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Recent advances in transmission electron microscopy instrumentation have made possible the detailed investigation of sp2-bonded atomically thin membranes of graphene and boron nitride. This talk will discuss sample preparation, imaging methods, and interpretation of ordered and defected regions of these materials. Of particular interest are the configurations of edge atoms and their time evolution, and in-sheet defect formation and dynamics. In addition, methods will be presented to use TEM electrons for high-resolution lithography, and the use of monlayer films for TEM imaging of externally deposited light atoms and molecules.