

Fig. S1. Graphic definition of what is meant by inside, outside of curl and of fibre, and the direction of curl in main text.

Table S1. Sheep used in study. Body live weight measured before and after wool collection. Body condition score is an expert observer subjective score from (1 = emaciated to 5 = fat). Curvature and diameter are grand means of measurements for all snippets measured using methods described in text (fibres were chosen to maximise the range of curvatures for each sheep).

Tag	Body wt. (kg)		Body cond. score		Mean Curvature (SD) °/mm	Mean Diameter (SD) µm
	Apr	Oct	Apr	Oct		
477	62.8	65.2	4	4	56.8 (27.1)	30.1 (3.7)
482	62.0	66.6	4	4	58.8 (28.5)	30.7 (6.0)
MR17	60.4	69.4	4	4	69.6 (23.1)	27.0 (3.0)
TB2	56.2	58.8	4	3	77.6 (30.8)	25.6 (2.5)
TA25	67.6	70.0	5	4	78.2 (19.0)	30.9 (5.0)
TB8	64.6	71.4	4	4	83.8 (30.9)	25.7 (2.7)
TB6	65.6	68.8	4	4	87.7 (36.9)	25.7 (2.6)
VL12	56.4	58.4	3	3	90.2 (28.0)	24.7 (2.5)

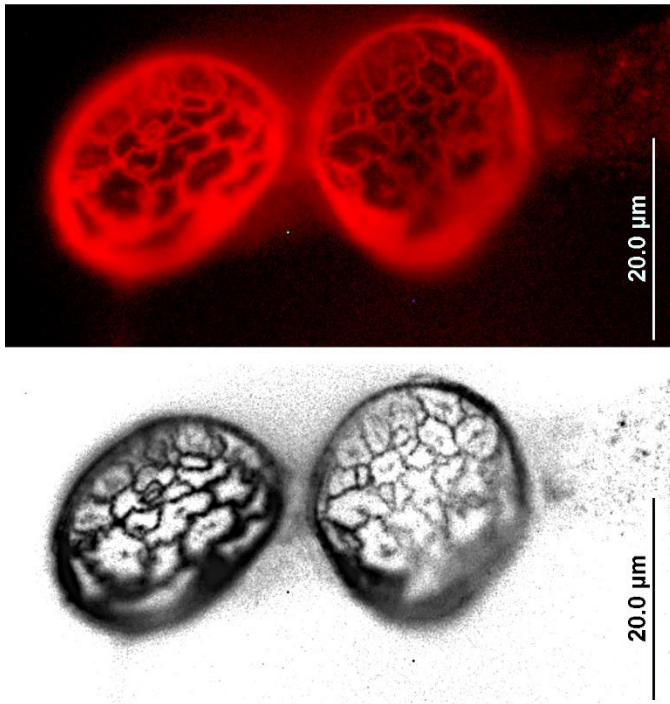


Fig. S2. Optical cross-sections from confocal microscopy of merino wool stained with cell boundary staining method taken during method development. The inverted and sharpened version in the bottom panel illustrates that cell boundaries are clearly visible throughout the fibre.

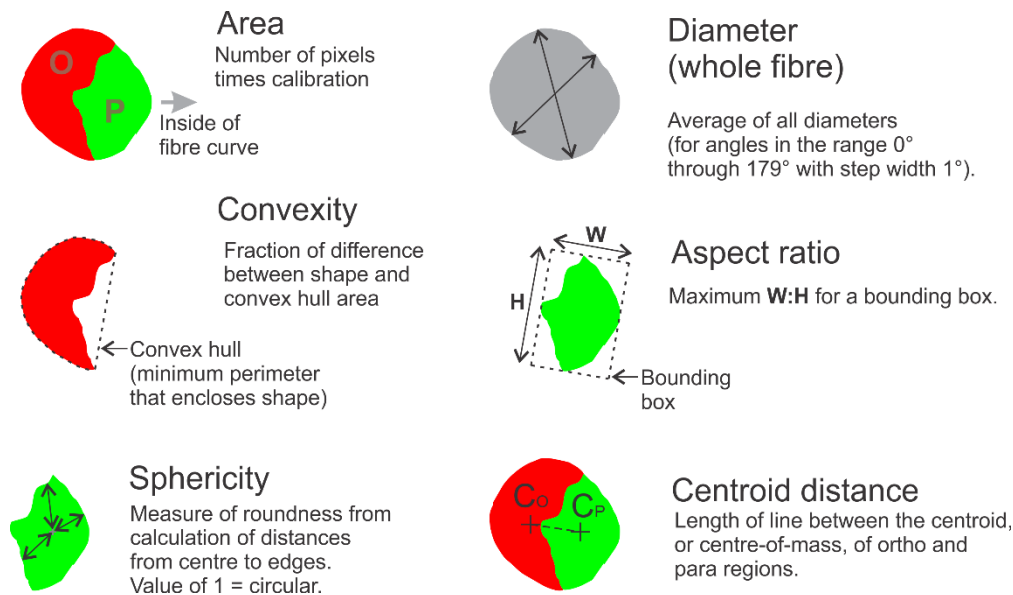


Fig. S3. Definitions of the key image analysis measurements made on segmented fibre images and fibre profiles.

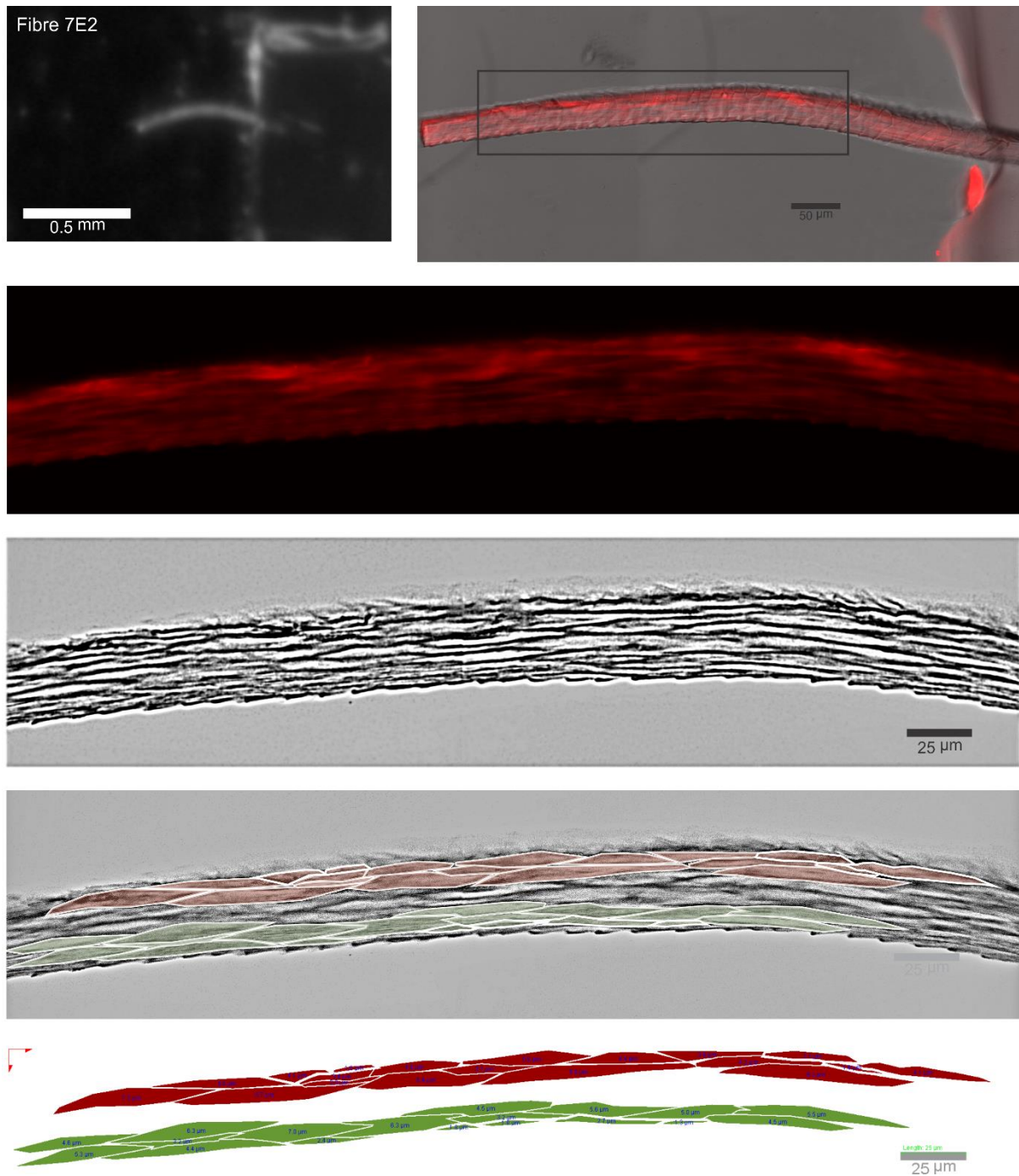


Fig. S4. Example images from preliminary work carried out to determine sampling approach. This included non-linear changes to contrast and local contrast enhancement methods. Cells taken within two cell widths from the fibre surface ensured that cell type could be determined. Centrally located cells were less easy to identify unambiguously.

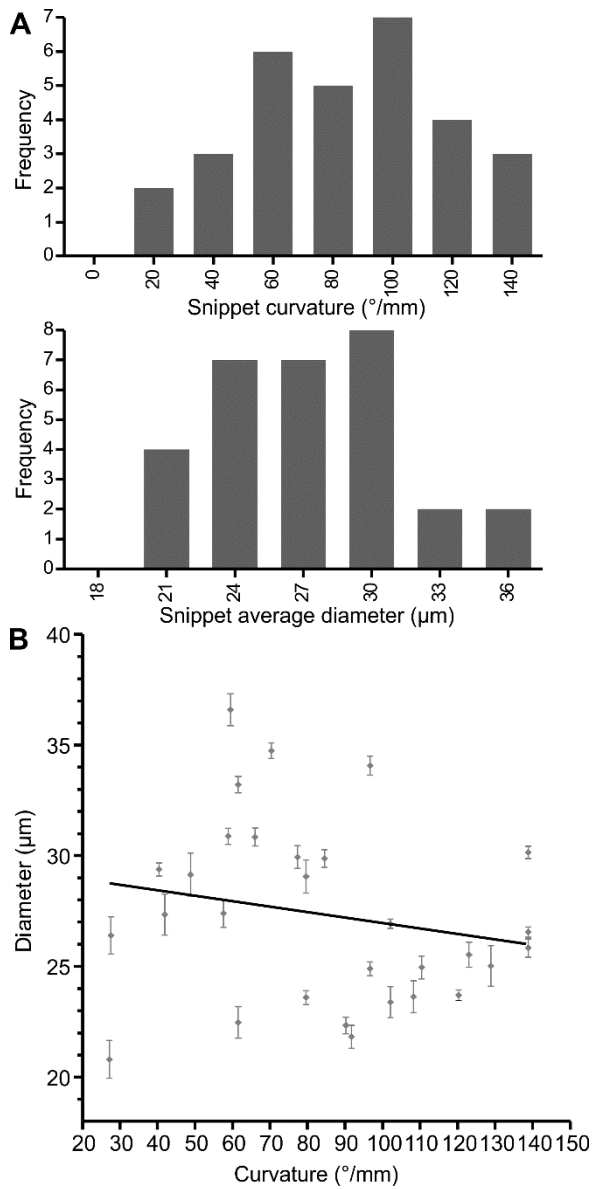


Fig. S5. Range of curvatures and diameters of snippets used in the cell-type analysis. A. distributions of curvatures and diameters. B. Diameter plotted against curvature for all snippets as means of 5 x-z sections per snippet, error bars are standard error of the mean and line is a linear regression.

Table S2. Regressions of data from orthocortex/paracortex analysis (n = 30 snippets x 5 x-z sections per snippet). CSA is cross-sectional area. NS is non-significant.

Relationship	Linear regression (r ²)	Deviation from zero slope	Figure
Diameter and curvature	0.04	NS	Sup.Fig.5B
CSA orthocortex and diameter	0.75	P<0.0001	Figure 3A
CSA paracortex and diameter	0.69	P<0.0001	Figure 3A
CSA orthocortex and curvature	0.00	NS	Figure 3B
CSA paracortex and curvature	0.08	NS	Figure 3B
Orthocortex paracortex ratio and curvature	0.02	NS	Figure 4A
CSA orthocortex minus paracortex as a proportion snippet CSA and curvature	0.06	NS	Figure 4B
Distance between centres of mass of orthocortex and paracortex	0.01	NS	Figure 4C
Distance between central points normalised by diameter of snippet	0.07	NS	Figure 4D
Orthocortex convexity and curvature	0.10	NS	Figure 5A
Paracortex convexity and curvature	0.01	NS	Figure 5A
Orthocortex aspect ratio and curvature	0.01	NS	Figure 5B
Paracortex aspect ratio and curvature	0.42	NS	Figure 5B
Cortex aspect ratio and curvature	0.05	NS	Figure 5B
Orthocortex circularity and curvature	0.01	NS	Figure 5C
Paracortex circularity and curvature	0.10	NS	Figure 5C
Cortex circularity and curvature	0.02	NS	Figure 5C

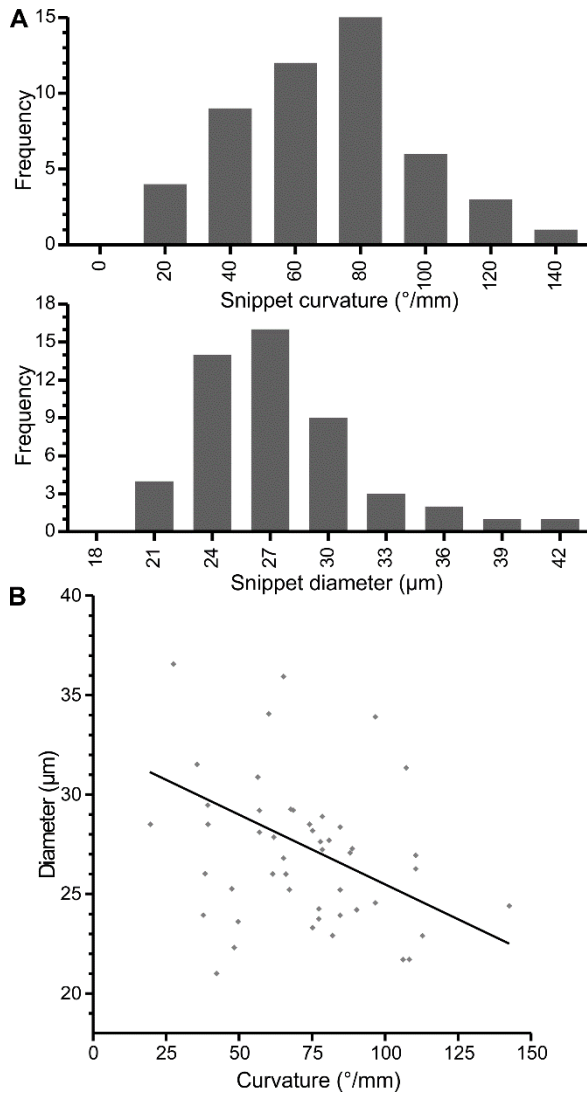


Fig. S6. Range of curvatures and diameters of snippets used in the cell-length analysis. A. distribution of curvatures and diameters. B. Diameter plotted against curvature for all snippets. The line is a linear regression.

Table S3. Regressions of data from cell length/number analysis (n = 50 snippets).

Relationship	Linear regression (r^2)	Deviation from zero slope	Figure
Diameter and curvature	0.18	P<0.0025	Sup.Fig.6B
Outside cell length and fibre diameter	0.14	P<0.01	Figure 7A
Inside cell length and fibre diameter	0.22	P<0.001	Figure 7A
Pooled cell length and fibre diameter	0.21	P<0.001	Figure 7A
Outside cell length and fibre curvature	0.01	NS	Figure 7B
Inside cell length and fibre curvature	0.13	P=0.013	Figure 7B
Pooled cell length and fibre curvature	0.02	NS	Figure 7B
Outside to inside cell length difference and curvature	0.30	P<0.0001	Figure 7C
Outside to inside cell length difference divided by fibre diameter, and fibre curvature	0.42	P<0.0001	Figure 7D
Ratio of number of cells in 250 μ m, outside:inside and fibre diameter	0.02	NS	Figure 8A
Ratio of number of cells in 250 μ m, outside:inside and fibre curvature	0.23	P<0.001	Figure 8B