       | $0.02 \pm 0.02 s^{-1}$ [2]                |
|           |                                                  | $0.027 s^{-1}$ [3]                         |
| $k_X$     | Apical rate of exocytosis                        | $0.045 s^{-1}$ [3]                         |
| $k_R$     | Recruitment rate of Bni1 by Cdc42                | $1.6 \times 10^{-6} s^{-1}$ [4]           |
| $k_I$     | Inactivation rate of Bni1                        | $0.018 s^{-1}$ [4]                         |
| $D$       | Membrane diffusion constant of Cdc42             | $0.0053 \mu m^2 s^{-1}$ [4]               |
Spatial stochastic polarization model details and parameter values  Reactions for the spatial stochastic model of Cdc42 and actin polarization coupled to cell wall mechanics presented in the main text. Species with a subscript ‘m’ (e.g. $Cdc42GDP_m$) refer to membrane bound species and species with a subscript ‘c’ (e.g. $Cdc42GDP_c$) refer to cytoplasmic species.

\[
\begin{align*}
Cdc42GDP_c & \overset{\beta_2}{\rightarrow} Cdc42GDP_m \\
Cdc42GDP_m & \overset{\beta_3}{\rightarrow} Cdc42GDP_c \\
Cdc42GDP_c + Actin_m & \overset{\beta_1}{\rightarrow} Cdc42GDP_m + Actin_m \\
Cdc42GDP_m + Actin_m & \overset{\alpha_1}{\rightarrow} Cdc42GTP_m + Actin_m \\
Cdc42GTP_m & \overset{\alpha_2}{\rightarrow} Cdc42GDP_m \\
Actin_c + Cdc42GTP_m & \overset{A_{on}}{\rightarrow} Actin_m + Cdc42GTP_m \\
Actin_c & \overset{A_{CWI} [\dot{\epsilon}_s + \dot{\epsilon}_\phi]}{\rightarrow} Actin_m \\
Actin_m & \overset{A_{off}}{\rightarrow} Actin_c
\end{align*}
\]

| Parameter | Value          | Description                      | Source |
|-----------|----------------|----------------------------------|--------|
| $D_m$     | 0.0053 $\mu m^2 s^{-1}$ | Diffusion constant on membrane | [4]    |
| $D_a$     | 0.0 $\mu m^2 s^{-1}$  | No actin diffusion on membrane   | [4]    |
| $D_c$     | 10 $\mu m^2 s^{-1}$   | Diffusion constant in cytoplasm  | [5]    |
| $R$       | 2 $\mu m$            | Radius of cell                   | [4]    |
| $N_C$     | 3000                 | Total number of Cdc42 molecules  | [6]    |
| $N_A$     | 40                   | Total number of Actin cables     | [4]    |
| $\alpha_1$| 0.2 $\mu m^2 s^{-1}$ | Activation of Cdc42 by Cdc24     | [6]    |
| $\alpha_2$| 1 $s^{-1}$           | Deactivation of Cdc42            | [6]    |
| $\beta_1$ | 0.266 $\mu m^3 s^{-1}$ | Activation of Cdc42 by Cdc24    | [6]    |
| $\beta_2$ | 0.28 $\mu m s^{-1}$  | Attachment of Cdc42 to membrane  | [6]    |
| $\beta_3$ | 1 $s^{-1}$           | Detachment of Cdc42 from membrane| [6]    |
| $A_{on}$  | 0.197 $\mu m^3 s^{-1}$ | Recruitment of Actin by Bni1     | [4]    |
| $A_{off}$ | 2.70 $s^{-1}$        | Detachment of Actin from membrane| [4]    |
| $A_{CWI}$ | varied               | Cooperativity of mechanical feedback|        |
| $\dot{\epsilon}_s + \dot{\epsilon}_\phi$ | varied | Cell wall strain rates          |        |
References

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