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Entropically Driven Helix Formation

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We model the folding of helices via the depletion interaction between a semi-flexible tube and hard spheres. We find that the lowest-entropy geometry of the tube depends on both the concentration and size of the spheres. In the limit of small spheres, the helix becomes optimally tight, that is, maximally thick for a fixed length. We discuss this effect when both the tube and spheres are confined in a cylinder, as a model of the ribosomal channel. The depletion interaction alone forces the tube to lie against the wall, as opposed to the tight helix. Hydrophobicity and electrostatics can stabilize the compact tube and we estimate the strength of these effects necessary to favor a tight helix.