



Research on the Mechanism of Dopamine Regulating the Formation of Shells in *Crassostrea gigas*

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Abstract: Shellfish protect themselves from predation, support tissue and prevent dryness by forming a hard shell. Dopamine (DA), as an excitatory neurotransmitter, plays an important role in the development of shellfish larvae and shell formation. This study found that after DA treatment, the expression of dopamine type I receptor (CgDRD1) in *Crassostrea gigas* was upregulated, the activity of casein kinase 2 (CgCK2) was increased, while the phosphorylation level of the downstream transcription factor CgCREM was decreased, and the activity of chitinase (CgChitinase) was significantly reduced, which in turn affected the formation of shell chitin framework. After injection of a dopamine receptor 1 inhibitor (SCH23390), the activity of CgCK2 was significantly reduced, while the phosphorylation level of CgCREM was increased, and the activity of CgChitinase in the mantle was significantly increased. This study clarified the mechanism by which DA regulates the formation of chitin framework in shells by activating the DRD1-CK2-CREM signaling pathway, providing scientific basis and potential solutions for the oyster breeding industry to cope with the challenge of shell damage.

Keywords: *Crassostrea gigas*; Dopamine; Casein kinase 2; CREM; Chitinase

Results

After 3 days and 7 days of CgCREM-RNAi treatment, the mRNA expression level and protein expression level of CgCREM decreased significantly, and both the mRNA expression level and enzyme activity of Cgchitinase decreased significantly. Staining and electron microscopy observations were conducted on the nascent shell membranes. Compared with the NC group, both the CREM-RNAi group showed phenomena of ambiguous structure and irregular arrangement.

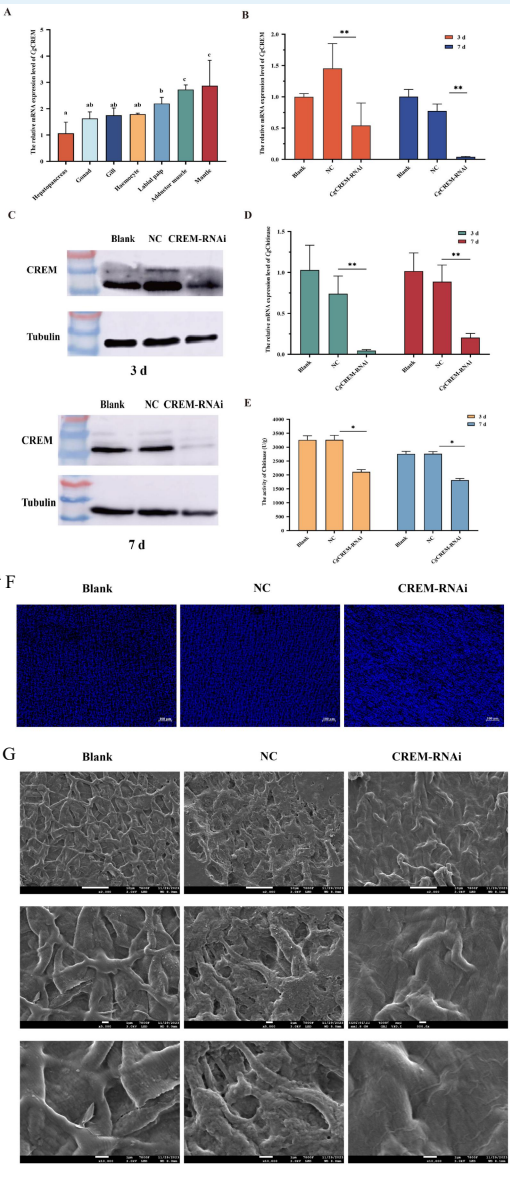


Fig. 1 The effect of interfering with CgCREM on the expression of chitinase and the chitin framework in the nascent capsid membrane

After treatment with CgCK2 inhibitor (TBB), the phosphorylation level of CgCREM, the mRNA expression level of chitinase and the enzyme activity were all significantly increased compared with the control group.

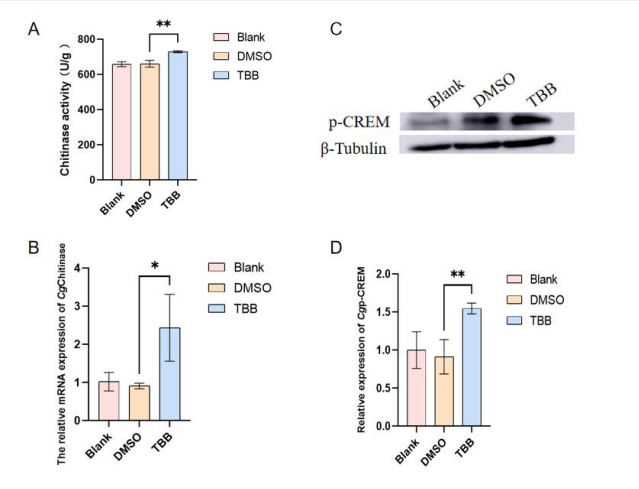


Fig. 2 The effects on CgCREM and chitinase after inhibiting CgCK2

Treated with DA, dopamine receptor 1 inhibitor (SCH23390), and dopamine receptor 2 inhibitor (Droperidol), the expression level of Cgp-CREM protein significantly decreased after DA treatment, while it significantly increased after SCH23390 treatment. After SCH23390 treatment, The expression level of CgCK2 mRNA and the enzyme activity were both significantly decreased.

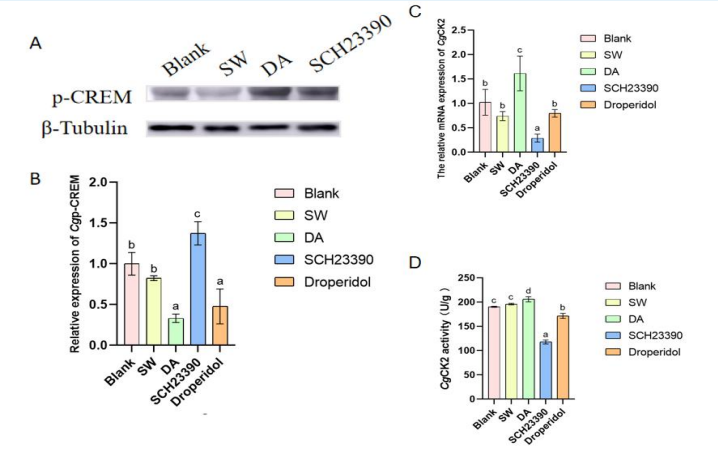


Fig. 3 Detection of phosphorylation levels of CgCREM and expression of CgCK2 after treatment with DA, dopamine receptor 1 inhibitor (SCH23390) and dopamine receptor 2 inhibitor (Droperidol)