(26).

Hierarchical Morphogenic Transitions and Fractal-Order Wrinkling Direct the Standard Mode of *V. cholerae* Pellicle Formation at a Fluid–Fluid Interface

D_{600} = 0.005 0.1 (B)

(, g. 1*A*, 1).

(27–29).

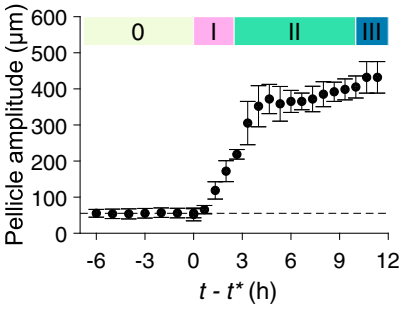
(6 48 , 2).

( ) (g. 1*B* *I A* , g. 1). (g. 1*C*,) – (g. 1*D*). (g. 1*C*,), (g. 1*C*, , g. 1*E*). (g , g. 1*F*). (g , g. 1*G*).

(30, 31).

Pellicle Morphogenesis Begins with Microcolony Growth and the Onset of Primary Wrinkling Instabilities

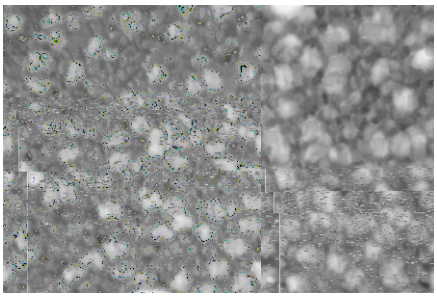
73385205416 298093( ) 409.3785 2.9.7.)-42.737-3 412 g 1(10)-35(2 ,03224/ 105(678459.04244132822 (0.4990) .0108/ 8 6 3008 6 346277322

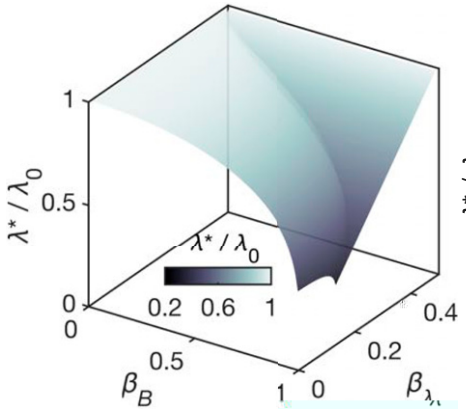


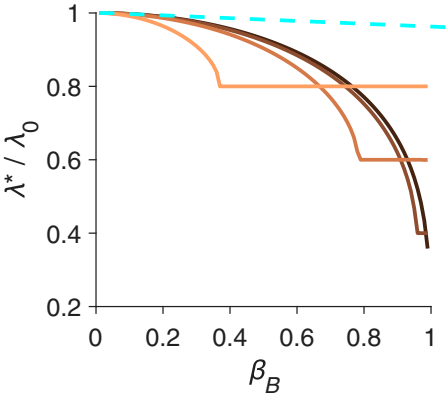
A Cascade of Fractal Wrinkles Marks *V. cholerae* Pellicle Maturation

2D (g. 1F 2H) (20, 23, 25) (10). (20). . A (g. 1G 3A). A (g. 3B). 1.64 (g. 3C), (g) φ $\varphi = \lambda / \lambda_{+1}$ $\phi = 1.62$

. D (34) g (35). (g. 3D) $\delta = 1.55$, (g. 3E). δ *E*. 1 1.6 (g. 3F). A *B* - (13), (36). A (37), (26).




λ* / λ0
1
0.5
0
0
0.5
1
βB
λ* / λ0
0.2 0.6 1
0.4
0.2
0
βλ*


λ* / λ0
1
0.8
0.6
0.4
0.2
0 0.2 0.4 0.6 0.8 1
βB

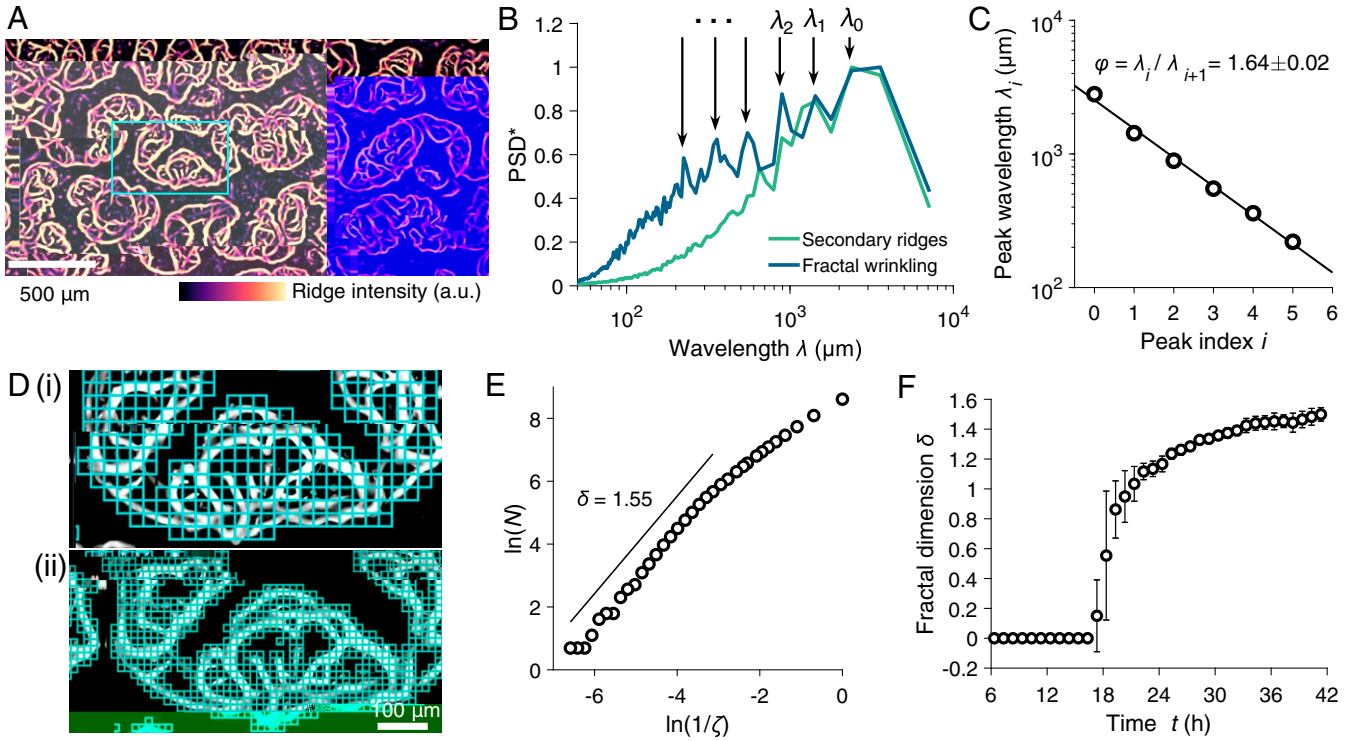


Fig. 3. *V. cholerae* [illegible]

The Memory of the Heterogeneous Microstructure Is Preserved during *V. cholerae* Pellicle Morphogenesis

[illegible]

The Dynamics of *V. cholerae* Pellicle Morphogenesis Are Controlled by Its Initial Microstructure

[illegible]

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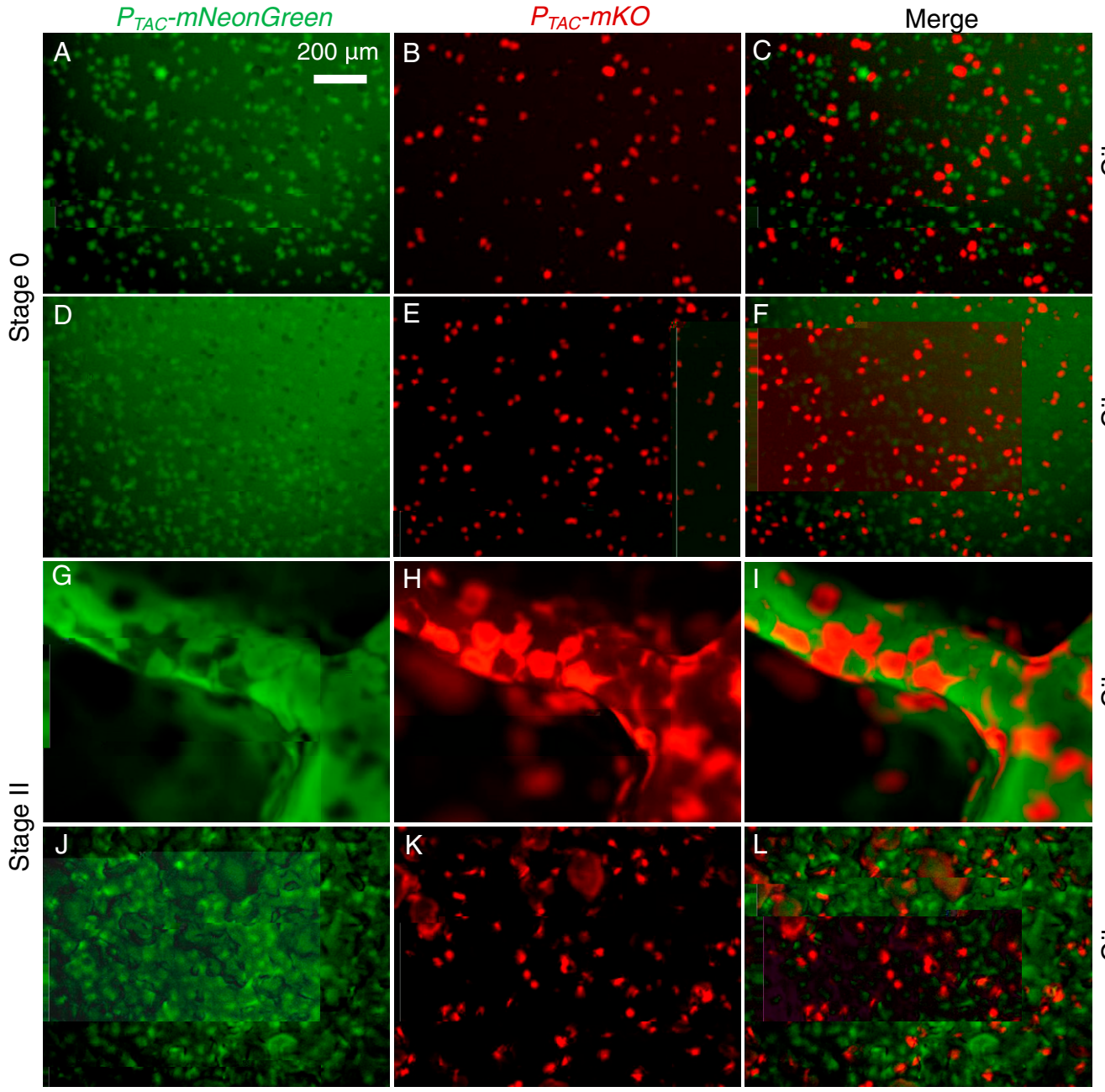

Fig. 4. [illegible] *V cholerae* [illegible] *V cholerae* [illegible] *mNeonGreen* [illegible] *mKO* [illegible] *A–F* [illegible] *V cholerae* [illegible] *A–C* [illegible] *D–F* [illegible] *P_{TAC} mNeonGreen* [illegible] *P_{TAC} mKO* [illegible] *G–L* [illegible] *V cholerae* [illegible] *G–I* [illegible] *J–L* [illegible] µJ

[illegible] (*I A* [illegible] , [illegible] 4*B*). [illegible] ($D_{600} \geq 3$), [illegible] ([illegible]) [illegible] 2D [illegible] . A [illegible] ($D_{600} = 0.05$ [illegible] 3), [illegible] 0 [illegible] ([illegible] 5*D*). A [illegible] ([illegible] 5*C* [illegible] *I A* [illegible] , [illegible] 7). [illegible] $D_{600} \sim 2$, [illegible] ([illegible] 5*C* [illegible] 4). [illegible] ([illegible]).

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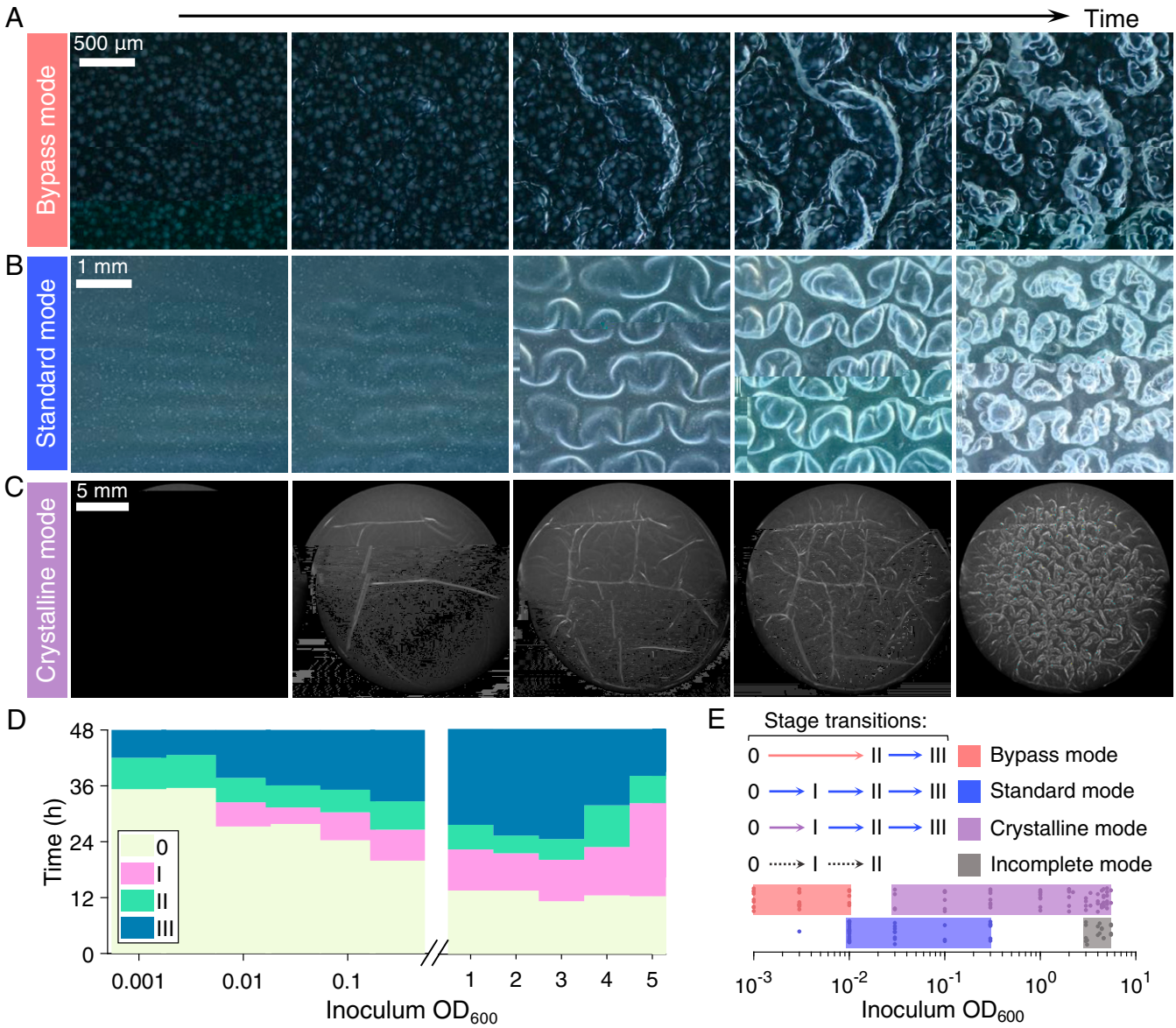

Fig. 5. *V. cholerae*

Conclusion

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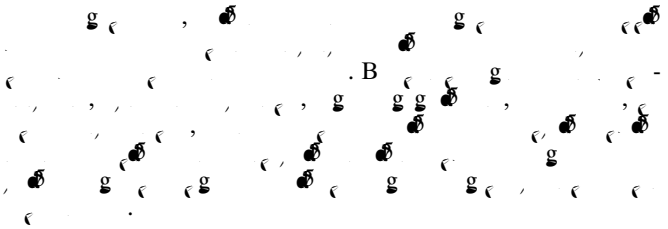

Materials and Methods

Strains and Growth Medium. *V cholerae* *V cholerae* *vpvC* *vpvC* *V cholerae* *vpvC* *V cholerae* *vpvC* Δ*vc1807*::P_{TAC} *mNeonGreen Spec*ʳ *V cholerae* *vpvC* Δ*vc1807*::P_{TAC} *mKO Spec*ʳ

Pellicle Development. *V cholerae*

Stereo Microscopy Imaging.

Image Processing.

Fractal Dimensions of Pellicle Surfaces.

Mathematical Modeling of the Primary Wavelength for a Heterogeneous Pellicle. *V cholerae*

[illegible] $\mathbf{F} = \mathbf{F}\ \mathbf{F}$ [illegible]

$\mathbf{F} = \left[\begin{array}{c} + \epsilon \\ \\ \end{array}\right]$ [illegible] $\epsilon = \epsilon / (+ \epsilon)$ [illegible] ϵ [illegible] $= \mathbf{F}\mathbf{F}^{-}$ [illegible] σ [illegible] $\mathbf{F}$ [illegible] $\Psi(\mathbf{F}) = \frac{G}{}(I - - J) + \frac{G\upsilon}{\upsilon}(J)$ [illegible] G [illegible] $v \approx$ [illegible] $I = (\mathbf{F}^T\mathbf{F})$ [illegible] $J = (\mathbf{F})$ [illegible] V *cholerae* [illegible] $G = G(\boldsymbol{X})$ [illegible]

∇