Supplemental Movie Legends.

Movie 1. Cellulose synthase localization follows a diurnal pattern in living Arabidopsis cells growing in very short days without exogenous sucrose (Supporting Figure 1 A). Spinning disc confocal timelapse movies of YFP-CesA6 observed in living Arabidopsis cells at different timepoints during a diurnal cycle (top) or at the end of a 4-h extended night (bottom) in seedlings grown in 4 h/20 h light/dark cycles in the absence of exogenous sucrose. CesAs are primarily in intracellular compartments at the end of the night period and are localized to the plasma membrane during the day, before gradually being removed the next night. Extension of the night prevents the localization of CesA to the plasma membrane during the subjective day period. Time after the dark-light transition is indicated at the top. Frame interval is 10 s, and playback speed is 15 frames per second.

Movie 2. Cellulose synthase localization to the plasma membrane in the light requires active photosynthesis or an alternative carbon source (Supporting Figure 1 B). Seedlings were treated with the photosystem II inhibitor 3-(3,4-dichlorophenyl)-1,1-dimethylurea DCMU before being exposed to light. DCMU prevents the localization of CesA to the plasma membrane in the light. This is rescued by providing an alternative carbon source in the form of exogenous sucrose. Spinning disc confocal timelapse movies of YFP-CesA6 observed in living Arabidopsis cells treated with 1 µM DCMU for 20 h in the dark in the absence (top) and presence (bottom) of 2% sucrose in the medium before being exposed to a 4-h day period and imaged at the end of the day. Frame interval is 10 s, and playback speed is 15 frames per second.
Movie 3. A favorable metabolic status is necessary and sufficient to promote localization of cellulose synthase to the plasma membrane (Supporting Figure 1 C). Seedlings were kept in darkness during their normal light period and transferred to liquid MS medium containing 2% sucrose (top) or 2% mannitol (bottom) and imaged at the end of the subjective day. Adding exogenous sucrose in the absence of light stimulates CesA localization to the plasma membrane while the non-metabolizable sugar mannitol has no effect. Frame interval is 10 s, playback speed 15 frames per second.

Movie 4. Arabidopsis seedlings synthesize cellulose constantly under a favorable metabolic status (Supporting Figure 1 D,E). Spinning disc confocal timelapse movies of YFP-CesA6 observed in living Arabidopsis cells at different timepoints during a diurnal cycle (top) or at the end of a 4-h extended night (bottom) in seedlings grown in 4 h/20 h light/dark cycles with 2% sucrose in the medium. CesAs are present at the plasma membrane in large numbers at all times of the diurnal cycle and after extension of the night. Time after the dark-light transition is indicated at the top. Frame interval is 10 s, and playback speed is 15 frames per second.