Hierarchical Chirality Transfer in Biomaterials and Nanomaterials

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Chirality plays a significant role in the physical properties of many biological materials and nanomaterials, which have the habit of chiral growth. However, the physical mechanisms underlying the chiral growth or assembly of biological materials and nanomaterials are still unclear. Here, we take the plant tendril helices and nanoscale polymer lamellae as representative examples to investigate how the chiral growth is realized. Our experiments showed that chirality exists at multiple length scales in different forms, forming a hierarchy of chirality, and the chirality transfers from each lower level to its neighboring higher. Through experiments and simulations, we reveal that it is the microscale chirality that causes the intrinsic helical morphology of biomaterials and nanomaterials. A multiscale chirality transfer model is presented to explain the chiral growth. This work may be helpful for understanding the widely observed chiral behavior biomaterials and nanomaterials. It also suggests that chirality transfer can be utilized in the development of hierarchically chiral materials with unique properties.

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