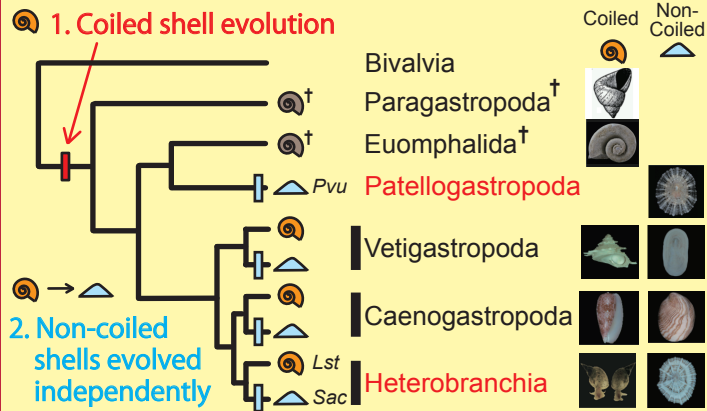


Developmental Mechanisms and Evolution of Shell Coiling in Gastropods

○ Shimizu K, Endo K (Tokyo Univ. Japan)

Conclusion : Changing pattern of *dpp* expression correlates with their shell shape evolution

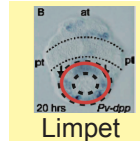
1. in the LCA of gastropods → **Asymmetric expression**, 2. true or false limpets → **Symmetric expression**



1. Introduction

1. Shell shape: important for survival in the environment
2. Shell formation (Early: Shell gland, Late: Mantle)
3. *dpp* expression in the shell gland

Limpet: Circular Dextral snail: Right half part only



Trochophore stage embryo

○ shell gland ○ *dpp*

Limpet: *Patella vulgata* (Nederbragde et al., 2002)
Dextral snail: *Lymnaea stagnalis* (Iijima et al., 2008)

4. *dpp* regulates cell proliferation activity (Hashimoto et al., 2012)

Hypothesis: Snail shells coil in response to a lopsided Dpp gradient in the mantle.

2. Methods

1. *dpp* and pSMAD1/5/8 expression analysis
 - a) *in situ* hybridization, b) qRT-PCR, c) Western Blotting
2. Dpp function
 - a) Dpp signal inhibitor (Dorsomorphin, DM) treatment

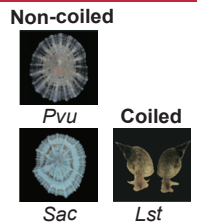
3. Materials

Pvu: *Patella vulgata*

Sac: *Siphonaria acmaeoides*

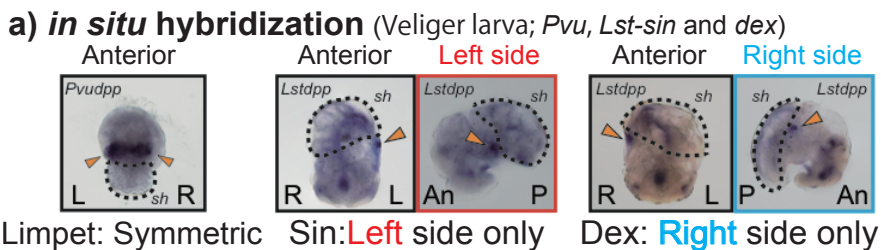
Lst: *Lymnaea stagnalis*

Dextral (WT), sinistral (mutant)

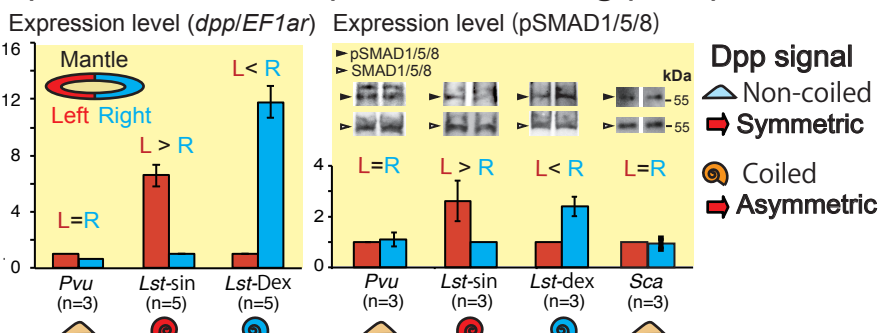


4. Results

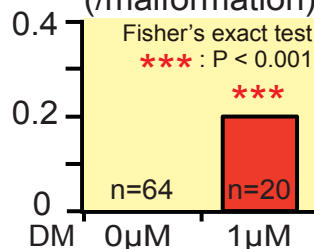
1. Asymmetric expression pattern of *dpp* in the snails with a coiled shell



b) qRT-PCR (Adult) c) Western blotting (Adult)



Non-Coiled Shell (/malformation)

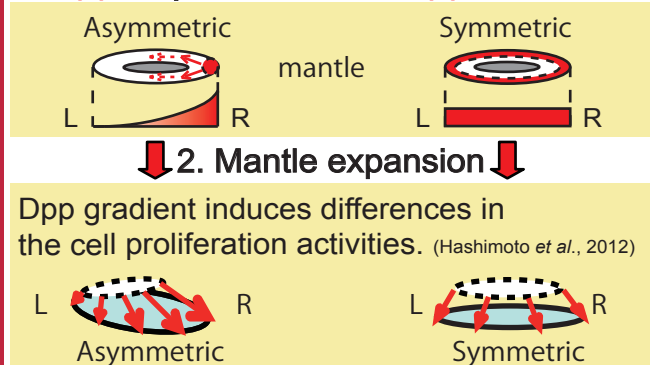


5. Discussion

1. Dpp signals are associated with asymmetric shell growth.
2. Changing *dpp* expression pattern most likely play an important role in shell coiling evolution.

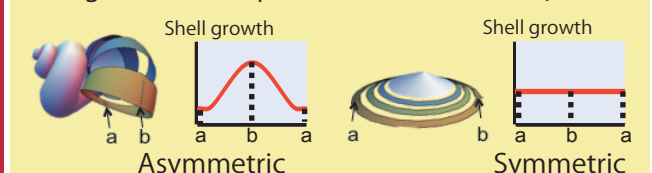
Dpp program snails shells to coil

1. *dpp* expression and Dpp diffusion



3. Shell growth

Shell growth corresponds to the mantle expansion



More details

- 1) **EvoDevo** (Shimizu et al. 2013, 4:15)
- 2) **Dev Genes Evol** (Shimizu et al. 2011, vol 221:pp59-68)