



**Figure 3.** Signalling network of GDNF/Ret with proteins encoded by genes mutated in some familial forms of Parkinson disease. DJ-1 (PARK7) is involved in GDNF/Ret cell survival signaling through the RAS/MAPK pathway and stimulates Ret expression.  $\alpha$ -synuclein (PARK1 and 4) inhibits Nurr1 and Ret expression. PINK1 (PARK6) and GDNF/Ret together control mitochondrial morphology and complex I activity. GDNF/Ret and parkin (PARK 2) signaling converges on mitochondrial morphology and complex I regulation. GDNF/Ret and parkin (PARK2) signaling also converges on mitochondrial morphology and complex I regulation by stimulating complex I activity and interacting with the NF- $\kappa$ B pathway to preserve mitochondrial integrity.