**Start Time Step** and diffuse Figure S1. A flow chart outlining the decisions made by cells and blood vessels for each time step. The labeled nutrients available parameters are defined in Table S1.  $(n_c / t_a \text{ units})$ ? No Yes Actions made by cells are ovals, actions made by vessels are parallelograms, and Are there any Consume  $n_c / t_a$ nutrients available? units of nutrients Nutrients arrive and decision points are diamonds. diffuse oes vessel serve more than  $t_o$  cells? Consume all remaining ach cell consume nutrients and metabolizes No Vessel is nutrients Each cell occluded metabolizes <sub>m</sub> / t<sub>a</sub> nutrients Are there fewer than V vessels? Repeat this step ta times Blood vessel turnover can No Add vessels to occur hypoxic patches each cel Does the cell move amount of nutrient (use propensity p) n<sub>t,i</sub> stored?  $0 < n_{t,i} \le n_r$  $n_{t,i} > n_r$ low is movemen Cell may divide direction selected?  $n_{t,i} = 0$ Randomly Gradient Ascent Move to max Move 1 step in a random direction Cell is starving Cell may move nutrient patch in and dies Do progeny get a new mutation? neighborhood No Is the cell in an Is the cell in an edge patch? edge patch? Update migration propensity Yes (p<sub>i</sub>) & rate (m<sub>i</sub>) Has cell moved m Has cell moved Cell migrates times? from neoplasm m times? **End Time Step**