Supplementary Tables

Supplementary table 1: models equations

Supplementary table 2: goodness-of-fit metrics of these three single tumor growth models.

Supplementary table 3: parameter values and identifiability of the Gompertz, power law and "proliferation inhibition" model for the single tumor growth fits

Supplementary table 1: models equations

Model name	Equations
Competition	$\begin{cases} \frac{dV_1}{dt} = aV_1 \ln\left(\frac{K}{V_1+V_2}\right) & V_1(t=0) = V_{0,1} \\ \frac{dV_2}{dt} = aV_2 \ln\left(\frac{K}{V_1+V_2}\right) & V_2(t=0) = V_{0,2} \end{cases}$
Angiogenesis inhibition	$\begin{cases} \frac{dV_1}{dt} = aV_1 \ln\left(\frac{K_1}{V_1}\right) & V_1(t=0) = V_{0,1} \\ \frac{dK_1}{dt} = bK_1 - dV_1^{2/3}K_1 - eV_2\mathbb{1}_{K_1>K_0} & K_1(t=0) = K_0 \\ \frac{dV_2}{dt} = aV_2 \ln\left(\frac{K_2}{V_2}\right) & V_2(t=0) = V_{0,2} \\ \frac{dK_2}{dt} = bK_2 - dV_2^{2/3}K_2 - eV_1\mathbb{1}_{K_2>K_0} & K_1(t=0) = K_0 \end{cases}$
Proliferation inhibition	$\begin{cases} \frac{dP_1}{dt} = \alpha P_1 - (\beta P_1 + \gamma(P_1+P_2))\mathbb{1}_{P_1>0} & P_1(t=0) = V_{0,1} \\ \frac{dQ_1}{dt} = (\beta P_1 + \gamma(P_1+P_2))\mathbb{1}_{P_1>0} & Q_1(t=0) = 0 \\ V_1 = P_1 + Q_1 & \\ \frac{dP_2}{dt} = \alpha P_2 - (\beta P_2 + \gamma(P_1+P_2))\mathbb{1}_{P_2>0} & P_2(t=0) = V_{0,2} \\ \frac{dQ_2}{dt} = (\beta P_2 + \gamma(P_1+P_2))\mathbb{1}_{P_2>0} & Q_2(t=0) = 0 \\ V_2 = P_2 + Q_2 & \end{cases}$
Proliferation inhibition (log-kill)	$\begin{cases} \frac{dP_1}{dt} = \alpha P_1 - (\beta P_1 + \gamma(P_1+P_2))P_1 & P_1(t=0) = V_{0,1} \\ \frac{dQ_1}{dt} = (\beta P_1 + \gamma(P_1+P_2)) & Q_1(t=0) = 0 \\ V_1 = P_1 + Q_1 & \\ \frac{dP_2}{dt} = \alpha P_2 - (\beta P_2 + \gamma(P_1+P_2))P_2 & P_2(t=0) = V_{0,2} \\ \frac{dQ_2}{dt} = (\beta P_2 + \gamma(P_1+P_2)) & Q_2(t=0) = 0 \\ V_2 = P_2 + Q_2 & \end{cases}$

Model name	**Equations**
Proliferation inhibition (P+Q)	$\begin{cases} \frac{dP_1}{dt} = \alpha P_1 - \left(\beta V_1 + \gamma\left(V_1 + V_2\right)\right)\mathbb{1}_{P_1>0} & P_1(t=0) = V_{0,1} \\ \frac{dQ_1}{dt} = \left(\beta V_1 + \gamma\left(V_1 + V_2\right)\right)\mathbb{1}_{P_1>0} & Q_1(t=0) = 0 \\ V_1 = P_1 + Q_1 & \\ \frac{dP_2}{dt} = \alpha P_2 - \left(\beta V_2 + \gamma\left(V_1 + V_2\right)\right)\mathbb{1}_{P_2>0} & P_2(t=0) = V_{0,2} \\ \frac{dQ_2}{dt} = \left(\beta V_2 + \gamma\left(V_1 + V_2\right)\right)\mathbb{1}_{P_2>0} & Q_2(t=0) = 0 \\ V_2 = P_2 + Q_2 & \end{cases}$

Supplementary table 2: goodness-of-fit metrics of these three single tumor growth models.

Model	SSE	AIC	RMSE	R2	p
Power law	**0.117(0.0158 - 0.713)[1]**	**-12.3(-34.5 - 2.95)[1]**	0.4(0.145 - 0.957)[2]	0.983(0.784 - 0.998)[2]	
Gompertz	0.121(0.019 - 0.67)[2]	-11.6(-32.4 - 2.39)[2]	**0.394(0.159 - 0.928)[1]**	**0.984(0.815 - 0.997)[1]**	
Proliferation inhibition	0.159(0.00741 - 0.883)[3]	-10.1(-33.2 - 4.88)[3]	0.45(0.0994 - 1.07)[3]	0.966(0.7 - 0.999)[3]	

SSE = Sum of Square Errors, AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, R2 = coefficient of determination. # = number of parameters.

Supplementary table 3: parameter values and identifiability of the Gompertz, power law and "proliferation inhibition" model for the single tumor growth fits

Model	Par.	Unit	Median value (CV)	NSE (%) (CV)
Power law	α	mm$^{3(1-\gamma)}$· day^{-1}	0.921 (41.9)	10.6 (55)
	γ	-	0.788 (9.35)	3.42 (62.4)
Gompertz	α_0	day^{-1}	1.84 (35.7)	9.28 (65.3)
	β	day^{-1}	0.0792 (43)	12 (74.4)
Proliferation inhibition	α	day^{-1}	3.71 (54.4)	21.4 (61.7)
	$\beta + \gamma$	day^{-1}	3.45 (59)	24.5 (74.5)

Par. = parameter. CV = coefficient of variation. NSE = normalized standard error.