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doi:10.1017/S1431927621005250
Microsc. Microanal. 27 (Suppl 1), 2021

Connected Through Imaging: Development of a National Network Cryo-Electron Tomography Centers

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Over the last several years, cryo-electron tomography (cryo-ET) has emerged as the leading technology for visualizing the three-dimensional (3D) native-state structure of intact mammalian cells, bacterial cells, enveloped viruses, and larger complexes at "macromolecular" (nm-level) resolution. The recent advances in cryo-EM technologies that include the improvement of detector sensitivity through the development of the direct-electron detector, innovations in energy filter design, and more powerful image processing algorithms brought about 'the resolution revolution' in single particle cryo-EM, are now rapidly being translated to cryo-ET workflows. These advances have culminated in research groups solving sub-nanometer, high-resolution sub-volume (or sub-tomogram) averaged structures of complexes located in cells and viruses. Continued developments to cryo-EM instrumentation, correlative imaging solutions, specimen preparation equipment, and computational tools are supporting the expansion of whole cell cryo-ET for *in situ* structural cell biology.

To keep pace with the need for access to and training with advanced cryo-ET technologies by the larger biomedical research community, national and international research and training centers have begun to be established. In the United States, the NIH developed an initiative to increase research capacity for cryo-ET. The goal, establish a network of cryo-ET centers to support nationwide access to cryo-ET instrumentation and assistance for investigators as they train to acquire skills needed for research using cryo-ET. In 2020, four NIH-funded national centers were established to build a national network of cryo-ET centers. The four coordinated centers are, the national cryo-ET network hub located at the University of Wisconsin, Madison: the Midwest Center for Cryo-Electron Tomography (MCCET); and three service centers located at the University of Colorado, Boulder: the Center for Cryo-Electron Tomography (CCET); Stanford-SLAC: Stanford-SLAC CryoET Center (SCSC); and the New York Structural Biology Center: the National Center for In-Situ Tomographic Ultramicroscopy (NCITU). The network of four centers will coordinate to support investigators by providing access to well-trained staff and state-of-the-art equipment for (1) routine and advanced cryo-ET specimen preparation, data collection, and computation; and (2) hands-on, remote, and virtual training in cryo-ET specimen preparation, data collection, and data processing and validation.

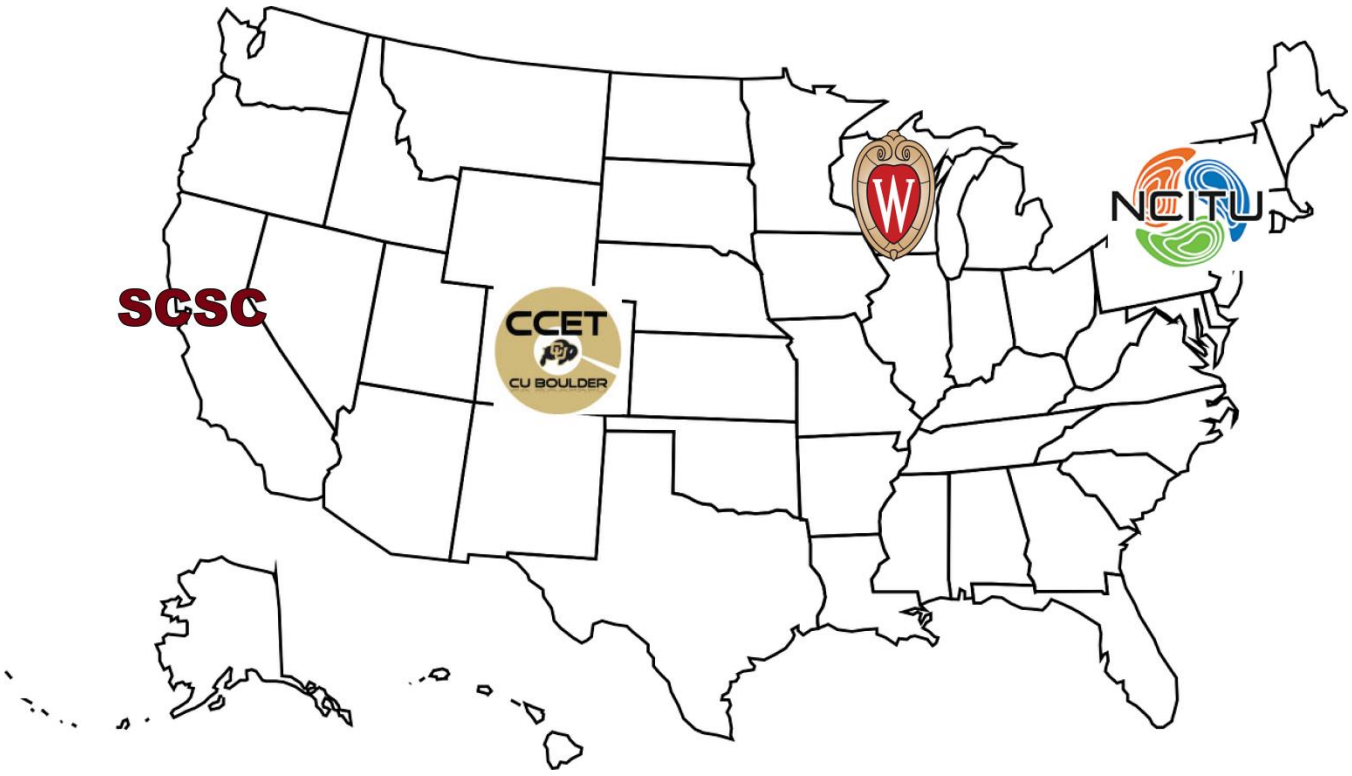

Figure 1. Figure 1. The NIH National Network of Cryo-ET Centers. Four NIH-funded cryo-ET centers were established in 2020. The centers are located at the University of Wisconsin, Madison; the University of Colorado, Boulder; the New York Structural Biology Center, and Stanford University-SLAC. The network will support users with access to and training in cryo-electron tomography (cryo-ET) specimen preparation, data collection, and data analysis workflows.

References

This research was supported in part by funds from the University of Wisconsin-Madison, University of Wisconsin-Madison Department of Biochemistry, Morgridge Institute for Research, and the National Institutes of Health (U24 GM139168) to E.R.W.

https://doi.org/10.1017/S1431927621005250 Published online by Cambridge University Press