Electronic Supplementary Material (ESI) for Soft Matter.

Supplementary Information
(A mechanistic understanding of microcolony morphogenesis: Coexistence of mobile and sessile aggregates)

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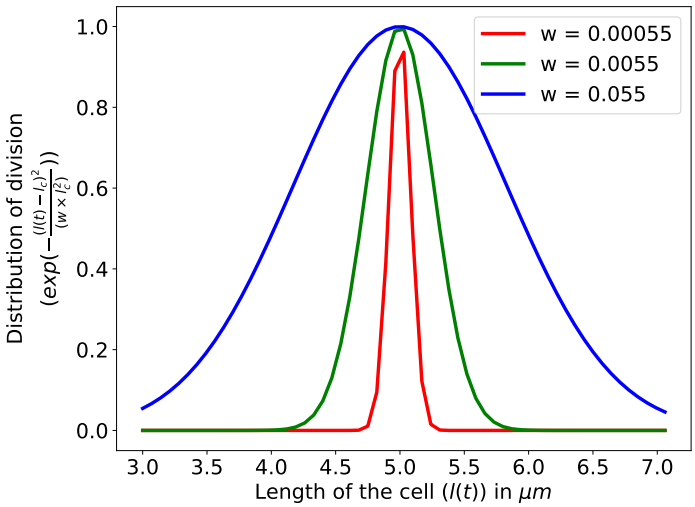

Figure S1 Distribution of division as a function of cell length. For $w = 0.0055$, most of the cells will divide at $l(t) = l_c$, but there is also finite probability for dividing the cells at $l_c > l(t) \lesssim 5.6$ or $4.4 \gtrsim l(t) < l_c$.

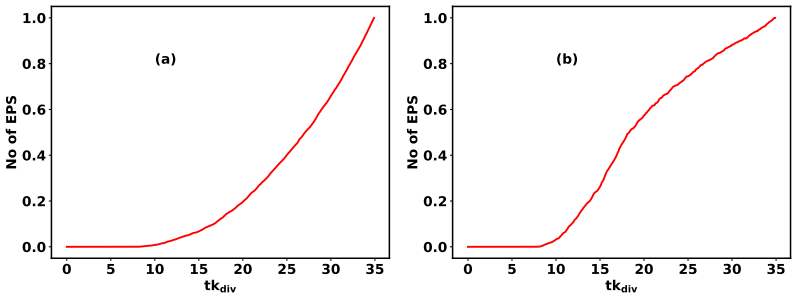

Figure S2 (a) Number of EPS particles as a function of time for (a) the whole colony and (b) the particular circular region, respectively.

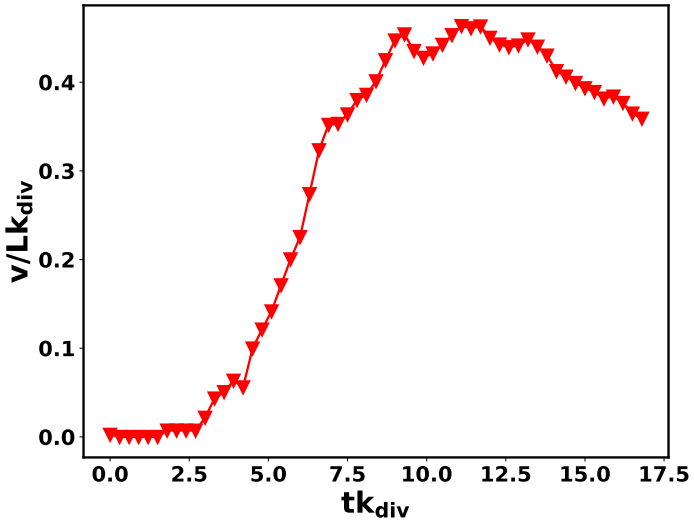

Figure S3 Front speed as a function of time for the motile bacterial colony in absence of the nutrient reservoir.

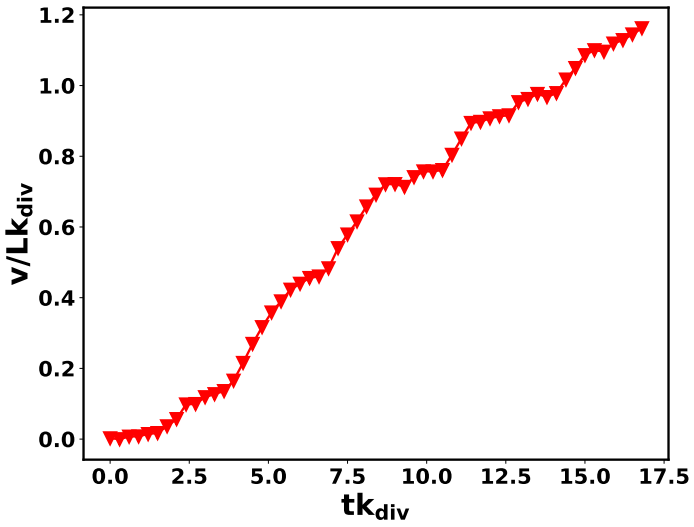

Figure S4 Front speed as a function of time for the non-motile bacterial colony. There are few crests and troughs in the speed profile in some intervals which suggests weak oscillatory nature in the speed.

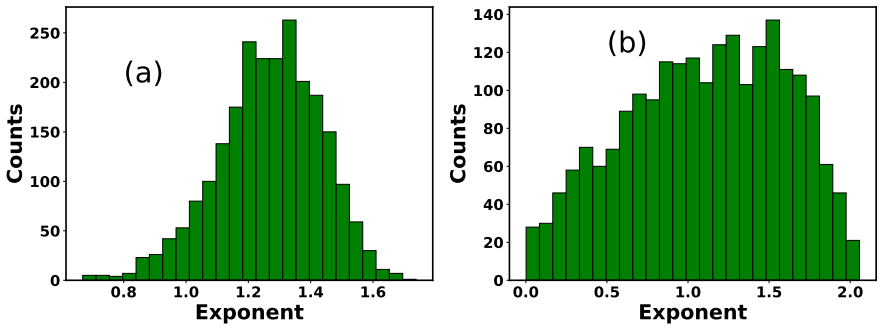

Figure S5 Distribution of MSD exponents of cells in the presence of sticky EPS for a high initial nutrient concentration $C_0 = 10.0 fg.\mu m^3$ for two different lag times: (a) small ($\tau_1 k_{div}$) and (b) large ($\tau_2 k_{div}$), respectively. For both cases more cells are showing sub-diffusion in two time scales in comparison with a low initial nutrient concentration $C_0 = 3.0 fg.\mu m^3$.

Table S1 Parameters and constants used in our agent-based model

Parameter	Symbol	Simulations
Box area	$L_x \times L_y$	800.0×800.0 μm^2
Average length at division	l_c	5.0 μm
Diameter of cell	d_o	1.0 μm
Diameter of EPS particle	d_{eps}	0.5 μm
Linear growth rate	ϕ	3.5 μm/h
Cell division rate	k_{div}	0.1 /h
EPS production rate	k_{eps}	1.0 /h
Elastic modulus (cell and EPS)	E	2×10^5 Pa
Friction coefficient (cell)	η_{cell}	200 Pa$\cdot$h
Friction coefficient (EPS)	η_{eps}	200 Pa$\cdot$h
Nutrient concentration	C_0	3.0, 10.0, 20.0, and 30.0 fg$\cdot\mu$m^3
Nutrient consumption rate	k	4.0 /h
Diffusion rate of nutrient	D	300 μm^2/h
Threshold area-density of cell	Cell [x, y]	8.0 μm^2
Threshold area-density of EPS	EPS[x, y]	0.3 μm^2
Concentration cut off for EPS production	C^*	0.006 fg$\cdot\mu$m^3
Motility force	f_{mot}	100, 300, 500, and 700 $Pa.\mu m^2$
Strength of attraction	ε	18.0 $Pa.\mu m^3$

1 Video

Video-S1 :-This video demonstrates that cells grow, divide, move, and secrete EPS in nearby areas depending upon the local accessibility of the nutrients and interact through mechanical forces to self-organize. Here initial nutrient concentration and motility force are $C_0 = 3.0 fg.\mu m^3$ and $f_{mot} = 500 Pa.\mu m^2$ respectively and all other parameters are the same as Table-S1. This video reveals the presence of apparently distinct phases of sessile aggregates and some motile cells within the colony's interior and mobile phases at the expanding periphery.