Glutathione redox dynamics and expression of glutathione-related genes in the developing embryo

Alicia R. Timme-Laragy, Jared V. Goldstone, Barry R. Imhoff, John J. Stegeman,

Mark E. Hahn, Jason M. Hansen

Supplemental file 4

Glutathione dynamics in developing vertebrate animals:

Comparison of studies and methods

Species	Measurements	Method	Developmental stages examined	Findings	Reference
frog (*Xenopus laevis*)	GSH_T	spectro-photometric	Daily from 1-7 dpf (Stages 22-48 encompassing hatching, organogenesis.	Increased GSH_T from stage 22 to 44/45	[68]
frog (*Rana ridibunda* and *Bufo viridis*)	GSH_T; GSH; GSSG	spectro-photometric	Weeks 1, 3, 5, 8 post fertilization	Increase in GSH and GSHT with later stages (5^{th} and 8^{th} week), increase in GSSG at week 3 and 8	[69]
crocodile (*Caiman yacare*)	GSH_T; GSH; GSSG	spectro-photometric	Embryo, juvenile, adult, in liver, kidney, lung, brain, heart, muscle	Increase in GSH and GSHT from embryos to juvenile and adjult stages, decrease in GSSG from embryo to juvenile stages.	[70]
rat (*Rattus norvegicus*)	GSH_T	spectro-photometric	Males only, GD20 and post natal days 1,3,5,7,14,21,28,42,63,84,112	Increase GSH_T at PND 3, 7, 112.	[71]
mouse (*Mus musculus*)	GSH_T; GSH; GSSG	HPLC	Oocyte, fertilized embryo, 2 cell, 4 cell, to GD3 (blastocyst, pre-implantation)	GSSG not detected until blastocyst, decrease in GSH between oocytes and blastocyst	[72]
cod	GSH_T; GSH;	spectro-	Oocytes, sperm, in depth sampling of	GSH_T increased through the hatching gland	[74]

(*Gadus morhua*)	GSSG; E_h	photometric	cleavage, blastula, gastrulation, through pre-hatch embryos (Hall stages 6.5-23	stage, GSSG increased after gastrulation	
zebrafish (*Danio rerio*)	GSH_T; GSH; GSSG; E_h	HPLC	Oocytes, mid-blastula transition, gastrulation, segmentation, pharyngula, pre-hatch, hatched eleutherolarvae (0-120 hpf)	GSH decreased while GSSG increased from oocytes through mid-segmentation, then oscillated until hatch. GSH_T concentration increased between 12 hpf and hatching. E_h was oxidized during the first 12 h, and then oscillated around -190 mV through organogenesis, E_h was reduced after hatch (-220 mV)	this study