Supporting Online Movies

Movie 1. The FM movie shows 7:3 DPPC:POPG at 25^{o}C on water folding at higher surface pressure. Note the hexagonal packing structure explored and analyzed in detail in the text. The surface is "jerking", i.e. being laterally displaced, which is indicative of folding events at some distance away from the field of view. Folds appear as bright lines running vertically across the image, perpendicular to the direction of compression, which is horizontal. Toward the end of the video many folding events can be observed, leading to the eventual compaction of the monolayer sheet.

Movie 2. The FM movie shows 8:2 DPPC:G_{M1} on water folding at high surface pressures. As in the 7:3 DPPC:POPG movie, the hexagonal packing should be noted as well as the formation of folds and "jerking" motions.

Movie 3. Movie shows 7:3 DPPC:POPG 10 wt% SP-B 9-25 at high surface pressures. Note that no "jerking" motion is observed as was seen with the pure lipid monolayer, indicating no folding events present. Furthermore, the banding structure is clearly seen. Note the buckling of the bands during compression. As mentioned in the text, this in-plane band buckling is similar to force chains and force chain behavior is granular systems.

Movie 4. Movie shows 5:5 DPPC:G_{M1} at high surface pressure. As with the DPPC:POPG system with peptide, note the banding of domains and lack of folds and "jerks".

Movie 5. Fluid collapse of 7:3 DPPC:POPG at 37^{o}C, four degrees above its melting point. Bright disks appear randomly underneath the surface indicating fluid flow into the subphase. The system can never attain high surface pressures.

Movie 6. POPG monolayer at 25^{o}C compressed far beyond initial collapse. POPG at this temperature behaves as a fluid; however, over-compressing the fluid layer can give rise to elastic type behavior. The frame rate here is 180 frames-per-second. Note the bright disks that indicate some fluid-like collapse. When the layer first gains rigidity, there is noticeable in-plane shearing, with large parts of the layer rearranging. Eventually, these motions cease, at which point folding is observed.