Long-Range Alignment of Nanoscale Filaments

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Fig. 1: *A knot made with peptide amphiphile string.*

With engineering precision over long distances, this work showcases the discovery on how to align nanoscale filaments. These centimeter-long gel "strings" of nanofibers contain living cells aligned in linear fashion that are flexible, biodegradable and can be made into different lengths and widths.

The team uses aggregates of specially designed peptide amphiphile molecules in water as starting materials. Heating the solution causes them to emerge into two-dimensional flat sheets suspended in water. When cooled, the sheets break spontaneously into bundles of fibers, forming irreversibly an unusual liquid crystal. The gentle force of dragging the liquid crystal across a surface aligns the resulting fibers in one direction. A salt solution can instantly freeze the alignment before disorder sets in. The unusual liquid crystal forms as a result of a phenomenon known as *two-dimensional Rayleigh instability*, which the authors extended to include the interfacial energy changes on curvature that are required to induce the breaking of the sheet. This nanoscale facile alignment method can be applied to carbon nanotubes as well as other conductive soft structures of interest in non-biological electronic applications.

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