This New Views article focuses on key recent developments on the Ab Initio Multiple Spawning (AIMS) and contrasts its formalism with the commonly employed mixed quantum/classical method Trajectory Surface Hopping (TSH). For a molecular example, DMABN, we propose a preliminary comparison between TSH (with and without decoherence correction) and AIMS, highlighting the role of (de)coherence in molecular systems. Hence, we believe that this work will be of interest to the readership of Molecular Physics as it overviews specific fields of the very active and diverse field of nonadiabatic molecular dynamics.