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TET dioxygenases initiate DNA demethylation and are commonly inactivated in myeloid neoplasms by somatic mutations or metabolically by 2-hydroxyglutarate (2HG) product of mutant IDH1/2 enzymes. In this issue, the team of Jha, Maciejewski, and colleagues shows that minimal TET activity is essential for neoplastic cell survival and underlies synthetic lethality of TET and IDH mutations. To prove the concept and harness it for therapy, the authors develop TETi76 as a mimic of 2HG. TETi76 inhibits TET activity and mimics synthetic lethality of IDH mutation in TET-deficient cells while sparing normal hematopoiesis. TETi76 selectively restricts clonal expansion of TET2-mutant cancer cells in mouse xenografts. For details, please see the article on page 146.