Table 1

Selenoprotein family	Protein name	Normal brain function	Disruption leading to oxidative stress	Reference
Glutathione	GSH	GSH is a major endogenous antioxidant functioning directly in neutralization of free radicals and reactive oxygen compounds. GSH is the reduced form of glutathione and its SH group of cysteine is able to reduce and/or maintain reduced form of other molecules.	Disruptions leads to increased oxidative stress and apoptosis.	(Dringen, 2000) (Hall, 1999)
Glutathione Peroxidase (GPx) Family	GPx1	Peroxide/ROS reduction (Promotes neuroprotection in response to oxidative challenge). Brain expression levels are highest in microglia and lower levels detected in neurons.	Brains of GPx1−/− mice are more vulnerable to mitochondrial toxin treatment, ischemia/ reperfusion, and cold-induced brain injury. Cultured neurons from GPx1−/− mice were reported to be more susceptible to Aβ-induced oxidative stress, and addition of ebselen reversed this.	(Lindenau, 1998) (Crack, 2001;Flentjar, 2002;Klivenyi, 2000) (Crack, 2006)
	GPx4	Reduction of phospholipid Hydroperoxides. Only in neurons during normal conditions.	Brains of GPx4+/− mice were shown to have increased lipid peroxidation (a sign of oxidative stress). Injury-induced GPx4 expression in astrocytes. In vivo over expression of GPx4 protects against oxidative stress-induced apoptosis.	(Chen, 2008) (Savaskan, 2007) and (Borchert, 2006) and (Ran, 2004)
Thioredoxin Reductase (TrxR) Family	TrxR1	Cytocsolic localization. Contributes to the reduction of hydrogen peroxide and oxidative stress, and regulates redox-sensitive transcription factors that control cellular transcription mechanisms. TrxR-1 regulates the induction of the antioxidant enzyme heme oxygenase 1 (HO-1).	Overexpression of human Trx1 and Trx2 protects retinal ganglion cells against oxidative stress-induced neurodegeneration.	(Pitts, 2014) (Zhong, 2000) (Burk, 2013) (Arbogast, 2010;Trigona, 2006) (Munemasa, 2008)
	TrxR2	Mitochondrial localization. Contribute to the reduction of hydrogen peroxide and oxidative stress, and	Exogenously administered human rTrx ameliorates neuronal damage after transient middle cerebral	(Pitts, 2014) (Arbogast, 2010;Gladyshev, 1996;Papp, 2007)

		regulates redox sensitive transcription factors that control cellular transcription mechanisms.	artery occlusion in mice, reduces oxidative/nitrative stress and neuronal apoptosis after cerebral ischemia/reperfusion injury in mice	(Hattori, 2004)(Ma, 2012)
Other relevant seleno-proteins	SelH	Nuclear localization. Redox sensing.	Hypersensitivity of SelH shRNA HeLa cells to paraquat- and H2O2-induced oxidative stress.	(Panee, 2007)(Novoselov, 2007) (Wu, 2014)
	SelK	Transmembrane protein localized to the ER membrane. ER homeostasis and oxidative stress response.	Protects HepG2 cells from ER stress agent-induced apoptosis. Overexpression of SelK attenuated the intracellular reactive oxygen species level and protected cells from oxidative stress-induced toxicity in cardiomyocytes	(Shchedrina, 2011) (Du, 2010) (Lu, 2006)
	SelS	Transmembrane protein localized to the ER membrane. Catalyze the reduction of disulfide bonds and peroxides.	SelS overexpression increased astrocyte resistance to ER-stress and inflammatory stimuli, and suppression of SelS compromised astrocyte viability.	(Liu, 2013) (Fradejas, 2011) (Fradejas, 2008) (Gao, 2007)
	MSRB1, SelR, SelX	Function in reduction of oxidized methionine residues, and actin polymerization.	Induce expression of MSRB1 protects neurons from amyloid β-protein insults in vitro and in vivo.	(Lee, 2013) (Moskovitz, 2011)(Pillai, 2014)
	SelW	Expressed in synapses. Plays an antioxidant role in cells.	Rat in vivo overexpression of SelW was shown to protect glial cells against oxidative stress caused by heavy metals and 2,20-Azobis. Silencing of SelW made neurons more sensitive to oxidative stress.	(Reeves, 2009) (Sun, 2001) (Loflin, 2006) (Raman, 2013) (Chung, 2009)
	SelP	Is important for selenium transport, distribution and retention within the brain. Acts as a ROS-detoxifying enzyme. Protects human astrocytes from induced oxidative.	SelP-/- mice show neurological dysfunction and that Se content and GPx activity were reduced within brain, Se supplementation to diet attenuated. neurological dysfunctions. SelP-/- mice have reported deficits in PV-interneurons due to diminished antioxidant defense capabilities. Decreased neuronal	(Steinbrenner, 2009)(Arbogast, 2010)(Zhang, 2008) (Hill, 2003;Hill, 2004) (Cabungcal, 2006) (Pitts, 2012) (Byrns, 2014) (Schomburg, 2003)

			selenoprotein synthesis may be a functional outcome of SelP Colocalization of Sel P with amyloid plaques SelP can function as an antioxidant enzyme against reactive lipid intermediates	(Rock, 2010)