Winter Colloquium Series

Seeing the "Impossible" in Biology

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Abstract:

The microscope, long a workhorse of biology, is nowadays less about lenses and waves and more about algorithms and data. I will describe a new workhorse of biology, the superresolution localization microscope, which in recent years has been the subject of a Nobel Prize because of its ability to reveal sub-cellular features that used to be invisible to a conventional microscope.

The main insight that enables a localization microscope is the recognition that a blurry image still contains information on the precise locations of the objects that are being used to form the image. This information is easier to extract from the image if only a handful of objects are producing the image, and while biology is rarely so obliging as to give us sparse objects (a living cell is a treasure trove of features on many scales), modern fluorescence labeling techniques enable us to only collect information on a sparse subset of the objects in the cell. By mathematically piecing together different sparse subsets of objects, we can reconstruct very high-resolution images of a cell.

I will describe some of the work done on this problem in my research group, including work on the fundamental limits to the amount of information that can be extracted from a given superresolution experiment. I will then describe work that I am doing in collaboration with the laboratory of Dr. Tijana Jovanovic-Talisman at City of Hope, in which we are reconstructing the clustering of proteins on the surface of cancer cells.

Wednesday, January 13, 1:05 - 1:50pm in 3-1639