Supplementary Materials

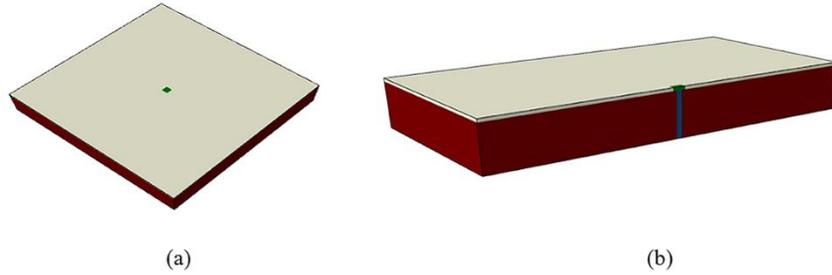<p style="text-align:center">(a)   (b)</p>

Figure S1. The double-layer soft model mimicking a small piece of the cortex: (a) An entire model with a green area in the middle representing there is a bundle of axonal fibers beneath it; (b) The cross-section of our cortex model. Blue color represents a bundle of axonal fibers.
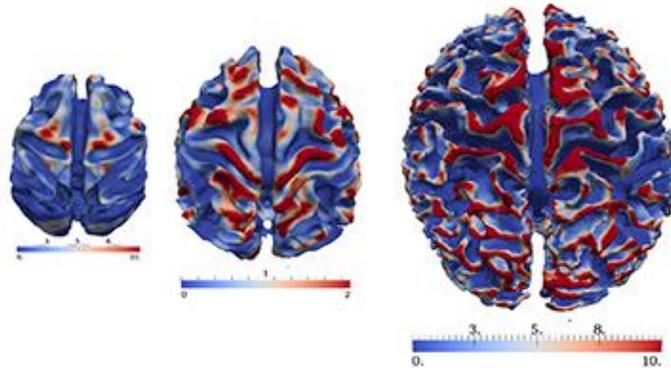

Figure S2. Examples of the cortical surfaces color-coded by fiber density values across the three species with the corresponding color bar under each surface (from the left to the right are macaque, chimpanzee and human brain, respectively).
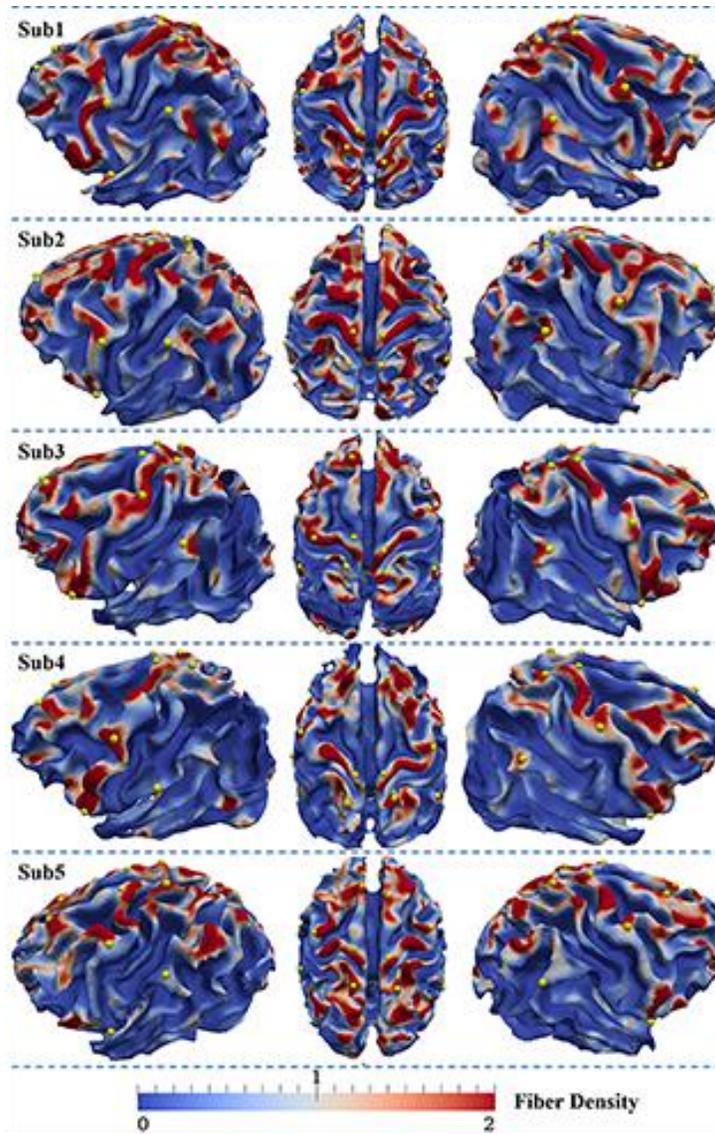
Figure S3. Visualization of the distributions of 2-hinge and 3-hinge fiber densities in 5 randomly selected chimpanzee brains.
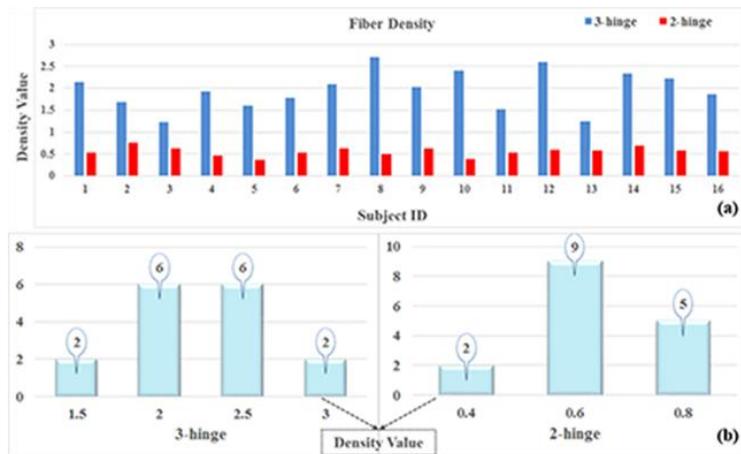
Figure S4. (a) The average fiber densities on 2 hinges and 3 hinges within the group of 16 chimpanzees. (b) 2-hinge and 3-hinge density value distributions within the group of 16 chimpanzees. The number of subjects in each range is indicated in the blue circle with an arrow.
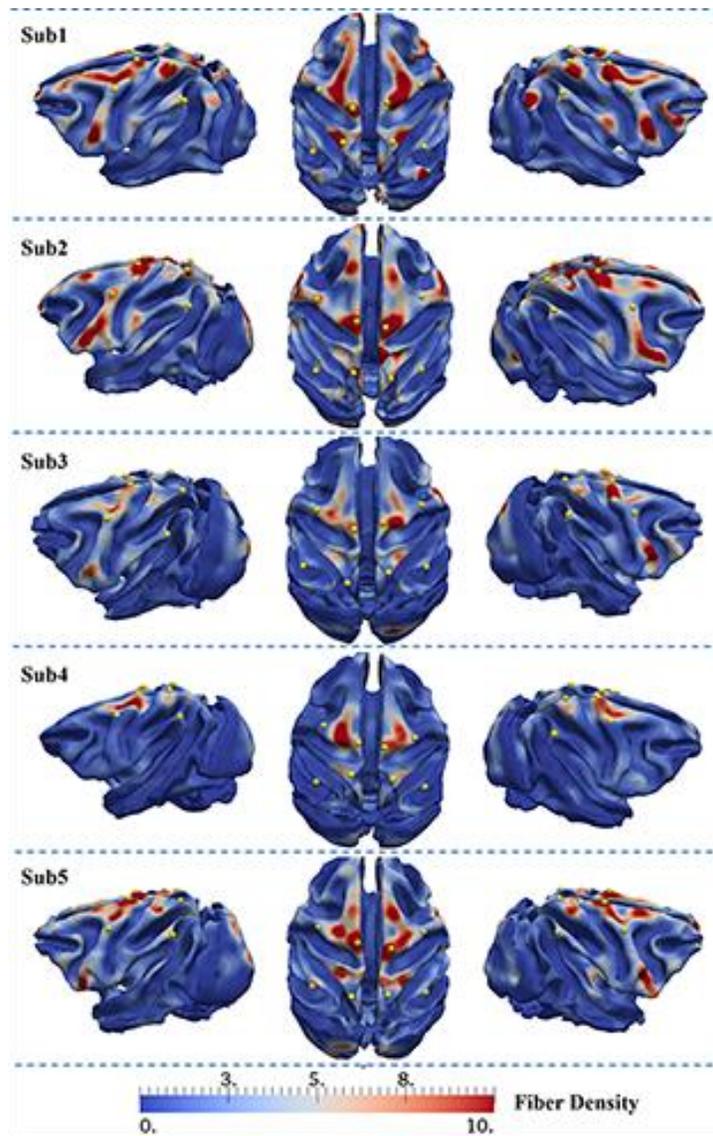

Figure S5. Visualization of the distributions of 2-hinge and 3-hinge fiber densities in 5 randomly selected macaque brains.
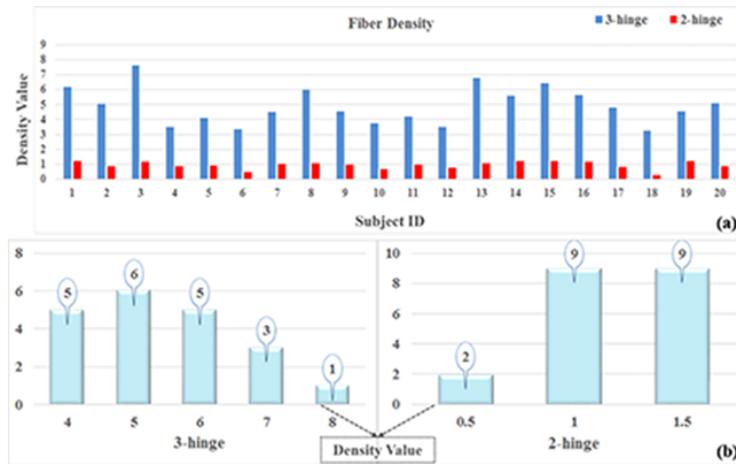
Figure S6. (a) The average fiber densities on 2 hinges and 3 hinges within the group of 20 macaques. (b) 2-hinge and 3-hinge density value distributions within the group of 20 macaques. The number of subjects in each range is indicated in the blue circle with an arrow.
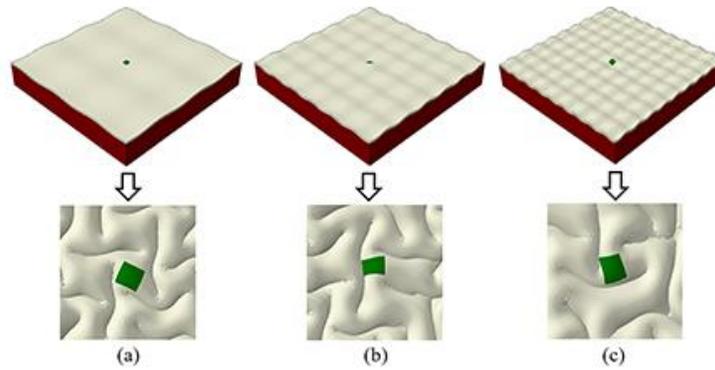

Figure S7. (a)-(c) Three different initial perturbations after convolution lead to different hinge patterns in the center of the model. In all models with the presence of the growing fibers, the green area is located on a 3-hinge.
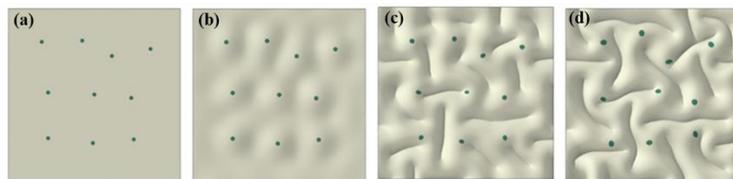

Figure S8. (a)-(d) Evolution steps of a finite element model with ten growing fiber bundles. After convolution, 3- hinges were always formed on the top of these growing fiber bundles.

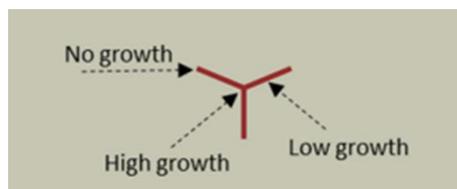**Figure S9.** Effect of gradient growth of Y-shaped fibers on the formation of 3-hinges — the initial computational model.