

Table S1. Cell-Type-Specific Properties, Related to Figure 3

Cell type	color	strong PINs				weak PINs	SHR prod.	SCR prod.	cell width (µm)
		rootw.	shootw.	inw.	outw.	inw.			
vascular	red	X					X		5
pericycle	orange	X					X		5
QC	dark gray	X						X	~ 20
endodermis	yellow	X		X				X	12
cortex MZ	green	X				X		X	20
CEI	dark green	X				X		X	~ 25
cortex EZ	light green		X			X		X	20
epidermis	blue		X			X		X	17
LEI	purple		X			X		X	~ 17
LRC	light gray		X			X		X	20
columella	cyan	X	X	X	X			X	~ 20

QC: quiescent center; CEI: cortex-endodermis initial; LEI: lateral root cap-epidermis initial; LRC: lateral root cap; MZ: meristem zone; EZ: elongation zone; rootw.: rootwards; shootw.: shootwards; inw.: inwards; outw.: outwards. Cell height is 48 µm in the EZ and 16 µm in the MZ.

Table S2. Parameter Values of Models 1 and 2, Related to Figures 3 and 4

symbol	description	unit	value	range of bistability	range of conservation spatial patterning
$D_X$	auxin diffusion coefficient	$\mu\text{m}^2/\text{s}$	600		
$P_{in}$	influx auxin permeability	$\mu\text{m}/\text{s}$	20		
$P_{e_{bg}}$	background PIN efflux permeability	$\mu\text{m}/\text{s}$	1		
$P_{e_{SPIN}}$	permeability due to strong PIN expression	$\mu\text{m}/\text{s}$	20		
$P_{e_{WPIN}}$	permeability due to weak PIN expression	$\mu\text{m}/\text{s}$	5		
$d_X$	auxin decay	$\text{s}^{-1}$	$10^{-4}$		
$K$	fold diffusion rate reduction in cell wall	—	15		
$D_H$	SHR diffusion coefficient	$\mu\text{m}^2/\text{s}$	0.2		
$V_n$	nuclear volume	$\mu\text{m}^2$	10		
$X$	typical auxin concentration (ODE analysis)	a.u.	1000	$0 - 1.40 \times 10^4$	
$c_{H_c}$	rate by which SHR leaves nucleus	$\text{h}^{-1}$	1	$0 - 1.77 \times 10^7$	$0 - 10^{15}$
$c_{H_n}$	rate by which SHR enters the nucleus	$\text{a.u.}^{-1} \text{h}^{-1}$	5	$7.43 \times 10^{-7} - 140.4$	$7.92 \times 10^{-7} - 28.0$
$c_R$	RBR phosphorylation rate by CYCD6;1	$\text{a.u.}^{-1} \text{h}^{-1}$	20	$0 - 4.07 \times 10^4$	$2.58 \times 10^{-6} - 110$
$c_S$	$H_n$ -S combined action saturation constant	a.u.	1000	$3.37 - \infty$	$1.45 - 10^6$
$c_T$	SCR-RBR complex formation	$\text{a.u.}^{-1} \text{h}^{-1}$	0.4	$8.28 \times 10^{-2} - \infty$	$5.78 \times 10^{-4} - 225$
$c_X$	auxin conc. of half-max auxin-dependent <i>CYCD6;1</i> activation	a.u.	$2 \times 10^4$	$1.43 \times 10^3 - \infty$	$0 - \infty$
$d_C$	CYCD6;1 decay rate	$\text{h}^{-1}$	1	$0 - \infty$	$0 - 10^6$
$d_{H_c}$	cytosolic SHR decay rate	$\text{h}^{-1}$	1	$0 - 8.83 \times 10^6$	$0.44 - 4.17 \times 10^5$
$d_{H_n}$	nuclear SHR decay rate	$\text{h}^{-1}$	1	$0^* - 1.27 \times 10^3$	$0.05 - 6.92 \times 10^3$
$d_R$	RBR <sup>P</sup> decay rate	$\text{h}^{-1}$	1	$4.91 \times 10^{-4} - \infty$	$0 - 8.71 \times 10^3$
$d_S$	SCR decay rate	$\text{h}^{-1}$	10	$0^* - 4.38 \times 10^3$	$0 - 4.61 \times 10^3$
$d_T$	SCR-RBR decay rate	$\text{h}^{-1}$	10	$1.64 \times 10^{-4} - \infty$	$0 - 1.70 \times 10^7$
$H$	Hill coefficient auxin-dependent <i>CYCD6;1</i> activation	—	3	$3.59 \times 10^{-1} - \infty$	$0 - 65.4$
$p_C$	SHR-SCR and auxin-dependent <i>CYCD6;1</i> production rate	$\text{a.u.}^{-1} \text{h}^{-1}$	40	$0 - 8.15 \times 10^4$	$0 - 242$
$P_{H_c}$	cytosolic SHR production rate (spatial model)	$\text{a.u.} \text{h}^{-1}$	1500.		$0 - 3 \times 10^3$
	cytosolic SHR influx rate into CEI (ODE analysis)	$\text{a.u.} \text{h}^{-1}$	137.5	$0.108 - 3.72 \times 10^3$	
$p_{S1}$	SHR and SCR co-dependent SCR production rate	$\text{a.u.}^{-1} \text{h}^{-1}$	5	$1.17 \times 10^{-2} - 110$	$0 - 19.9$
$p_{S2}$	background SCR production rate	$\text{a.u.} \text{h}^{-1}$	0.5	$0^* - 9.81$	$0 - 1.87$
$R$	total RBR	a.u.	5000.	$1.04 \times 10^3 - 2.03 \times 10^9$	$1.2 \times 10^3 - 2.51 \times 10^6$
$Z$	geometric factor of CEI (ODE analysis)	—	0.01858	$6.87 \times 10^{-4} - 1.86 \times 10^{-2}$	

Default parameter values used in all simulations and analyses, except when indicated otherwise, see figure captions and section “Specific extra details regarding the simulations” in “Modeling Procedures.”

\*: Any parameter value larger than zero presents bistability, but there is no bistability when the parameter is exactly zero.

Table S3. Parameter Sweeps, Related to Figure 4

	10-fold	100-fold	1000-fold	$1 \times 10^6$ -fold	$1 \times 10^9$ -fold
$X=1000$	97.53	83.74	68.16	38.61	27.21
$X=10,000$	65.66	58.88	53.27	35.53	26.19
Random 1,1	0.09	1.34	2.89	4.93	5.82
Random 1,1000	99.99	91.47	70.77	35.99	24.56

Robustness was analyzed by percentage of simulation runs that yielded bistability (values in table), for varying fold variations in parameter range (columns). We performed robustness analysis for different levels of auxin (two top rows). We also repeated the analysis by setting all default parameters to 1 and varying values around that value (third row) as well as setting all rates to 1 and all mass dependent parameters to 1000, and then varying around these (last row).

Table S4. Parameter Values of Model 3, Related to Figure 5

symbol	description	unit	value	range of bistability	range of conservation spatial patterning
$X$	typical auxin concentration (ODE analysis)	a.u.	1000	$0 - 1.16 \times 10^4$	
$c_A$	SHR-SCR complex formation	$\text{a.u.}^{-1} \text{h}^{-1}$	5	$6.24 \times 10^{-2} - \infty$	$0 - 10.7$
$c_R$	RBR phosphorylation rate by CYCD6;1	$\text{a.u.}^{-1} \text{h}^{-1}$	0.01	$0 - 13.1$	$0 - 1.29 \times 10^{-1}$
$c_T$	SCR-RBR complex formation	$\text{a.u.}^{-1} \text{h}^{-1}$	0.4	$3.23 \times 10^{-2} - \infty$	$4.49 \times 10^{-4} - 2.64 \times 10^3$
$c_X$	auxin conc. of half-max auxin-dependent <i>CYCD6;1</i> activation	a.u.	$2 \times 10^4$	$1.72 \times 10^3 - \infty$	$0 - \infty$
$c_U$	binding of SHR-SCR to RBR	$\text{a.u.}^{-1} \text{h}^{-1}$	0.4	$1.09 \times 10^{-3} - 4.76$	$0 - 2 \times 10^3$
$c_{U2}$	binding of SHR to SCR-RBR	$\text{a.u.}^{-1} \text{h}^{-1}$	5	$0 - 401$	$8.49 \times 10^{-2} - 1.20 \times 10^5$
$d_A$	SHR-SCR decay rate	$\text{h}^{-1}$	1	$0^* - 29.7$	$0.39 - 136$
$d_C$	CYCD6;1 decay rate	$\text{h}^{-1}$	1	$7.64 \times 10^{-4} - \infty$	$0 - 10^7$
$d_H$	SHR decay rate	$\text{h}^{-1}$	1	$0 - 1.92 \times 10^6$	$0 - 10^7$
$d_R$	RBR <sup>P</sup> decay rate	$\text{h}^{-1}$	1	$7.64 \times 10^{-4} - \infty$	$0 - 9.55 \times 10^6$
$d_S$	SCR decay rate	$\text{h}^{-1}$	10	$0^* - 86.5$	$4.7 - 10^7$
$d_T$	SCR-RBR decay rate	$\text{h}^{-1}$	10	$2.24 \times 10^{-2} - 86.8$	$0 - 114$
$d_U$	SHR-SCR-RBR decay rate	$\text{h}^{-1}$	1	$3.17 \times 10^{-2} - \infty$	$0 - 1.10 \times 10^7$
$H$	Hill coefficient auxin-dependent <i>CYCD6;1</i> activation	—	3	$5.45 \times 10^{-1} - \infty$	$0 - 65.7$
$p_C$	SHR-SCR and auxin-dependent <i>CYCD6;1</i> production rate	$\text{h}^{-1}$	8000	$0 - 1.05 \times 10^7$	$0 - 1.08 \times 10^5$
$p_H$	SHR production rate (spatial model)	a.u./h	300		$0 - 687$
	SHR influx rate into CEI (ODE analysis)	a.u./h	137.5	$19.9 - 3.04 \times 10^4$	
$p_{S1}$	SHR-SCR-dependent SCR production rate	$\text{h}^{-1}$	1000	$140 - 3.72 \times 10^5$	$0 - 2.17 \times 10^3$
$p_{S2}$	background SCR production rate	a.u./h	100	$1.19 \times 10^{-1\dagger} - 4.47 \times 10^4$	$0 - 4.57 \times 10^4$
$R$	total RBR	a.u.	5000	$808 - 3.45 \times 10^4$	$1.5 \times 10^3 - 4.85 \times 10^5$
$z$	geometric factor of CEI (ODE analysis)	—	0.01858	$6.58 \times 10^{-5} - 1.31 \times 10^{-1}$	

Default parameter values used in all simulations and analyses, except when indicated otherwise, see figure captions and section “Specific extra details regarding the simulations” in the Supplementary Modeling Procedures. Parameter values regarding auxin, SHR transport and nuclear volume are as given in Table S2.

\*: Any parameter value larger than zero presents bistability, but there is no bistability when the parameter is exactly zero.

†: Hopf bifurcation (all other boundary points are fold bifurcations).