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The Protective Effect of Astaxanthin on Fetal Alcohol Spectrum Disorder in Mice

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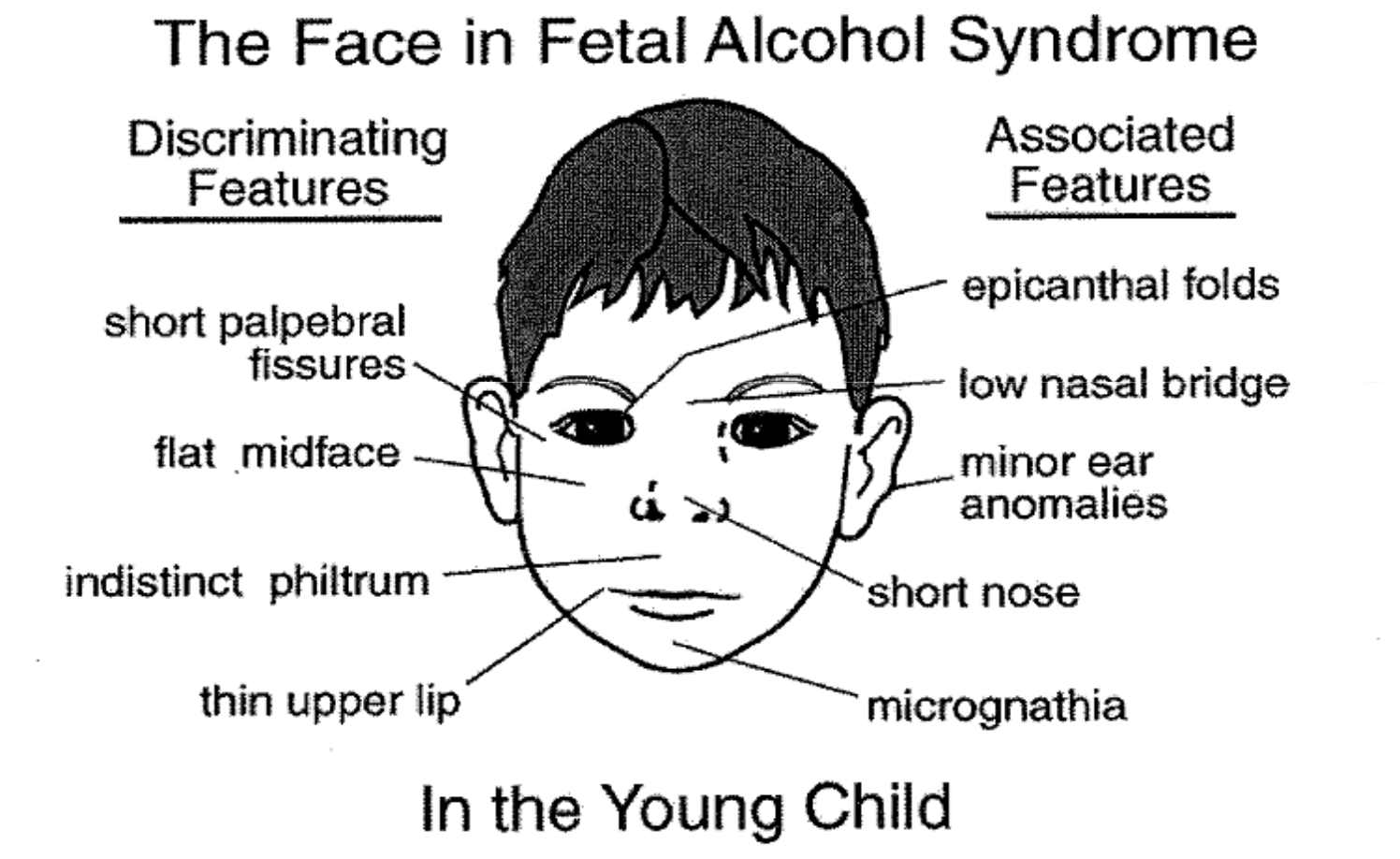
Background

Fetal alcohol syndrome (FAS), is diagnosed based on (i) prenatal and/or postnatal growth retardation; (ii) craniofacial abnormalities, including microcephaly, short palpebral fissures, and a deficient philtrum; (iii) central nervous system dysfunction. (1973 Jones and Smith)

Background

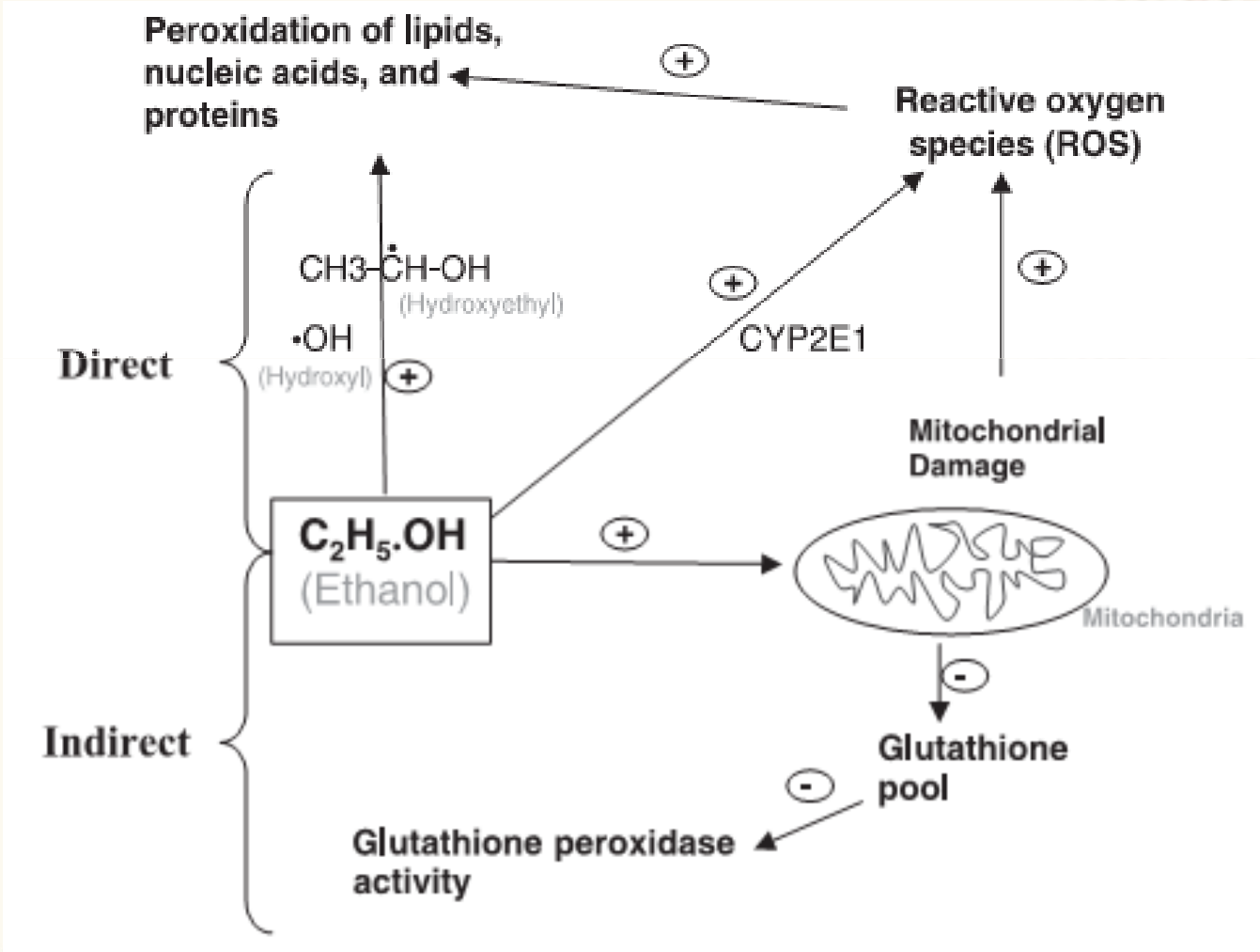

The Face in Fetal Alcohol Syndrome
Discriminating Features
Associated Features
short palpebral fissures
flat midface
indistinct philtrum
thin upper lip
epicanthal folds
low nasal bridge
minor ear anomalies
short nose
micrognathia
In the Young Child

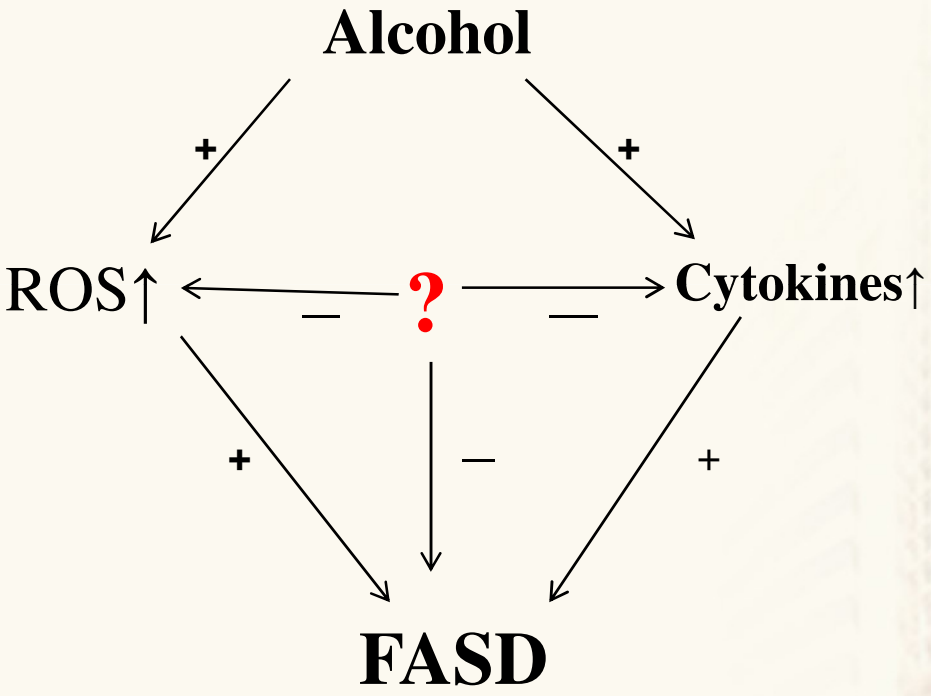
Background

FASD（fetal alcohol spectrum disorders, FASD） is an umbrella term that describes the range of effects that can occur in an individual whose mother drank alcohol during pregnancy. These effects can be physical, mental, or behavioral, with possible lifelong implications.

The rate of FASD is 8-10 per 1000 live births. FASD constitute a major public health problem.

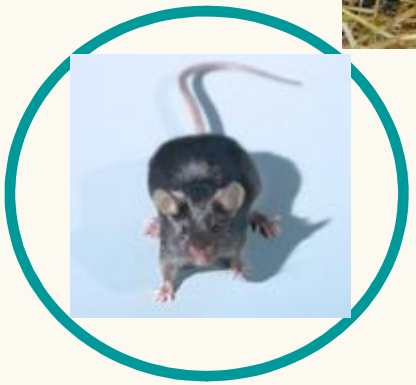
FASD -- Foetal Alcohol Spectrum Disorders




Alcohol
+
+
ROS↑
?
Cytokines↑
—
—
+
—
+
FASD

Animal Models



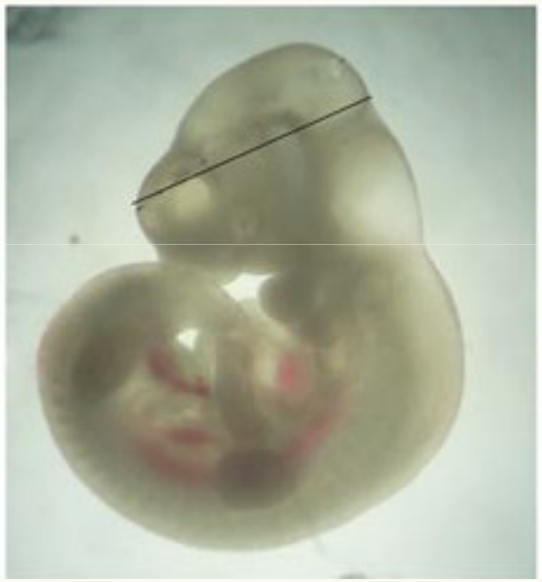





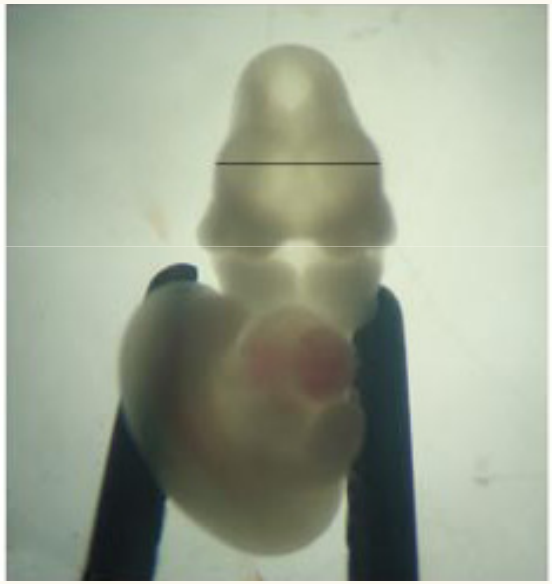

Mice

Embryos of Mouse

The measurements of Embryonic Morphology



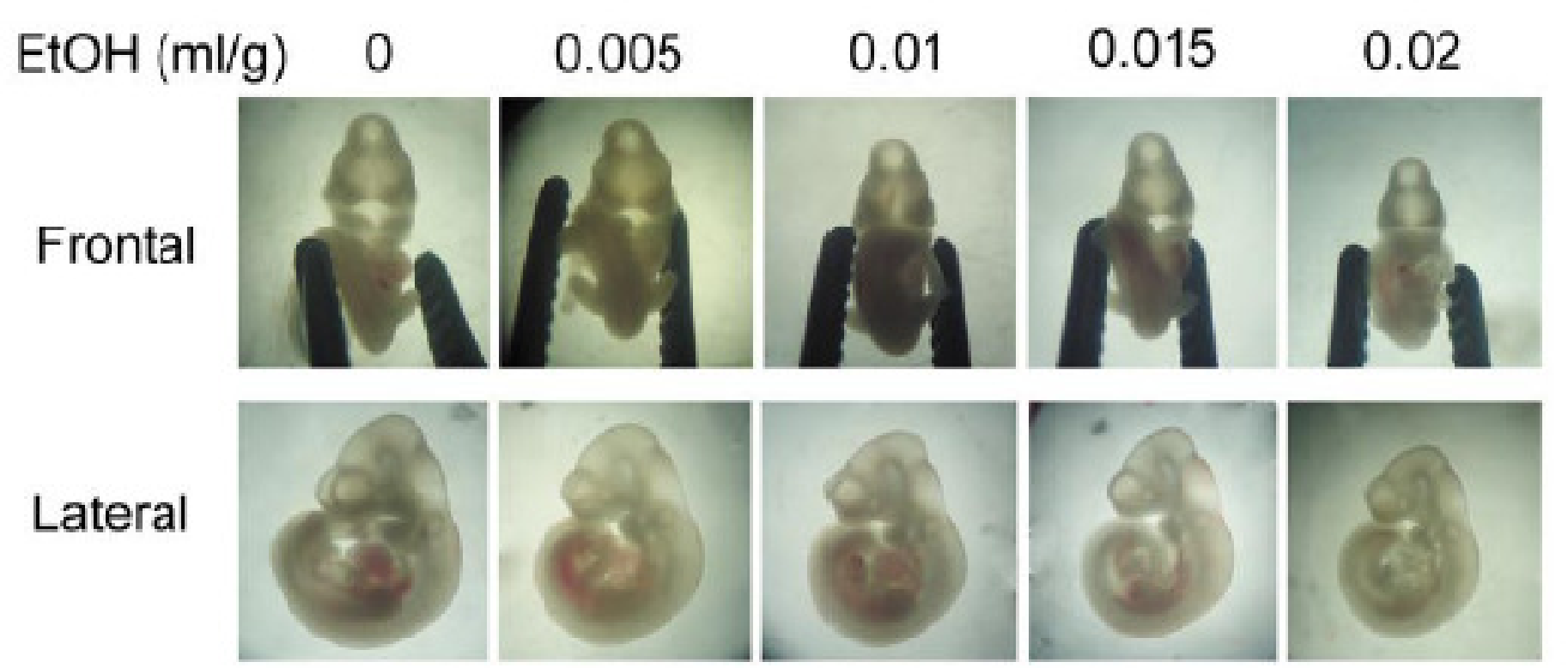
HL



HW

CRL(crown rump length)

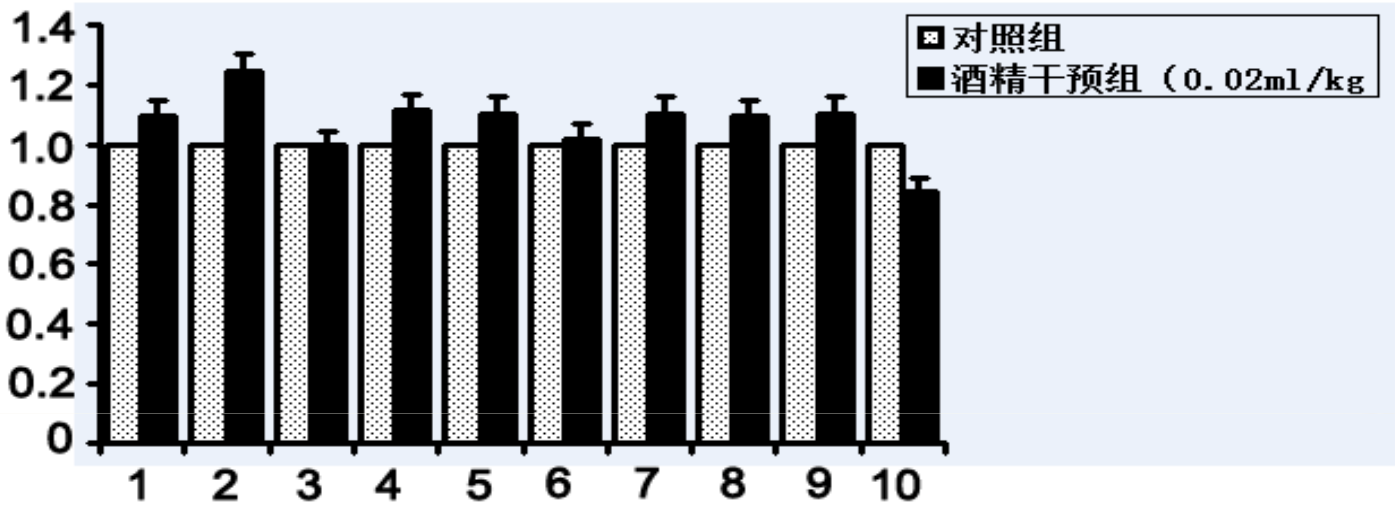
Effect of different concentration of alcohol on mouse embryos



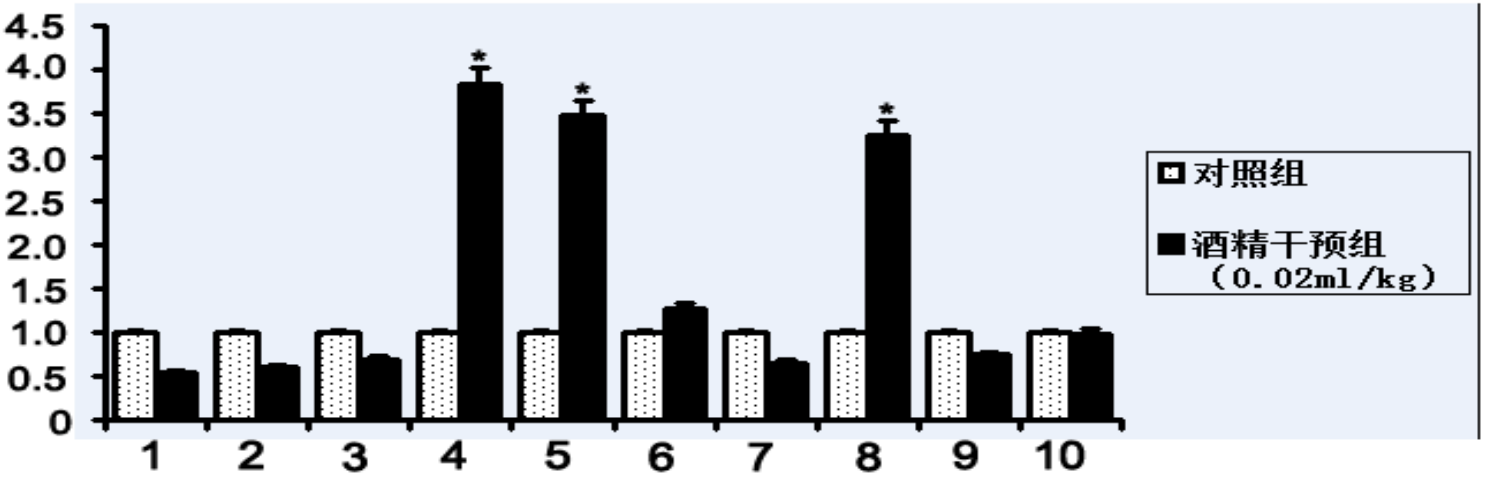
Effect of different concentration of alcohol on mouse embryos

Concentration (25%,ml/g)	Embryos	HL (mm)	HW (mm)	CRL (mm)
0	23	2.40±0.04	1.54±0.02	5.00±0.06
0.005	23	2.23±0.05*	1.44±0.02*	4.71±0.09*
0.01	22	2.23±0.05	1.44±0.02*	4.69±0.09*
0.015	20	2.17±0.04*	1.34±0.03*	4.53±0.07*
0.02	19	1.86±0.05*	1.16±0.02*	4.12±0.08*

Expression of TLRs in FASD



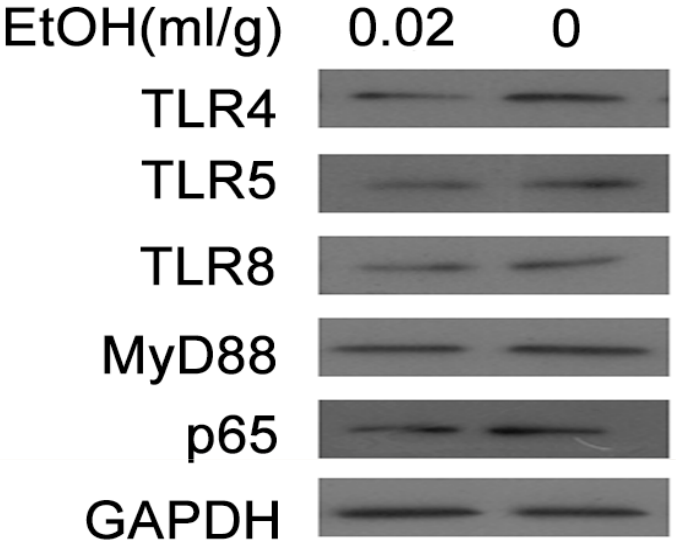
HEAD

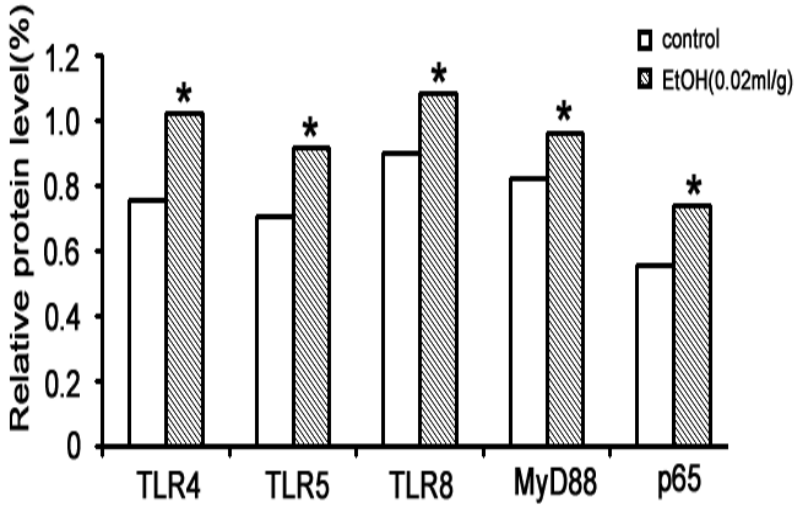


BODY

Expression of TLRs in FASD

Ethanol induced the expression of TLR4 signaling.



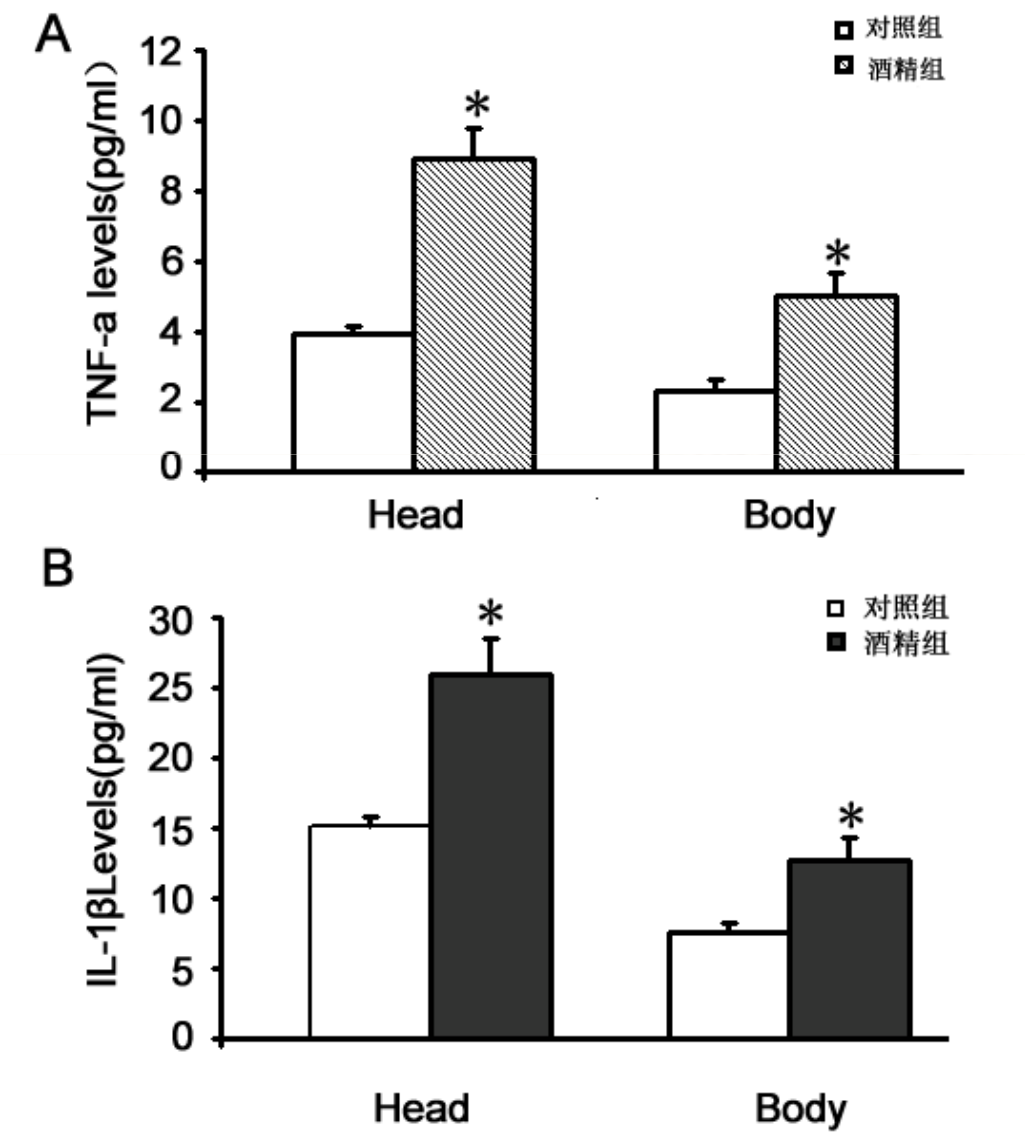


Expression of Cytokines in FASD

Ethanol induce

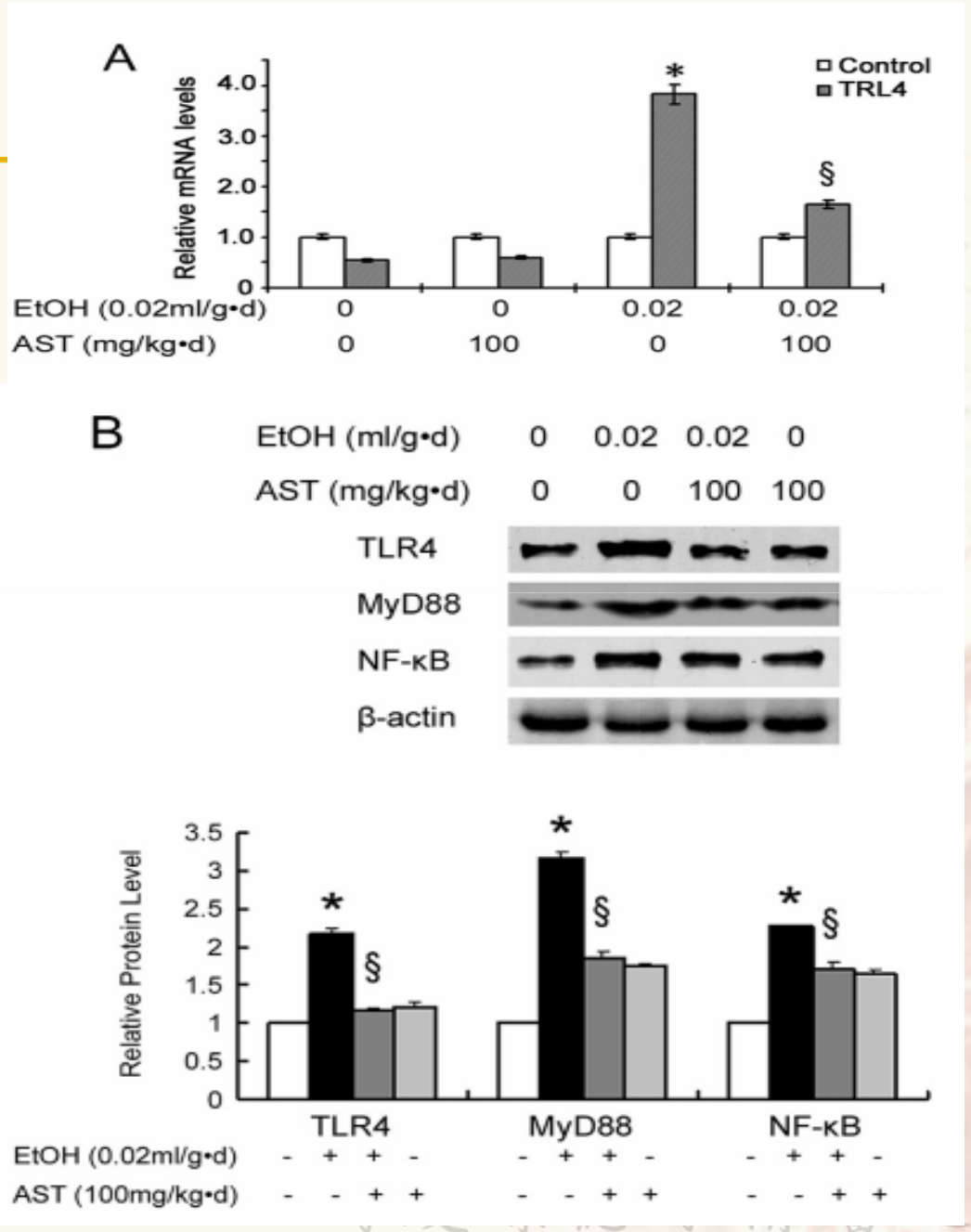
production of TNF-a(A),

and IL-1b(B) in embryos.



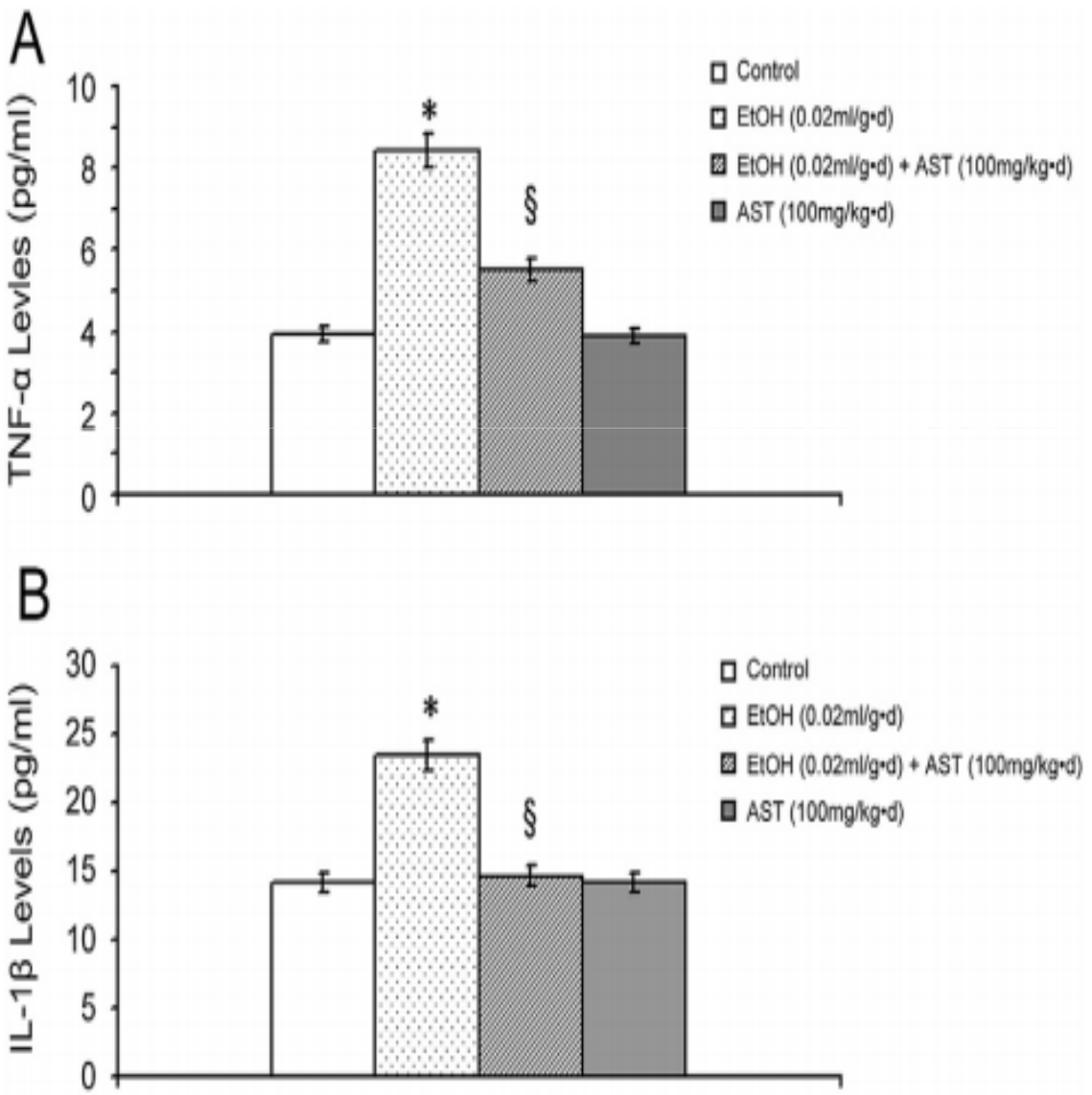
Intervention of AST on the TLRs system

Ethanol induced the expression of TLR4 signaling, that can be blocked by AST pretreatment.



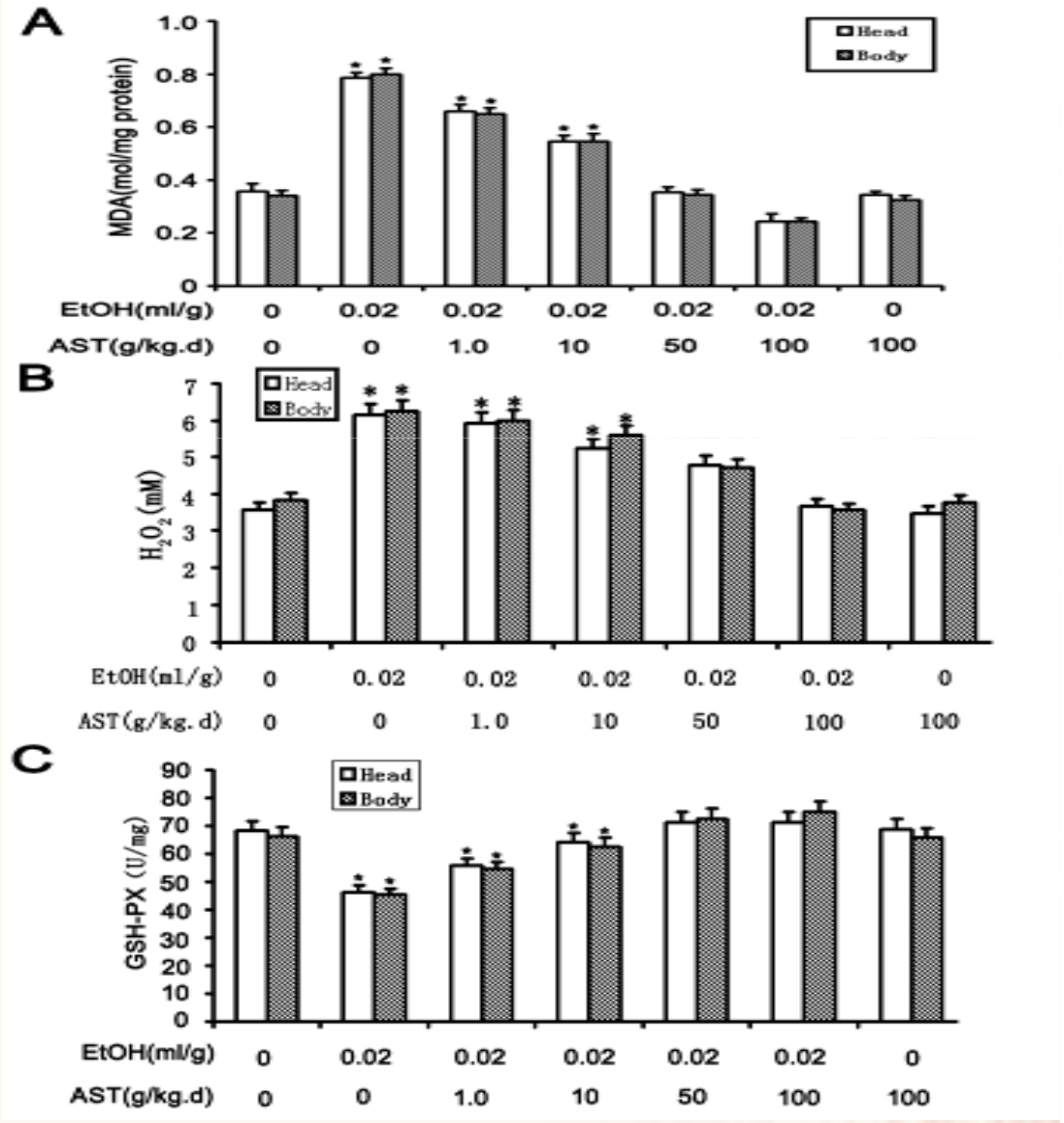
Intervention of AST on the Cytokines

AST inhibited ethanol-induced production of TNF-a(A), and IL-1b(B) in embryos.



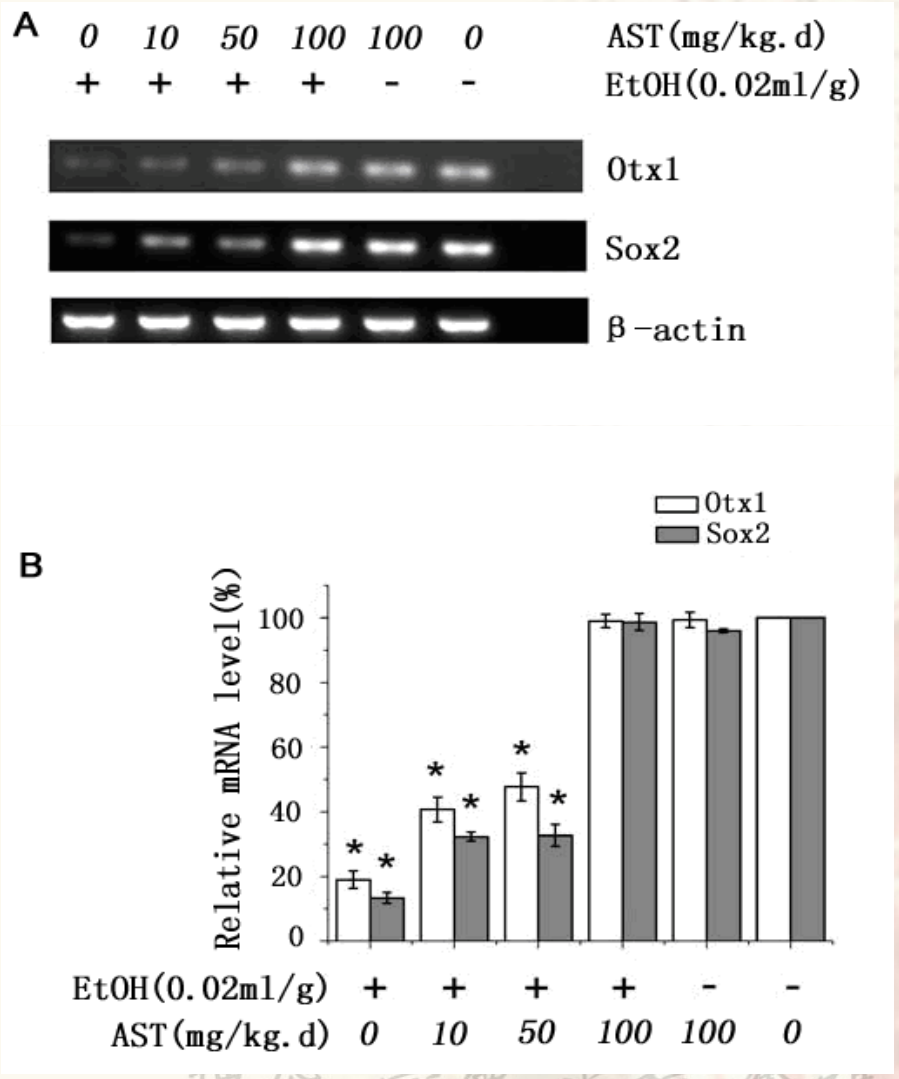
Mechanisms of Oxidative Stress Related FASD and Prevention of AST

AST rescued up-regulation of MDA、H2O2 and down-regulaion of GSH-PX induced by alcohol.



Mechanisms of Oxidative Stress Related FASD and Prevention of AST

AST rescued Otx1 and Sox2 mRNA down-regulation induced by alcohol.



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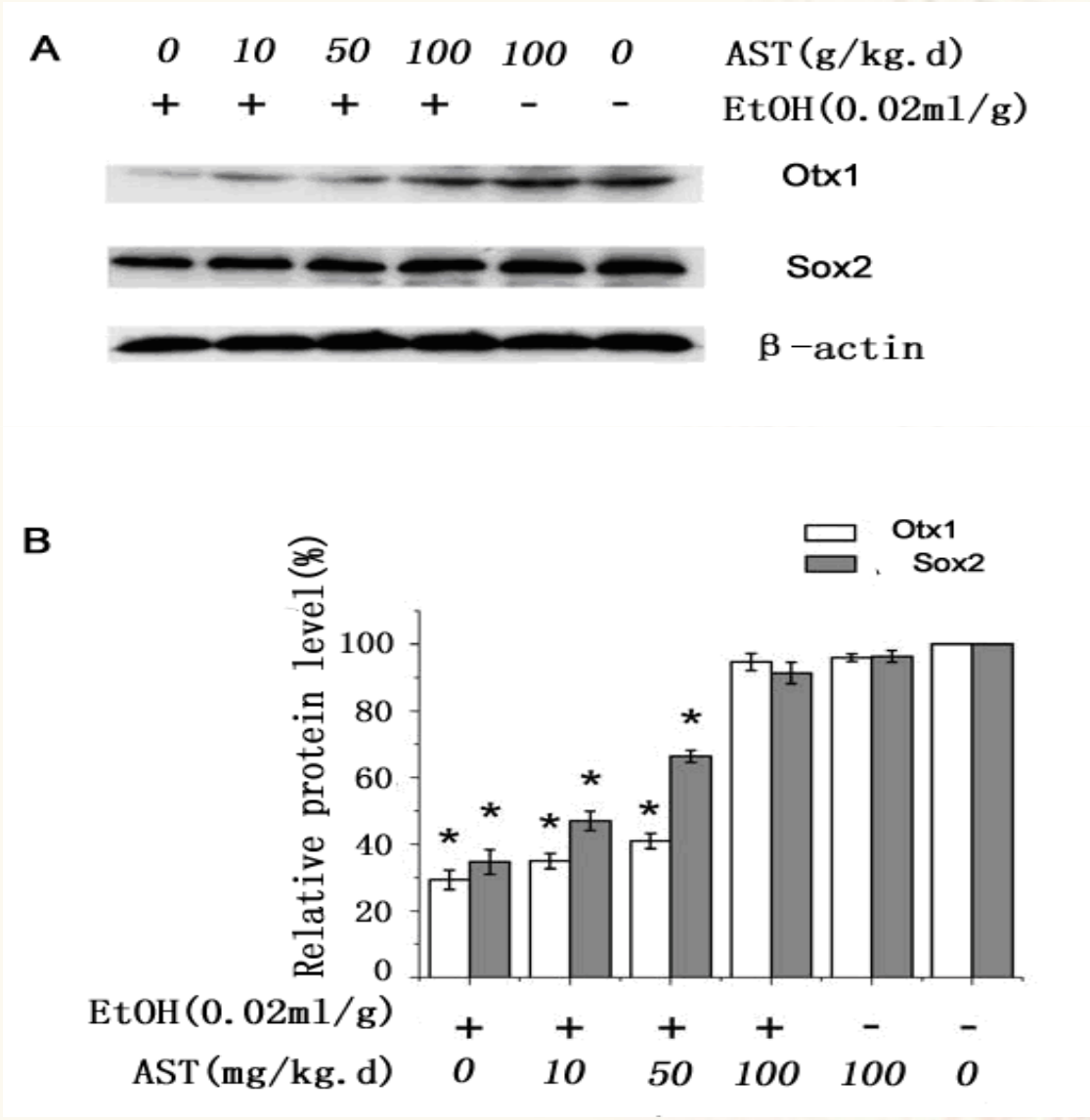
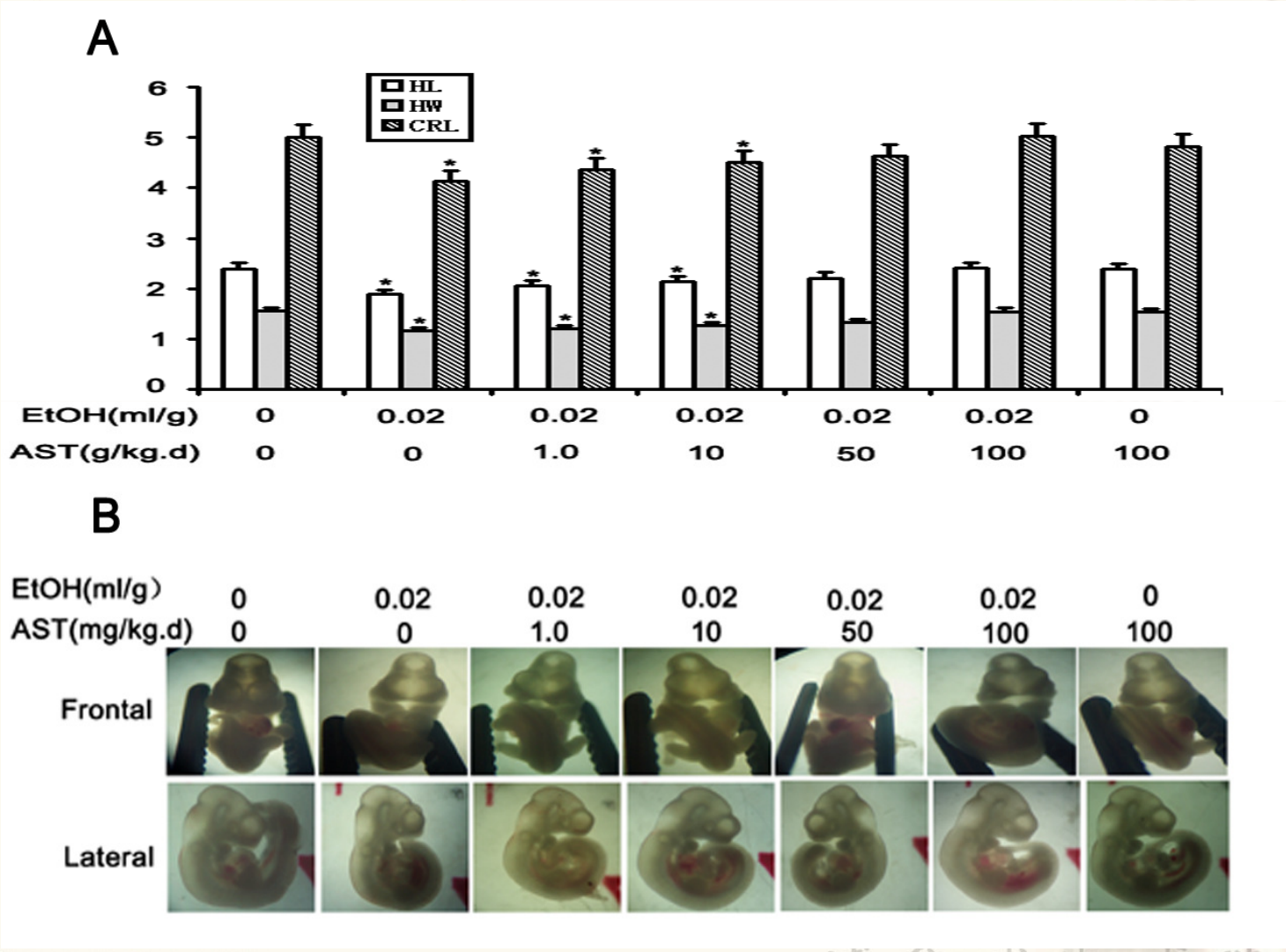
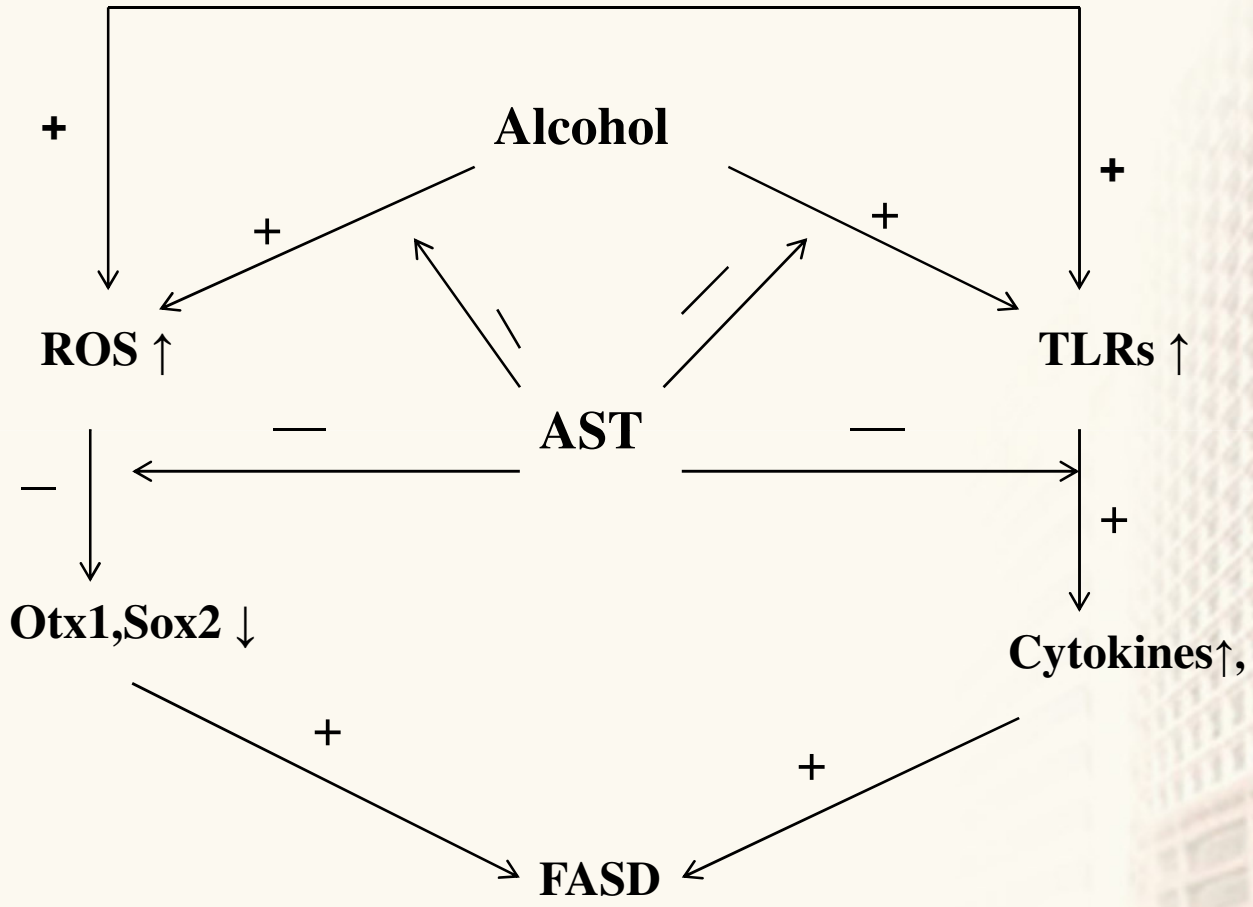


AST prevented ethanol-induced developmental retardation in mouse embryos




Alcohol
+
+
+
+
ROS ↑
TLRs ↑
AST
—
—
—
+
Otx1,Sox2 ↓
Cytokines↑,
+
+
FASD

Conclusions

1,Morphological observations showed protective effects of AST treatment against ethanol-induced growth retardation in mouse embryos.

2, AST can rescue the Otx1 and Sox2 low expression on mRNA and protein level and GSH-PX overexpression caused by alcohol .

3. Oxidative stress and toll-like receptor signaling associated inflammatory reaction were involved in this process

4, Our data confirmed the protective effect of astaxanthin(AST) on fetal alcohol spectrum disorder

Acknowledgments

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Thanks !