A passive mechanism enables pinecones to close when they are wet (left) and open when they are dry (right) whether the pinecones are dead or alive.

Swelling occurs perpendicular to cellulose fibrils. Each leaf of the pinecone has a sheet of fibrils oriented along the length of the leaf (light gray) and a sheet of fibrils oriented perpendicular to the length (dark gray). When the pinecone swells the configuration that minimizes the energy of the pinecone leaf is bent. This can be rationalized using Timoshenko’s bimetallic thermostat theory replacing temperature with humidity.

Function: pinecones carry coniferous trees’ seeds
Relevant physics: swelling, bilayer mechanics