1 2	Supplementary Information for	$\begin{array}{c} 63 \\ 64 \end{array}$
3 4	Occupies water fluxes with cell well mechanics in a multicellular model of plant development	65 66
5 6	Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin	$\begin{array}{c} 67 \\ 68 \end{array}$
7 8 9 10	Corresponding authors: Ibrahim Cheddadi and Christophe Godin. E-mail: ibrahim.cheddadi@univ-grenoble-alpes.fr, christophe.godin@inria.fr	69 70 71 72
11 12	This PDF file includes:	73 74
$\begin{array}{c} 1 \\ 1 \\ 3 \\ 1 \\ 4 \\ 1 \\ 5 \\ 1 \\ 6 \\ 1 \\ 7 \\ 1 \\ 8 \\ 1 \\ 9 \\ 2 \\ 0 \\ 2 \\ 1 \\ 2 \\ 2 \\ 3 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2$	<text></text>	$\begin{array}{c} 75\\ 76\\ 77\\ 78\\ 79\\ 80\\ 81\\ 82\\ 83\\ 84\\ 85\\ 86\\ 87\\ 88\\ 89\\ 90\\ 91\\ 92\\ 93\\ 94\\ 95\\ 96\\ 97\\ 98\\ 99\\ 100\\ 101\\ 102\\ 103\\ 104\\ 105\\ 106\\ 107\\ 108\\ 109\\ 110\\ 111\\ 112\\ 113\\ 114\\ 115\\ 116\\ 117\\ 118\\ 119\\ 120\\ 121\\ 122\\ 123\\ 124\\ \end{array}$

125 Supporting Information Text

 $\frac{126}{127}$ 1. Calculations for simplified models

 $228 \\ 229$





 140
 Fig. S1. Geometrical parameters of Lockhart-Ortega models: height h and length l of the cell, thickness w of the walls. The two faces orthogonal to the x axis are refered to as base faces while the four other faces are refered to as lateral faces.
 202

 141
 as base faces while the four other faces are refered to as lateral faces.
 203

 142
 204

142204143Lockhart-Ortega models. The equations of cell wall elongation (Eq. (1) in main text) and of water uptake (Eq. 2 in main text)205144can be linked thanks to the geometry of the cell and the mechanical equilibrium. See Fig. S1 for the geometrical description.206145First, the cell volume is $V = h^2 l$ and therefore we find that the relative growth rate of the cell is equal to the strain rate of207146the walls:208

$$\dot{\gamma} = \frac{1}{V} \frac{\mathrm{d}V}{\mathrm{d}t} = \frac{1}{l} \frac{\mathrm{d}l}{\mathrm{d}t} = \dot{\varepsilon}.$$
[S1] ²⁰⁹
₂₁₀

Then, we consider the balance of forces on the base faces (see Fig. S1 for the nomenclature); their area is $h \times h$ and they are submitted to a total pressure force Ph^2 in the direction of the main axis of the cell, balanced by the tension from the lateral walls. Let σ be the common (scalar) stress in the walls; the wall thickness is w so their cross section is $h \times w$ and therefore they each exert a force σhw on the base faces. To be coherent with the bidimensional model we propose, we consider that the top and bottom lateral faces bear no stress and the balance of forces leads to

$$Ph^2 = 2\sigma hw 217$$

157 and therefore the balance of forces leads to $P = 2\frac{w}{h}\sigma$. Finally, thanks to this equation and the identity Eq. (S1), the 219 158 Lockhart-Ortega model (eqs. (1), (3) in main text) is reduced to the following differential equation for P: 220

$$\frac{1}{\bar{E}}\frac{\mathrm{d}P}{\mathrm{d}t} + \phi^w (P - P^Y)_+ = \phi^a \left(P^M - P\right), \qquad [S2] \begin{array}{c} 221\\ 222\\ 223 \end{array}$$

where $\phi^a = \frac{AL^a}{V}$ has been introduced in the main text; in order to keep the calculations as simple as possible, Lockhart made the assumption that the area of the base faces is negligeable compared to the area A = 4hl of the lateral faces (see Fig. S1). Note that the cell volume is $V = h^2 l$ and therefore the ratio A/V = 4/h is constant.

Let's study the transient behaviour of equation Eq. (S2), from an initial condition P(t = 0) = 0:

• Elastic regime: first, P is below P^Y and the plastic rate is zero; Eq. (S2) becomes

h

where $\lambda^a = \frac{1}{\phi^a E}$ is a characteristic time. The solution is

$$P = P^M (1 - \exp(-t/\lambda^a)).$$

The relative growth rate is

$$\dot{\gamma} = \phi^a P^M \exp(-t/\lambda^a).$$

• Plastic regime: the plastic regime starts when $P = P^Y$, at $t^0 = \lambda^a \log\left(\frac{P^M}{P^M - P^Y}\right)$. The equation Eq. (S2) becomes:

$$\frac{1}{\bar{E}}\frac{\mathrm{d}P}{\mathrm{d}t} + (\phi^a + \phi^w)P = \phi^a P^M + \phi^w P^Y,$$
243
244

 $245 \\ 246$

Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin

249	where $\lambda^{aw} = \frac{1}{(\phi^a + \phi^w)\bar{E}}$ is a characteristic time. The solution is		311
250	$(\phi^* + \phi^*)E$		312
251	$P = \alpha^{a} P^{M} + (1 - \alpha^{a}) P^{Y} - \alpha^{a} (P^{M} - P^{Y}) \exp((t^{0} - t)/\lambda^{aw}), $ [S	53]	313
252		50]	314
252	$\dot{\gamma} = \frac{\phi^a \phi^w}{\phi^a + \phi^w} (P^M - P^Y) - \frac{(\phi^a)^2}{\phi^a + \phi^w} (P^M - P^Y) \exp((t^0 - t)/\lambda^{aw}).$ [5]	241	315
$\frac{253}{254}$	$\gamma = \frac{1}{\phi^a + \phi^w} (r - r) - \frac{1}{\phi^a + \phi^w} (r - r) \exp((t - t)/\lambda). $	54]	
			316
255	The stationnary solution is		317
256			318
257	$P^* = \alpha^a P^M + (1 - \alpha^a) P^Y $ [S	S5]	319
258	$\phi^a \phi^w$ is a second		320
259	$\dot{\gamma}^* = \frac{\phi^a \phi^w}{\phi^a + \phi^w} (P^M - P^Y).$ [S	56]	321
260	$\phi^a + \phi^w$		322
261			323
262	Single polygonal cell.		324
263	vertex v		325
$\frac{203}{264}$	n_1 \wedge		326
	$n_1 e_1 p_2 p_2$		
265			327
266			328
267			329
268			330
269	π/n		331
270			332
271			333
272			334
273	σ P $^{\vee}$		335
274			336
275			337
276	x		338
$\frac{270}{277}$			
			339
278			340
279			341
280			342
281			343
282			344
283	We consider a regular convex polygon of radius R with n edges that represents a cell.		345
284	Machine antibicity I at a hother stress in the walls and D the process incide the cell, the cutside processor is get to pro-		346
285	Mechanical equilibrium. Let σ be the stress in the walls and P the pressure inside the cell; the outside pressure is set to zero.		347
286	The length of the edges is $2R\sin(\pi/n)$, and the walls are given a height h and a thickness w; therefore the stresses are exert		348
$\frac{-00}{287}$	on a surface hw; the contribution of pressure on vertex v is $\frac{1}{2}P2hR\sin(\pi/n)(n_1+n_2)$. Therefore, the balance of forces	on	349
288	vertex v writes:		350
	$rac{1}{2}P2hR\sin(\pi/n)(m{n_1}+m{n_2})+\sigma hw(m{e_1}+m{e_2})=0.$		
289	-		351 252
290	The normal vectors are		352
291	${m n}_1 = (-\sin(\pi/n), \cos(\pi/n)) ext{and} {m n}_2 = (\sin(\pi/n), \cos(\pi/n)).$		353
292			354
293	The tangent vectors are		355
294	$e_1 = (-\cos(\pi/n), -\sin(\pi/n))$ and $e_2 = (\cos(\pi/n), -\sin(\pi/n)).$		356
295	By symetry, the x component of the resulting force is zero; the projection of the balance of forces on y axis yields		357
296	by symetry, the x component of the resulting force is zero, the projection of the balance of forces on y axis yields		358
297	$2BhPain(\pi/n) \cos(\pi/n) - 2\pi hw \sin(\pi/n) = 0$		359
298	$2PhR\sin(\pi/n)\cos(\pi/n) - 2\sigma hw\sin(\pi/n) = 0,$		360
299	and		361
300		ושר	362
301	$P = \frac{w}{R\cos(\pi/n)}\sigma.$ [S	57]	363
302			364
	When $n \to \infty$, $\cos(\pi/n) \to 1$ and we recover the Laplace law.		
303	Flux equation The surface of the polygon is		365
304	Flux equation. The surface of the polygon is		366
305	$S_n = n \times 2R \sin(\pi/n) R \cos(\pi/n)/2 = R^2 n \sin(\pi/n) \cos(\pi/n).$		367
306	$\mathcal{D}_n = n \wedge 2n \operatorname{Sin}(n/n) n \operatorname{COS}(n/n)/2 = n n \operatorname{Sin}(n/n) \operatorname{COS}(n/n).$		368
307	The volume of the cell is $V = S_n h$, so the volume variation is		369
308	The volume of the cent is $v = D_n n$, so the volume variation is		370
309	$\mathrm{d}V$ $\mathrm{d}R$ $\mathrm{d}R$		371
310	$\frac{\mathrm{d}V}{\mathrm{d}t} = 2hR\frac{\mathrm{d}R}{\mathrm{d}t}n\sin(\pi/n)\cos(\pi/n).$		372

Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin

The perimeter of the polygon is $n \times 2R \sin(\pi/n)$ so the lateral area of the cell is

Note that the ratio A/V is not constant:

$$=\frac{2}{R\cos(\pi/n)}.$$
439
440
441

Finally, the flux equation writes

$$2hR\frac{\mathrm{d}R}{\mathrm{d}t}n\sin(\pi/n)\cos(\pi/n) = n2hR\sin(\pi/n)L(P^M - P),$$

which yields

$$\frac{dR}{dt} = \frac{L}{\cos(\pi/n)} (P^M - P)$$
[S8] 447
448

Wall rheology. Let ε^e be the elastic deformation of the walls; it is related to the stress by the constitutive equation $\sigma = E\varepsilon^e$ where E is the elastic modulus. The length of the edges is $l = 2R\sin(\pi/n)$ and therefore the strain rate of the edges is $\frac{1}{l}\frac{dl}{dt} = \frac{1}{R}\frac{dR}{dt}$. The rheological behaviour of the walls is given by

 $A = 2nhR\sin(\pi/n).$

 $\frac{A}{V}$

$$\frac{1}{R}\frac{\mathrm{d}R}{\mathrm{d}t} = \frac{\mathrm{d}\varepsilon^e}{\mathrm{d}t} + \Phi^w E \max(0, \varepsilon^e - \varepsilon^Y), \qquad [S9] \quad \frac{453}{454}$$

or equivalently

$$\frac{1}{R}\frac{\mathrm{d}R}{\mathrm{d}t} = \frac{1}{E}\frac{\mathrm{d}\sigma}{\mathrm{d}t} + \Phi^w \max(0, \sigma - \sigma^Y), \qquad [S10] \quad \begin{array}{c} 456\\457\end{array}$$

where ε^{Y} (resp. σ^{Y}) is a yield elastic deformation (resp. stress).

Numerical results. The problem to solve is reduced to a set of two differential equations. It is numerically solved with the 460 odeint routine from the python library scipy.

We study the growth of a hexagonal cell (n = 6) growing from an initial state where the elastic deformation of the walls is set to the threshold value, in order to bypass the pure elastic regime; computations are run over a long time scale. We want to 463 study how this models compares to Lockhart-Ortega when the relative importance of fluxes and wall synthesis varies; to this end, we run three simulations with $\alpha^a = 0.1, 0.5, 0.9$. Let $R_0 = 10 \mu \text{m}$ be the initial radius of the cell, then $P^Y = \frac{w}{R_0 \cos(\pi/6)} E \varepsilon^Y$ is a representative value for the yield turgor of a hexagonal cell. The value $\varepsilon^{Y} = 0.1$ is chosen accordingly to experimental observations where wall deformations can be of the order of 10%; then we choose E such that $P^{Y} = 0.5$ MPa, which sets an 467 order of magnitude for the initial turgor of the cell, close to observed experimental data. We choose $P^M = 0.7$ MPa so that it is above P^{Y} . Finally, we can use the Lockhart's prediction Eq. (S6) as an order of magnitude of the relative growth rate; we 469 choose $\dot{\gamma}^* = 2\% \cdot h^{-1}$. Then, a given value of α^a (evaluated with the initial area of the cell) sets a unique value of L^a and ϕ^w . At the onset of the simulation, walls start to extend irreversibly and plastic growth occurs. Fig. S2a,c shows that the volume 471 increases faster for large values of α^a , although we have chosen the parameters so that the Lockhart model predicts a constant 472 and common value of $\dot{\gamma}$. Fig. S2b shows that P is initially close to Lockhart predictions P^* but decreases fastly to zero; the fast decrease of P coincides with peaks of $\dot{\gamma}$ (Fig. S2c) above the value $\dot{\gamma}^*$ with a higher peak for larger values of α^a ; the elastic deformation ε^e (Fig. S2d) is not constant either, with a large peak above the Lockhart-Ortega prediction for $\alpha^a = 0.9$. For all 475

values of α^a , ε^e converges toward the threshold ε^Y .

Two-cells model. The geometry and notations of the two-cells model is recalled in Fig. S3. Gathering the flux equation (Eq. 8 from main text) and the wall mechanics equation (Eq. 1 from main text) with $\frac{dP}{dt} = 0$, we get

$$\phi^{a}(P^{M} - P_{0}) + \frac{\phi^{s}}{2}(P_{1} - P_{0}) - \phi^{w}(P_{0} - P_{0}^{Y})_{+} = 0$$
[S11] $\frac{481}{482}$

$$\phi^{a}(P^{M} - P_{1}) - \frac{\phi^{s}}{2}(P_{1} - P_{0}) - \phi^{w}(P_{1} - P_{1}^{Y})_{+} = 0.$$
[S12] 483
484

First, we assume that both cells are growing $(P_i > P_i^Y, i = 0, 1)$. First regime: $P_i > P_i^Y$, i = 0, 1. Adding Eq. (S11) and Eq. (S12) we get: $\overline{P} = \alpha^a P^M + (1 - \alpha^a) \overline{P}^Y.$ [S13] 489 where $\alpha^a = \frac{\phi^a}{\phi^a + \phi^w}$, $\overline{P} = \frac{P_0 + P_1}{2}$. With Eq. 1 from main text, we get $\overline{\dot{\gamma}} = \frac{\phi^a \phi^w}{\phi^a + \phi^w} (P^M - \overline{P}^Y),$

[S14]

where $\overline{\dot{\gamma}} = \frac{\dot{\gamma}_0 + \dot{\gamma}_1}{2}$ Therefore, the gathering of two cells behaves the same as one cell if one considers the mean values.

Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin

$$458 \\ 459$$

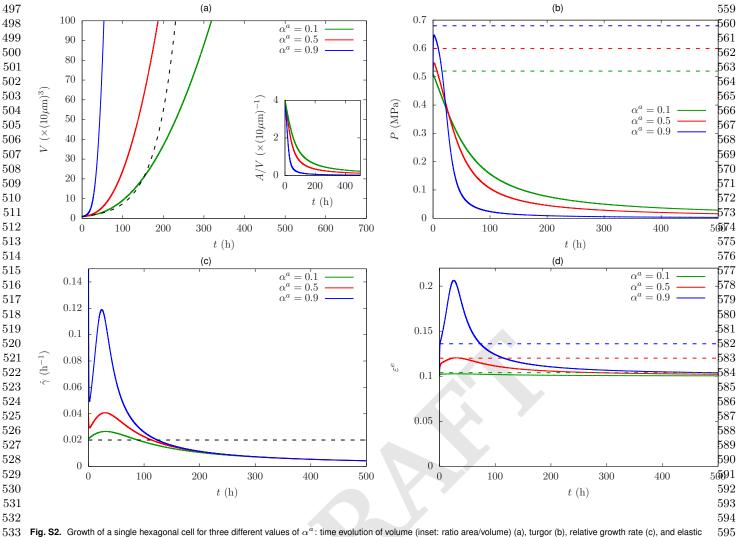


Fig. S2. Growth of a single hexagonal cell for three different values of α^a : time evolution of volume (inset: ratio area/volume) (a), turgor (b), relative growth rate (c), and elastic deformation of the walls (d). The dashed lines correspond to the solution of the Lockhart model; note that the chosen sets of parameters lead to the constant and equal value $\dot{\gamma}^* = 2\% \cdot h^{-1}$, and to the same evolution of volume.

Then, we examine the heterogeneities in turgor and growth rate. Subtracting Eq. (S11) to Eq. (S12), we get ϕ^w

$$\Delta P = \frac{\phi^w}{\phi^a + \phi^s + \phi^w} \Delta P^Y.$$
601
602
603

542 Let

546 Then the previous expression becomes 546

$\Delta P = \frac{(1 - \alpha^a)(1 - \alpha^s)}{1 - \alpha^s + \alpha^a \alpha^s} \Delta P^Y.$ [S15] 608

549 As $(1 - \alpha^{a})(1 - \alpha^{s}) = 1 - \alpha^{a} - \alpha^{s} + \alpha^{a}\alpha^{s} < 1 - \alpha^{s} + \alpha^{a}\alpha^{s}$, we find that turgor difference ΔP cannot exceed the value ΔP^{Y} . 550 When $\alpha^{s} = 0$ (symplasmic fluxes negligeable with respect to apoplasmic ones), then $\Delta P = (1 - \alpha^{a})\Delta P^{Y}$; when $\alpha^{s} > 0$, 551 symplasmic fluxes tend to reduce the turgor heterogeneity between cells. 552 With Eq. 7 from main text we get then

 $\alpha^s = \frac{\phi^s}{\phi^s + \phi^a}.$

532 With Eq. 7 from main text we get then

$$\Delta \dot{\gamma} = \frac{(\phi^a + \phi^s)\phi^w}{\phi^a + \phi^s + \phi^w} \Delta P^Y, \qquad [S16] \quad \begin{array}{c} 615\\ 616\\ 616\\ 017 \end{array}$$

556 where $\Delta \dot{\gamma} = \frac{\dot{\gamma}_0 - \dot{\gamma}_1}{2}$. Note that this expression is valid iff $P_1 > P_1^Y$ or equivalently $\dot{\gamma}_1 > 0$. The limit $\dot{\gamma}_1 = 0$ corresponds to the 557 situation where cell 0 is growing in such a way that it prevents cell 1 to grow because of the symplasmic fluxes between them. 558 We examine how this situation can occur depending on the values of the sumplasmic conductivity ϕ^s and the other parameters.

Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin

$621 \\ 622$	$\begin{array}{c} 683 \\ 684 \end{array}$
623	685
624	686
$625 \\ 626$	$\begin{array}{c} 687 \\ 688 \end{array}$
$620 \\ 627$	689
628	690
629 620	691
$\begin{array}{c} 630 \\ 631 \end{array}$	$692 \\ 693$
632	694
633	695
$634 \\ 635$	$\begin{array}{c} 696 \\ 697 \end{array}$
636	698
637	699
$\begin{array}{c} 638 \\ 639 \end{array}$	700 701
640	701
641	703
642	704
$\begin{array}{c} 643 \\ 644 \end{array}$	$705 \\ 706$
645	707
646	708
$\begin{array}{c} 647 \\ 648 \end{array}$	$709 \\ 710$
649	711
650	712
$651 \\ 652$	$713 \\ 714$
652	$714 \\ 715$
654	716
655	717
$\begin{array}{c} 656 \\ 657 \end{array}$	$718 \\ 719$
658	720
659	721
$\begin{array}{c} 660 \\ 661 \end{array}$	$722 \\ 723$
662	724
663	725
	$726 \\ 727$
666	728
667	729
$\begin{array}{c} 668 \\ 669 \end{array}$	$730 \\ 731$
$\frac{609}{670}$	$731 \\ 732$
671	733
$672 \\ 673$	$734 \\ 735$
$673 \\ 674$	736 736
675	737
$676 \\ 677$	738 720
$\begin{array}{c} 677 \\ 678 \end{array}$	$739 \\ 740$
679	741
680	742
	$743 \\ 744$

745 We find that

$$P_1 > P_1^Y \Longleftrightarrow \frac{\phi^a + \phi^s}{\phi^a + \phi^s + \phi^w} \frac{\Delta P^T}{P^M - \overline{P}^Y} < \frac{\phi^a}{\phi^a + \phi^w}$$

$$809$$

$$810$$

$$\phi^{a} + \phi^{a} + \phi^{a} P^{M} - P^{a} \phi^{a} + \phi^{a}$$

$$\begin{array}{ccc} 1 - (1 - \alpha^s)\alpha^{a} & 812 \\ 751 \\ 752 & \Longleftrightarrow \alpha^s < \frac{1 - \rho}{1 - \alpha^a} & 813 \\ 814 \end{array}$$

For instance, $P_0^Y = 0.25$ MPa, $P_1^Y = 0.5$ MPa, and $P^M = 0.625$ MPa yields $\rho = 0.5$. The hypothesis of this study 755 $(P_0^Y < P_1^Y < P^M)$ corresponds to the condition $\rho \in [0, 1]$. Note that if $\alpha^a > \rho$, then $\frac{1-\rho}{1-\alpha^a} > 1$, and the condition is verified 756 whatever the value of α^s ; if $\alpha^s = 1 - \rho$, the condition is equivalent to $\alpha^a > 0$, which is also always verified. Fig. S3a) recapitulates the regions of the parameters space $\alpha^a \times \alpha_s$ where the condition is verified, for different values of ρ . The size of the region $\dot{\gamma}_1 = 0$ increases as ρ gets closer to 1.

Second regime: $P_0 > P_0^Y$ and $P_1 < P_1^Y$. In this case, eqs. Eq. (S11) and Eq. (S12) turn into

$$\phi^{a}(P^{M} - P_{0}) + \frac{\phi^{s}}{2}(P_{1} - P_{0}) - \phi^{w}(P_{0} - P_{0}^{Y}) = 0$$
[S17]
⁸²³
₈₂₄

$$\phi^a(P^M - P_1) - \frac{\phi^s}{2}(P_1 - P_0) = 0.$$
[S18]
⁸²⁵
₈₂₆
₈₂₇

Eq. (S18) leads to

 $P_1 = (1 - \tilde{\alpha}^s) P^M + \tilde{\alpha}^s P_0.$ [S19]

where $\tilde{\alpha}^s = \frac{\phi^s}{2\phi^a + \phi^s}$. Adding eqs. Eq. (S17) and Eq. (S18) leads to

$$P_0(\phi^a + \phi^w) = 2\phi^a P^M + \phi^w P_0^Y - \phi^a((1 - \tilde{\alpha}^s)P^M + \tilde{\alpha}^s P_0),$$

$$P_0(\phi^a(1+\tilde{\alpha}^s)+\phi^w) = \phi^a(1+\tilde{\alpha}^s)P^M + \phi^w P_0^Y,$$
834
835
836
836

and finally

$$P_0 = \alpha^{as} P^M + (1 - \alpha^{as}) P_0^Y, \qquad [S20] \quad \frac{837}{838}$$

where

$$\alpha^{as} = \frac{\phi^{as}}{\phi^{as} + \phi^w} \quad \text{and} \quad \phi^{as} = \phi^a (1 + \tilde{\alpha}^s). \tag{839}$$
840
840
841

780 Hence, thanks to the symplasmic fluxes from its neighbour cell 1, cell 0 benefits from an enhanced access to the apoplasmic fluxes by a factor $\phi^{as}/\phi^a = 1 + \tilde{\alpha}^s$. Then, from Eq. 1 in main text, the relative growth rate of cell 0 is

$$\dot{\gamma}_0 = \frac{\phi^{as} \phi^w}{\phi^{as} + \phi^w} (P^M - P_0^Y).$$
[S21]

By hypothesis, the growth rate of cell 1 is zero, and we can compute the heterogeneity in turgor: from Eq. (S19), we find that

$$\Delta P = rac{1- ilde{lpha}^s}{2}(P^M-P_0),$$

and hence

$$\Delta P = \frac{1}{2} (1 - \tilde{\alpha}^s) (1 - \alpha^{as}) (P^M - P_0^Y).$$
 [S22]

2. Numerical resolution of the 2D multicellular model

Structure of the mathematical problem. Thanks to the geometrical constraint of uni-directional growth, the Lockhart-Ortega is very simple to resolve. The identity between the relative growth rate of the cell and the strain rate of the walls allows to couple the equation that describes fluxes, and the equation that describes walls synthesis. Then the stress in the walls and the pressure inside the cell are linked by the mechanical equilibrium. Finally there is only one independent variable (pressure for instance) and the model can be solved analytically.

Conversely, in the bidimensionnal model we propose, the properties of a given wall (elongation rate and elastic deformation) cannot be directly linked to the properties of the adjacent cells (growth rate and pressure). Hence a new strategy has to be developped. First, we emphasize the strong coupling between fluxes and mechanics: the motion of the vertices is prescribed by the mechanical equilibrium (Eq. 11 from main text) between pressure forces and elastic forces; meanwhile, a displacement of the vertices can cause a variation of volume of several cells, which has to be balanced by water fluxes (Eq. 10 from main text); water fluxes are limited by the finite permeability of the walls, which sets a constraint on possible variations of volume. Similarly, any variation in the length of the walls leads to a modification of their elastic deformation (Eq. 7 from main text). Another way to understand this problem is to consider it as the minimization of mechanical energy (mechanical equilibrium Eq. 11 from main text) under two constraints on the position of the vertices, through the volumes of the cells (Eq. 10 from main text) and the lengths of the edges (Eq. 7 from main text). This kind of problem is often encountered in mechanics, e.qsolid friction, contact mechanics, or incompressible fluid mechanics; a powerfull theoritical and practical tool to solve this is the 934

method of lagrangian multipliers. For instance, in the context of incompressible fluid mechanics, the constraint of volume 935 conservation is relaxed by pressure that acts as a lagragian multiplier. Physically, the pressure adjusts itself so that both the constraint and the mechanical equilibrium are satisfied. The model we propose exhibits the same structure, as pressure will adjust to both fluxes and mechanical constraints. However, the system here is discrete, and the flux equation (Eq. 10 in main text) is linear with respect to pressure, so it can be reduced to a linear system. We will take advantage of this for the resolution of the model.

Resolution algorithm.

Volumes and lengths as functions of the positions of the vertices. First, we express volumes and lengths as functions of the positions of the vertices. Let N_v be the number of vertices and $X \in \mathbb{R}^{2N_v}$ the vector of the positions of all the vertices. The volume of a cell i is $V_i = S_i h$ where S_i is its surface. As cells are non intersecting polygons, their signed surface is given by the general formula

$$S_{i} = \frac{1}{2} \sum_{k=0}^{n_{i}-1} (x_{k}y_{k+1} - x_{k+1}y_{k}), \qquad [S23] \quad \begin{array}{c} 947\\ 948\\ 949 \end{array}$$

where n_i is the number of vertices of cell i, $(x_k, y_k)_{k=0,\dots,n_i-1}$ are the coordinates of the vertices of the cell i in counterclockwise order, and we set $(x_{n_i}, y_{n_i}) = (x_0, y_0)$. Let N_c be the number of cells and $V \in \mathbb{R}^{N_c}$ the vector of all the cells volumes; thanks to Eq. (S23), it can be expressed as a function of X and its gradient $\nabla_X V$ with respect to X can be computed. Then the time derivative of V expresses as

$$\frac{\mathrm{d}\boldsymbol{V}}{\mathrm{d}t} = \nabla_{\boldsymbol{X}}\boldsymbol{V}\frac{\mathrm{d}\boldsymbol{X}}{\mathrm{d}t}.$$
954
955

Note here that $\nabla_{\mathbf{X}} \mathbf{V}$ is a $N_c \times 2N_e$ matrix and $\frac{d\mathbf{X}}{dt}$ is a $2N_e$ vector, so their product is well defined and has the correct dimension.

Similarly, the length of a segment k with two vertices $v_1 = (x_1, y_1)$ and $v_2 = (x_2, y_2)$ at its ends is

$$l_k = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}.$$
 [S24]
[S24]
959
960

Let N_e be the number of edges and $l \in \mathbb{R}^{N_e}$ the vector of all the edges lengths; thanks to Eq. (S24), it can be expressed as a function of X and its gradient $\nabla_X l$ with respect to X can be computed. Then the time derivative of l expresses as

$$\frac{\mathrm{d}\boldsymbol{l}}{\mathrm{d}\boldsymbol{t}} = \nabla_{\boldsymbol{X}}\boldsymbol{l}\frac{\mathrm{d}\boldsymbol{X}}{\mathrm{d}\boldsymbol{t}}.$$
963
964

Time discretisation. Time is discretized using a fixed time step Δt and the time derivatives are approximated by the 1st order Euler scheme, for instance:

$$\frac{\mathrm{d}\boldsymbol{X}}{\mathrm{d}t}(t) \approx \frac{\boldsymbol{X}(t+\Delta t) - \boldsymbol{X}(t)}{\Delta t}.$$
967
968

Let $\varepsilon \in \mathbb{R}^{N_{\varepsilon}}$ be the vector of all the elastic deformations of the edges. Let $X^{0} = X(0)$ and $\varepsilon^{0} = \varepsilon(0)$ be some initial conditions. We construct successive approximations of the solution at times $t_n = n\Delta t$ for n > 0 by solving at each time step the mechanical equilibrium (Eq. 11 from main text) along with the discretized versions of flux (Eq. 10 from main text) and wall rheology (Eq. 7 from main text) equations: let $P \in \mathbb{R}^{N_c}$ be the vector of all the cells pressures; these equations can be written in a matrix form:

$$\nabla_{\boldsymbol{X}} \boldsymbol{V}(\boldsymbol{X}^{n+1}) \frac{\boldsymbol{X}^{n+1} - \boldsymbol{X}^n}{\Delta t} = M_P \boldsymbol{P}^{n+1} + \boldsymbol{b}_P, \qquad [S25] \quad 974$$

$$\frac{\varepsilon^{n+1} - \varepsilon^n}{\Delta t} + \beta^n \varepsilon^{n+1} = \frac{1}{l(\boldsymbol{X}^{n+1})} \nabla_{\boldsymbol{X}} \boldsymbol{l}(\boldsymbol{X}^{n+1}) \frac{\boldsymbol{X}^{n+1} - \boldsymbol{X}^n}{\Delta t}.$$
[S26] 976
977

where M_P is a $N_i \times N_i$ matrix, with the following non-zero coefficients:

$$M_P(i,i) = A_i L_i^a - \sum_{j \in n(i)} A_{ij} L_{ij}^s, \quad \forall i = 1, \dots, N_c,$$
979
980
981

$$M_P(i,j) = A_{ij}L_{ij}^s, \quad \forall i = 1, \dots, N_c, \qquad \forall j \in n(i),$$
982
983

with $\boldsymbol{b}_P \in \mathbb{R}^{N_c}$ is defined by its coefficients

$$\boldsymbol{b}_{p}(i) = A_{i}L_{i}^{a}P^{M}, \qquad \forall i = 1, \dots, N_{c}.$$
984
985

Note here that the model implies no time derivative of the pressure, so that $\forall n > 0$, \mathbf{P}^{n+1} can be computed without the knowledge of \boldsymbol{P}^n , and the initial value of the pressure is not needed.

In addition, β^n is the $N_e \times N_e$ diagonal matrix with components $\beta^n(k,k) = \frac{2w}{h} \phi^w_k E_k \max\left(0, \frac{\varepsilon_k^n - \varepsilon_k^Y}{\varepsilon_k^n}\right)$ for $k = 1, \dots, N_e$,

and for the purpose of notation, $\frac{1}{I}$ is the $N_e \times N_e$ diagonal matrix with components $1/l_k$. Note here that the variables β^n are taken at time step n so that they are considered as constants at time step n + 1 and the equation Eq. (S26) is linear with respect to the unknown ε^{n+1} .

8 of 11

993 Pressure and elastic deformation as functions of the position of the vertices. Thanks to this time discretization, we see 994 that at each time step, the unknown pressure P^{n+1} and elastic deformation ε^{n+1} are defined through the linear equations Eq. (S25) and Eq. (S26) which can be easily inverted, which allows to express both these variables as functions of the spatial unknown X^{n+1} .

First, from equation Eq. (S25):

$$P(\mathbf{X}^{n+1}) = \frac{1}{\Delta t} M_P^{-1} \nabla_{\mathbf{X}} \mathbf{V}(\mathbf{X}^{n+1}) \mathbf{X}^{n+1} - M_P^{-1} \left(\frac{1}{\Delta t} \nabla_{\mathbf{X}} \mathbf{V}(\mathbf{X}^{n+1}) \mathbf{X}^n - \mathbf{b}_P \right).$$
[S27] 1060
1061
1062

Then, using Eq. (S26):

$$\boldsymbol{\varepsilon}\left(\boldsymbol{X}^{n+1}\right) = \frac{1}{\Delta t} M_{\boldsymbol{\varepsilon}}^{-1} \frac{1}{\boldsymbol{l}(\boldsymbol{X}^{n+1})} \nabla_{\boldsymbol{X}} \boldsymbol{l}(\boldsymbol{X}^{n+1}) \boldsymbol{X}^{n+1} - \frac{1}{\Delta t} M_{\boldsymbol{\varepsilon}}^{-1} \left(\frac{1}{\boldsymbol{l}(\boldsymbol{X}^{n+1})} \nabla_{\boldsymbol{X}} \boldsymbol{l}(\boldsymbol{X}^{n+1}) \boldsymbol{X}^{n} - \boldsymbol{\varepsilon}^{n}\right), \quad [S28] \quad \begin{array}{c} 1065\\ 1066\\ 1067\end{array}$$

1006 where $M_{\varepsilon} = \frac{1}{\Delta t} I_{N_e} + \beta^n$.

Structure of the resolution algorithm Thanks to the two previous steps, we are now able to propose a algorithm for the resolution of the model.

• Initialization: Define $X^0 \in \mathbb{R}^{2N_v}$ and $\varepsilon^0 \in \mathbb{R}^{N_e}$

• $\forall n \geq 0$, assuming \mathbf{X}^n and $\boldsymbol{\varepsilon}^n$ are known, let $\mathbf{F}^n : \mathbb{R}^{2N_v} \to \mathbb{R}^{2N_v}$ be the function such that $\forall v = 0, \ldots, N_v - 1$,

$$\begin{pmatrix} F_{2v+1}^n(\boldsymbol{X}) \\ F_{2v+2}^n(\boldsymbol{X}) \end{pmatrix} = \frac{1}{2} \sum_{k \in f(v)} \Delta_k P(\boldsymbol{X}) \ A_k(\boldsymbol{X}) \boldsymbol{n}_k(\boldsymbol{X}) + \sum_{k \in f(v)} E_k \varepsilon_k^e(\boldsymbol{X}) a_k(\boldsymbol{X}) \boldsymbol{e}_{k,v}(\boldsymbol{X}),$$

where F_k^n is the k-th component of F^n , and with the same notations as in Eq. 11 from main text; P(X) and $\varepsilon(X)$ are the functions of X given by Eq. (S27) and Eq. (S28). Then, the new position of the vertices X^{n+1} is the solution of the equation

$$\boldsymbol{F}^{n}(\boldsymbol{X}) = 0.$$
[S29]

Resolution of Eq. (S29). This is the last and most critical step of the resolution algorithm. The problem of computing the roots of a multidimensional non linear function is often encountered in the mechanical modelling of complex multibody systems, and a method of choice for the resolution is the Newton algorithm [1]. It is a iterative process which derives from a Taylor expansion about a current point u^k :

 $F^{n}(u^{k+1}) = F^{n}(u^{k}) + J(u^{k})(u^{k+1} - u^{k}) + o(u^{k+1} - u^{k}),$

where $J(u^k)$ is the jacobian matrix of function F^n . The new value u^{k+1} is obtained by setting the right-hand side to zero and neglecting the high order term, and then solving the linear system:

$$J(u^{k})\delta u^{k} = -F^{n}(u^{k}), u^{k+1} = u^{k} + \delta u^{k}.$$
1093
1094

With the initial value $u^0 = X^n$, iterations are run until a stopping criterium is met, for instance

$$\frac{\|\boldsymbol{F}^{n}(\boldsymbol{u}^{k})\|}{\|\boldsymbol{F}^{n}(\boldsymbol{u}^{0})\|} \le tol_{res},$$
[S30] 1097
1098
1099

where $tol_{res} > 0$ is a fixed value. Then one can set $X^{n+1} = u^k$.

The compution of the jacobian matrix $J(u^k)$ is non trivial here because of the numerous non-linearities of function F^n . 1040 Therefore we have chosen to use the Newton-Krylov variant of this algorithm, that avoids the computation of the jacobian without loosing efficiency [1].

However, Newton methods in general have only local convergence properties, which means that they need an initial guess close enough to the solution to be able to converge. This is critical for instance in the first time step of the simulation, because the initial conditions might be far from equilibrium, but also for further time steps. This lack of global convergence properties is often dealt with by adding a friction term proportional to the velocity and hence to the time derivative of the positions. With this method, the problem to solve at each time step becomes after time discretization: find \boldsymbol{X} such that

$$G(X) = F^{n}(X) - c \frac{X - X^{n}}{\Delta t} = 0,$$

1109

1110

1111

1111

1109

1110

1110

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

11111

11111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

1111

11111

11111

11111

11111

1111

11111

11111

11111

11111

where c > 0 is a friction coefficient. This new problem is easier to solve with the Newton method, all the more that c is large. However, the root of G might not satisfy the condition Eq. (S30), and in addition its value depends on the value of c. Therefore, instead of applying the Newton method to the function G, we perform the following iterative process:

• Initialization: $\boldsymbol{u}^0 = \boldsymbol{X}^n$

Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin

• Assuming u^k is known, compute u^{k+1} as the solution of

$$G^k(u^{k+1}) = 0,$$
 [S31] 1180
1181

where $G^{k}(u^{k+1}) = F^{n}(u^{k+1}) - c^{k} \frac{u^{k+1} - u^{k}}{\Delta t}$, and the value $c^{k} > 0$ will be adjusted to ensure a robust convergence (see below). This solution is computed thanks to the Newton method, with the tolerance $tol_{res}/10$ in the stopping criterium.

• The iterations are stopped when $\frac{\|F^n(u^k)\|}{\|F^n(u^0)\|} \leq tol_{res}$. Then the choice $X^{n+1} = u^k$ is an approximate solution of Eq. (S29).

In this algorithm, the choice of the friction coefficient c^k is not straightforward: a large value would ensure the convergence of subproblem Eq. (S31), but it would also slow down the convergence toward the solution of problem Eq. (S29). To avoid this, we choose a large initial value c^0 and decrease it with the law $c^{k+1} = c^k/2$. This choice ensures a robust behaviour of the algorithm.

3. Sets of parameters used for the bump simulations

Let $R_0 = 10\mu$ m be the initial radius of the cell, then $P^Y = \frac{w}{R_0 \cos(\pi/6)} E \varepsilon^Y$ is a representative value for the yield turgor of a 1194 hexagonal cell. However we have observed that the effective threshold pressure is approximately twice lower in multicellular 1195 tissues and we have adapted the value of E accordingly: we choose E such that $P^Y = 0.5$ MPa and multiplied this value by 1196 two to obtain a an order of magnitude for the initial turgor of the cell close to the target value 0.5 MPa. The value $\varepsilon^Y = 0.1$ is 1197 chosen accordingly to experimental observations where wall deformations can be of the order of 10%. We choose two values for 1198 P^M : 0.55 MPa close to the threshold, and 0.7 MPa. Finally, we can use the Lockhart's prediction $\dot{\gamma}^*$ (Eq.6 from main text) as 1199 an order of magnitude of the relative growth rate; we choose $\dot{\gamma}^* = 2\% \cdot h^{-1}$. Then, a given value of α^a (evaluated with $R = R_0$) 1200 sets a unique value of L^a and ϕ^w . The table S1 recapitulates the sets of parameters used in this article, either with the control parameters

$$\varepsilon^{Y}, P^{M}, P^{Y}, \dot{\gamma}^{*}, \alpha^{a},$$
[S32] 1203
1204

or equivalently with the actual parameters of the model

$$\varepsilon^{Y}, P^{M}, E, \Phi^{w}, L^{a}.$$
 [S33] 1206
1207

The correspondence has been obtained with $R_0 = 6.5 \mu m$.

References

	10 of 11 Ibrahim Cheddadi, Michel Génard, Nadia Bertin, Christophe Godin	
1178		1240
1177		1239
1176		1238
1175		1237
1174		1236
1173		1235
1172		1234
1171		1233
1170		1232
1169		1231
1168		1230
1167		1229
1166		1228
1165		1227
1164		1226
1163		1225
1162		1223 1224
1161		1222 1223
$1159 \\ 1160$		1221 1222
$1150 \\ 1159$		1220 1221
$1157 \\ 1158$		$1219 \\ 1220$
1156		1218
1155		1217
1154		1216
1153		1215
1152		1214
1151	193:357–397.	1213
$1145 \\ 1150$	1. Knoll DA, Keyes DE (2004) Jacobian-free newton-krylov methods: a survey of approaches and applications. J Comp Phys	1211 1212

(S32), and the bottom part to the actual parameters $Eq.$ $(S32)$ used in the 2D model. The rightmost parameters after the vertical are specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ϵ^Y P^M (MPa) Φ^w (MPa^{-1.s^{-1}) L^s (m.MPa^{-1.s^{-1}) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$ (ALPHA+)<	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ϵ^Y P^M (MPa) Φ^w (MPa^{-1.s^{-1}) L^s (m.MPa^{-1.s^{-1}) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$ (ALPHA+)<	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ϵ^Y P^M (MPa) Φ^w (MPa^{-1.s^{-1}) L^s (m.MPa^{-1.s^{-1}) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$ (ALPHA+)<	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ϵ^Y P^M (MPa) Φ^w (MPa^{-1.s^{-1}) L^s (m.MPa^{-1.s^{-1}) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$ (ALPHA+)<	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Q. (S32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertical parameters are specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters 10μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.75 $0.5 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ 9.6	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Image: Control parameters ϵ^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Image: Control parameters ϵ^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $9.6 \cdot 10^{-12}$ (ALP	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Image: Normal system Control parameters ϵ^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h^{-1}) α^a α^s $= 10\mu m$ and $w = h/20$. $memory = h/20$. $memory = h/20$. $memory = h/20$. $memory = h/20$. (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (PM-) 0.1 0.7 1.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $9.6 \cdot 10^{-12}$ $7.0 \cdot 10^{-9}$ <td>32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h⁻¹) α^a α^s μm and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa⁻¹.s⁻¹) L^a (m.MPa⁻¹.s⁻¹) L^s (m.MPa⁻¹.s⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<></td>	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Control parameters ϵY P^M (MPa) γ^* (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ϵ^Y P^M (MPa) Φ^w (MPa^{-1.s^{-1}) L^s (m.MPa^{-1.s^{-1}) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$ (ALPHA+)<	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	I. (S32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertical rare specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters 10μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.9 (CC-) 0.1 0.7 0.5 2:10 ⁻² 0.1 0.1 (REF) 0.1 0.7 0.5 2:10 ⁻² 0.1 0.1 (CC-) 0.1 0.7 0.5 2:10 ⁻² 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Image: Control parameters ϵ^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h^{-1}) α^a α^s = 10 μ m and $w = h/20$. Image: Control parameters ϵ^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h^{-1}) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (PM-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.9 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $9.6 \cdot 10^{-12}$ (ALP	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th></tr<>							
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	32), and the bottom part to the actual parameters Eq. (S32) used in the 2D model. The rightmost parameters after the vertice specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s μ m and $w = h/20$. Control parameters ε^Y P^M (MPa) P_6^Y (MPa) $\dot{\gamma}^*$ (h ⁻¹) α^a α^s (REF) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (CC-) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.1 (ALPHA+) 0.1 0.7 0.5 $2 \cdot 10^{-2}$ 0.1 0.9 (PM-) 0.1 0.55 0.5 $0.5 \cdot 10^{-2}$ 0.1 0.9 Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa ⁻¹ .s ⁻¹) L^a (m.MPa ⁻¹ .s ⁻¹) L^s (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.6 \cdot 10^{-12}$ <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>							
The specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters $10\mu m$ and $w = h/20$.Control parameters ε^Y P^M (MPa) P^Y_6 (MPa) $\dot{\gamma}^*$ (h^{-1}) α^a α^s (REF)0.10.70.5 $2 \cdot 10^{-2}$ 0.10.9(CC-)0.10.70.5 $2 \cdot 10^{-2}$ 0.10.1(ALPHA+)0.10.70.5 $2 \cdot 10^{-2}$ 0.10.9(PM-)0.10.550.5 $0.5 \cdot 10^{-2}$ 0.10.9Actual parameters ε^Y P^M (MPa) E (MPa) Φ^w (MPa^{-1}.s^{-1}) L^a (m.MPa^{-1}.s^{-1}) L^s (m.MPa^{-1}.s^{-1})(REF)0.10.7112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-)0.10.7112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $9.6 \cdot 10^{-12}$ (ALPHA+)0.10.7112.6 $3.1 \cdot 10^{-6}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$	The specific to multicellular models as they quantify the water conductivity between neighbour cells. The geometrical parameters in the product of the second se	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $							
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(S32), and the bott	tom part to the a	ctual paramete	ers Eq. (S32)	used in the 2D mode	el. The rightmost paran	neters after the vertic
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	(S32), and the both r are specific to mult	tom part to the a Iticellular models	ctual paramete	ers Eq. (S32)	used in the 2D mode	el. The rightmost paran	neters after the vertic
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	(S32), and the both are specific to multiple	tom part to the a Iticellular models	ctual paramete	ers Eq. (S32)	used in the 2D mode	el. The rightmost paran	neters after the vertic
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$({f S32})$, and the both are specific to mul	tom part to the a lticellular models 20.	ctual paramete	ers $Eq.$ (S32) tilfy the water	used in the 2D mode	el. The rightmost paran	neters after the vertic
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	(S32), and the bott are specific to mul $10\mu m$ and $w = h/2$	tom part to the a lticellular models 20.	ctual paramete s as they quan	ers $Eq.$ (S32) tilfy the water	used in the 2D mode conductivity betwee $\dot{\gamma}^*~({ m h}^{-1})$	el. The rightmost paran en neighbour cells. Th	neters after the vertic ne geometrical param
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	(S32), and the both are specific to mul $10\mu m$ and $w = h/2$ Control par	tom part to the a lticellular models 20. ε^Y	ctual parameters as they quan $P^{M} (MPa)$	Provide the second sec	used in the 2D mode conductivity between $\dot{\gamma}^*~({\rm h}^{-1})$ $2\cdot 10^{-2}$	el. The rightmost param en neighbour cells. Th α^a	neters after the vertic ne geometrical param $lpha^s$
Actual parameters ε^{Y} P^{M} (MPa) E (MPa) Φ^{w} (MPa ⁻¹ .s ⁻¹) L^{a} (m.MPa ⁻¹ .s ⁻¹) L^{s} (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $9.6 \cdot 10^{-12}$ (ALPHA+) 0.1 0.7 112.6 $3.1 \cdot 10^{-6}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$	Actual parameters ε^{Y} P^{M} (MPa) E (MPa) Φ^{w} (MPa ⁻¹ .s ⁻¹) L^{a} (m.MPa ⁻¹ .s ⁻¹) L^{s} (m.MPa ⁻¹ .s ⁻¹) (REF) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$ (CC-) 0.1 0.7 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $9.6 \cdot 10^{-12}$ (ALPHA+) 0.1 0.7 112.6 $3.1 \cdot 10^{-6}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	(S32), and the bott are specific to mul $10\mu m$ and $w = h/2$ Control par (REF) (CC-)	tom part to the a lticellular models 20. 20. colspan="2"> ε^Y colspan="2"> 0.1) 0.1	P ^M (MPa) 0.7 0.7	P_6^Y (MPa) 0.5	used in the 2D mode conductivity between $\dot{\gamma}^*$ (h ⁻¹) $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$	el. The rightmost paramen neighbour cells. The α^a 0.1 0.1	eters after the vertic be geometrical parameters α^s 0.9 0.1
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	(S32), and the bott are specific to mul 10μ m and $w = h/2$ (REF) (CC-) (ALPHA	to mean to the a licellular models 20. 20. colspan="2">colspan="2"> ε^Y colspan="2"> 0.1 0.1 0.1	P ^M (MPa) 0.7 0.7 0.7	Prescription Eq. (S32) tiffy the water P_6^Y (MPa) 0.5 0.5 0.5	$\dot{\gamma}^*$ (h ⁻¹) $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$	el. The rightmost paramen neighbour cells. The α^a 0.1 0.1 0.9	$lpha^s$ 0.9 0.1 0.9
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	(S32), and the bott are specific to multiple to mul	to mean to the a lticellular models 20.cameters ε^Y)0.1)0.1A+)0.1)0.1	P ^M (MPa) 0.7 0.7 0.7	Prescription Eq. (S32) tiffy the water P_6^Y (MPa) 0.5 0.5 0.5	$\dot{\gamma}^*$ (h ⁻¹) $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$	el. The rightmost paramen neighbour cells. The α^a 0.1 0.1 0.9	$lpha^s$ 0.9 0.1 0.9
(ALPHA+) 0.1 0.7 112.6 $3.1 \cdot 10^{-6}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$	(ALPHA+) 0.1 0.7 112.6 $3.1 \cdot 10^{-6}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$	(ALPHA+) 0.1 0.7 112.6 $3.1 \cdot 10^{-6}$ $7.8 \cdot 10^{-10}$ $7.0 \cdot 10^{-9}$	(S32), and the both are specific to multiple for $w = h/2$ $(D\mu m \text{ and } w = h/2)$ (REF) (CC-) (ALPHA) (PM-)	tom part to the a lticellular models 20. ε^Y γ 0.1 λ_+ 0.1 λ_+ 0.1	P ^M (MPa) 0.7 0.7 0.7 0.7 0.7 0.55	Press Eq. (S32) tify the water P_6^Y (MPa) 0.5 0.5 0.5 0.5 0.5	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ \hline 2 \cdot 10^{-2} \\ \hline 2 \cdot 10^{-2} \\ \hline 2 \cdot 10^{-2} \\ \hline 0.5 \cdot 10^{-2} \end{array}$	el. The rightmost paramen neighbour cells. The α^a 0.1 0.1 0.9 0.1	$\begin{array}{c} \alpha^s \\ \hline 0.9 \\ 0$
			$\begin{array}{c} (S32), \text{ and the bott}\\ \textbf{are specific to mul}\\ = 10 \mu \text{m and } w = h/2\\ \hline \\ \hline$	to m part to the a lticellular models 20.cameters ε^Y \circ 0.1 \circ 0.1 \circ 0.1 \circ 0.1 \circ 0.1 \circ ε^Y	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa)	Pers Eq. (S32) tify the water P_6^Y (MPa) 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	$\dot{\gamma}^*$ (h ⁻¹) $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $0.5 \cdot 10^{-2}$ Φ^w (MPa ⁻¹ .s ⁻¹) $2.8 \cdot 10^{-5}$	e. The rightmost parameter neighbour cells. The rightmost parameter α^a o.1 o.1 o.1 o.9 o.1 L^a (m.MPa ⁻¹ .s ⁻¹)	$\begin{array}{c} \alpha^s \\ \hline \alpha^s \\ 0.9 \\ 0.1 \\ 0.9 \\ 0.9 \\ 0.9 \\ L^s \ (\mathrm{m.MPa^{-1}.s^{-1}}) \end{array}$
(PM-) 0.1 0.55 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$	(PM-) 0.1 0.55 112.6 $2.8 \cdot 10^{-5}$ $8.7 \cdot 10^{-11}$ $7.8 \cdot 10^{-10}$	(PM-) 0.1 0.55 112.6 2.8 · 10 ⁻⁵ 8.7 · 10 ⁻¹¹ 7.8 · 10 ⁻¹⁰	(S32), and the bott r are specific to mul $= 10 \mu m$ and $w = h/2$ (REF, (CC-) (ALPHA (PM-) Actual para (REF,	to mean to the a licellular models 20. ε^Y 20. 0.1) 0.1 A+) 0.1) 0.1 ameters ε^Y c) 0.1 ameters ε^Y c) 0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7	P_6^Y (MPa) 0.5 0.5 0.5 0.5 1.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	$\dot{\gamma}^*$ (h ⁻¹) $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $2 \cdot 10^{-2}$ $0.5 \cdot 10^{-2}$ Φ^w (MPa ⁻¹ .s ⁻¹) $2.8 \cdot 10^{-5}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
			$\begin{array}{c} (\text{S32}), \text{ and the bott}\\ \textbf{r are specific to mul}\\ = 10 \mu \textbf{m and } w = h/2\\ \hline \\ \hline$	to m part to the a lticellular models 20.rameters ε^Y \circ)0.1 \circ)0.1 \circ)0.1 \circ)0.1 \circ ε^Y \circ)0.1 \circ \circ \circ)0.1 \circ)0.1 \circ)0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7	Pers Eq. (S32) tify the water P_6^Y (MPa) 0.5 0.5 0.5 0.5 0.5 112.6 112.6	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ \hline 2 \cdot 10^{-2} \\ \hline 2 \cdot 10^{-2} \\ \hline 2 \cdot 10^{-2} \\ \hline 0.5 \cdot 10^{-2} \\ \hline \Phi^{w} \ (\mathrm{MPa^{-1}.s^{-1}}) \\ \hline 2.8 \cdot 10^{-5} \\ \hline 2.8 \cdot 10^{-5} \\ \hline \end{array}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
			$\begin{array}{c} (S32), \text{ and the bott}\\ \hline \text{are specific to mul}\\ = 10 \mu \text{m and } w = h/2\\ \hline \\ \hline$	to m part to the a lticellular models 20.cameters ε^Y \circ 0.1 \circ 0.1 \bullet 0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7 0.55 P ^M (MPa) 0.7 0.55	$\begin{array}{c} P_{6}^{Y} \; (\text{MPa}) \\ \hline P_{6}^{Y} \; (\text{MPa}) \\ \hline 0.5 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline \end{array}$	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 0.5 \cdot 10^{-2} \\ \Phi^{w} \ (\mathrm{MPa}^{-1} . \mathrm{s}^{-1}) \\ 2.8 \cdot 10^{-5} \\ 2.8 \cdot 10^{-5} \\ 3.1 \cdot 10^{-6} \end{array}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
			q. (S32), and the bott ar are specific to mul = 10μ m and $w = h/2$ (REF) (CC-) (ALPHA (PM-) Actual para (REF) (CC-) (ALPHA	to m part to the a lticellular models 20.cameters ε^Y \circ 0.1 \circ 0.1 \bullet 0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7 0.55 P ^M (MPa) 0.7 0.55	$\begin{array}{c} P_{6}^{Y} \; (\text{MPa}) \\ \hline P_{6}^{Y} \; (\text{MPa}) \\ \hline 0.5 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline \end{array}$	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 0.5 \cdot 10^{-2} \\ \Phi^{w} \ (\mathrm{MPa}^{-1} . \mathrm{s}^{-1}) \\ 2.8 \cdot 10^{-5} \\ 2.8 \cdot 10^{-5} \\ 3.1 \cdot 10^{-6} \end{array}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
			$\begin{array}{c} (\text{S32}), \text{ and the bott}\\ \textbf{r are specific to mul}\\ = 10 \mu \textbf{m and } w = h/2 \\ \hline \\ \hline \\ \textbf{Control par}\\ \hline \\ (\text{REF})\\ \hline \\ (\text{CC-})\\ \hline \\ (\text{ALPHA}\\ \hline \\ \hline \\ (\text{REF})\\ \hline \\ \hline \\ (\text{CC-})\\ \hline \\ (\text{ALPHA}\\ \hline \\ \hline \\ (\text{REF})\\ \hline \\ (\text{CC-})\\ \hline \\ (\text{ALPHA}\\ \hline \\ \hline \\ (\text{REF})\\ \hline \\ (\text{CC-})\\ \hline \\ (\text{ALPHA}\\ \hline \\ \hline \end{array}$	to m part to the a lticellular models 20.cameters ε^Y \circ 0.1 \circ 0.1 \bullet 0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7 0.55 P ^M (MPa) 0.7 0.55	$\begin{array}{c} P_{6}^{Y} \; (\text{MPa}) \\ \hline P_{6}^{Y} \; (\text{MPa}) \\ \hline 0.5 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline \end{array}$	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 0.5 \cdot 10^{-2} \\ \hline \Phi^{w} \ (\mathrm{MPa}^{-1}.\mathrm{s}^{-1}) \\ 2.8 \cdot 10^{-5} \\ 2.8 \cdot 10^{-5} \\ 3.1 \cdot 10^{-6} \end{array}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
			$(S32), and the bottr are specific to mul= 10 \mum and w = h/2(REF)$ $(CC-)$ $(ALPHA)$ $(PM-)$ $Actual para(REF)(CC-)(ALPHA)(CC-)(ALPHA)$	to m part to the a lticellular models 20.cameters ε^Y \circ 0.1 \circ 0.1 \bullet 0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7 0.55 P ^M (MPa) 0.7 0.55	$\begin{array}{c} P_{6}^{Y} \; (\text{MPa}) \\ \hline P_{6}^{Y} \; (\text{MPa}) \\ \hline 0.5 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline \end{array}$	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 0.5 \cdot 10^{-2} \\ \hline \Phi^{w} \ (\mathrm{MPa}^{-1}.\mathrm{s}^{-1}) \\ 2.8 \cdot 10^{-5} \\ 2.8 \cdot 10^{-5} \\ 3.1 \cdot 10^{-6} \end{array}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
			S32), and the both re specific to multiple of the specific term of te	to m part to the a lticellular models 20.cameters ε^Y \circ 0.1 \circ 0.1 \bullet 0.1	P ^M (MPa) 0.7 0.7 0.55 P ^M (MPa) 0.7 0.55 P ^M (MPa) 0.7 0.55	$\begin{array}{c} P_{6}^{Y} \; (\text{MPa}) \\ \hline P_{6}^{Y} \; (\text{MPa}) \\ \hline 0.5 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline 112.6 \\ \hline \end{array}$	$\begin{array}{c} \dot{\gamma}^{*} \ (\mathrm{h}^{-1}) \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 2 \cdot 10^{-2} \\ 0.5 \cdot 10^{-2} \\ \hline \Phi^{w} \ (\mathrm{MPa}^{-1}.\mathrm{s}^{-1}) \\ 2.8 \cdot 10^{-5} \\ 2.8 \cdot 10^{-5} \\ 3.1 \cdot 10^{-6} \end{array}$	e. The rightmost parameter neighbour cells. The rightmost parameter neighbour cells. The result of	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$