Supplementary Information:
Regulation of Microtubule Disassembly by
Spatially Heterogeneous Patterns of Acetylation

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S1. Determining the parameters used in the simulations

1) For a lattice consisting entirely of GTP-bound tubulin subunits, the lateral interaction energies are estimated to be in the range $-6k_BT \lesssim g_l \lesssim -3k_BT$ in Stukalin *et al* [1, 2]. In our simulations we fix the lateral interaction energy of the completely deacetylated GTP-lattice to be $-4.5k_BT$.

2) The mean disassembly rate of a GTP lattice measured from experiments is $\approx 0.5\mu$m min^{-1} [3]. Accordingly, R_d is fixed from the simulations at 432μm min^{-1} (α is assumed to be 0 in all our simulations).

3) The mean growth rate of a GTP lattice measured from a set of experiments is $\approx 0.17\mu M^{-1}\mu$m min^{-1} [3]. Accordingly, R_a is fixed from the simulations at $0.17C\mu$m min^{-1} (since $\alpha = 0$), where C is the concentration of the free tubulin.

4) With R_d fixed, the lateral interaction energy of the completely deacetylated lattice consisting of only GDP-subunits, is fixed at $g_l^0 = -2.85k_BT$ such that the disassembly rate is $\approx 8\mu$m min^{-1} as measured from experiments [4].

5)
i) *In vitro* experiments have observed that the presence of acetylation reduces the lateral interaction between neighbouring protofilaments [4]. In order to accommodate this in the model, we consider that if the ith subunit is acetylated or if any of the neighbours (lateral and longitudinal) of this subunit in the lattice is acetylated, then the lateral interaction energy associated with u_i and w_i are modified accordingly.
ii) In the experiments of Portran *et al* [4], it was observed that in the presence of 96% acetylation, the disassembly rate of the MT lattice is $\approx 20\mu$m min^{-1}, three fold increased compared to the case at zero percent acetylation. Assuming that this disassembly rate is composed of the depolymerisation rate of GDP-subunits

alone, the modified lateral interaction energy of the GDP-subunits under the effect of acetylation is fixed at $g_l^{ac} = -2.25 k_B T$ such that at 100% acetylation, disassembly rate of the filament is $\approx 20 \mu m \ min^{-1}$.

References

[1] Stukalin EB, Kolomeisky AB. Simple growth models of rigid multifilament biopolymers. J Chem Phys. 2004;121(2).

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[4] Portran D, Schaedel L, Xu Z, Thery M, Nachury MV. Tubulin acetylation protects long-lived microtubules against mechanical ageing. Nat Cell Biol. 2017;19(4):391 – 398.