Soft Living Active and Adaptive Matter

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Crystallinity characterization of white matter in the human brain

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Abstract:

White matter microstructure underpins cognition and function in the human brain through the facilitation of neuronal communication, and the non-invasive characterization of this structure remains an elusive goal in the neuroscience community. Efforts to assess white matter microstructure are hampered by the sheer amount of information needed for characterization. Current techniques address this problem by representing white matter features with single scalars that are often not easy to interpret. Here, we address these issues by introducing tools from soft matter for the characterization of white matter microstructure. We investigate structure on a mesoscopic scale by analyzing its homogeneity and determining which regions of the brain are structurally homogeneous, or ``crystalline" in the context of materials science. We find that crystallinity is a reliable metric that varies across the brain along interpretable lines of anatomical difference. We also parcellate white matter into ``crystal grains," or contiguous sets of voxels of high structural similarity, and find overlap with other white matter parcellations. Our results provide new means of assessing white matter microstructure on multiple length scales, and open new avenues of future inquiry.

Date:
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Time:
9:00 AM-10:15 AM (PT)
12:00 PM-1:15 PM (ET)

About the speaker:

Dr. Erin Teich received her Sc.B. in Physics from Brown University in 2011, and subsequently served with AmeriCorps for a year, where she worked in a community center and an after-school program in Chicago. She received her Ph.D. in 2018 in Applied Physics from the University of Michigan, where she worked in Professor Sharon Glotzer's group and focused especially on elucidating mechanisms for glass formation in colloidal systems.

Dr. Teich is currently a postdoctoral researcher in Professor Dani Bassett's complex systems group at the University of Pennsylvania, where she uses simulation and theory drawn from statistical physics and network science to investigate problems related to understanding and designing complex behaviors in soft materials.

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