Natural products provide a unique source for drug discovery. We have successfully matched up several natural compounds with drug targets in cancer and other diseases. Berbamine (BBM) is a natural product compound isolated from the herbal medicine Berberis amurensis, which carries out its anti-tumor activity by targeting Ca$^{2+}$/calmodulin-dependent protein kinase II $\gamma$ (CAMKII$\gamma$; encoded by CAMK2G). We show that CAMKII$\gamma$ can stabilize MYC by phosphorylating it directly at Ser62, thereby promoting lymphomagenesis and other cancers. Targeting CAMKII$\gamma$ with BBM destabilizes the MYC protein to suppress T cell lymphomagenesis. BBM provides a new cancer therapeutic strategy for MYC-dependent cancers.