Cyclooxygenase 2

Prostaglandin-endoperoxide synthase 2 (prostaglandin G/H synthase and cyclooxygenase) (The HUGO official symbol is PTGS2; HGNC ID, HGNC:9605), also known as cyclooxygenase-2 or COX-2, is an enzyme that in humans is encoded by the PTGS2 gene.

Because the “COX” term is used for the stem symbol for “cytochrome c oxidase” family of genes and gene products including proteins, the “PTGS” symbol is used for the prostaglandin-endoperoxide synthase (cyclooxygenase) family of genes and proteins. It is involved in the conversion of arachidonic acid to prostaglandin H2, an important precursor of prostacyclin and thromboxane A2, among others.

Depression is considered a neuropsychiatric condition which is associated with neuronal injury within specific brain regions. We previously reported that cyclo-oxygenase (COX)-2, a rate-limiting enzyme for prostaglandin E2 (PGE2) synthesis, significantly enhanced depressive-like disorders induced by chronic stress in rats. However, the underlying molecular mechanisms and identification of potential therapeutic targets for preventing neuronal injury associated with depression remain largely uncharacterized. Here, we show that COX-2 inhibition by celecoxib protects against neuronal injury through suppression of oxidative stress and, in this way, mediates its antidepressant effects. COX-2 is highly expressed in the hippocampal dentate gyrus (DG) of rat depression model and its activity is responsible for depression-like behaviors as demonstrated in two independent rat models of depression. Inhibition of COX-2 exerts neuroprotective actions in DG regions, including suppressing neuroinflammatory response, against oxidative stress and neuronal apoptosis, which are the critical risk factors for neuronal injury and pathophysiology of depression. Moreover, the antioxidant, N-acetylcysteine (NAC), significantly attenuates oxidative stress levels and dendritic spine deficiencies resulting from COX-2 overexpression; and, suppression of oxidative stress by NAC also significantly ameliorates depressive behaviors in rats. These findings suggest that selective inhibition of COX-2 ameliorates depression-like behaviors in rat models of depression. This selective inhibition of COX-2 appears to be protective against oxidative stress and neuronal deterioration resulting from chronic stress. Taken together, these findings have potentially important clinical implications with regard to the development of novel therapeutic approaches in the treatment of neuropsychiatric conditions like depression [1)].

1)
Song Q, Feng YB, Wang L, Shen J, Li Y, Fan C, Wang P, Yu SY. COX-2 inhibition rescues depression-like behaviors via suppressing glial activation, oxidative stress and neuronal apoptosis in rats. Neuropharmacology. 2019 Sep 17:107779. doi: 10.1016/j.neuropharm.2019.107779. [Epub ahead of print] PubMed PMID: 31539536.