OIST Marine Genomics Seminar Ser 34th

Quantitative variation and evolution of left-right polarity in spiral cleavage.

Speaker: Dr. Takahiro Asami

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Bldg. 1. Level-C

Meeting Room 1 (C015)

The Spilaria (Lophotrochozoa) commonly begin to develop by spiral cleavage. At least in gastropods, a maternal effect of a nuclear gene determines the left-right polarity of spiral cleavage, which makes blastomere configuration asymmetric. The left-right geometry of blastomeres by itself determines the handedness of subsequent zygotic gene expressions to develop into a clockwise-coiled (dextral) or counterclockwise-coiled (sinistral) snail. Among these gastropods, internally fertilizing snails have genitalia in the lateral side, instead of the mid-plane. Thus, mutants of left-right reversal experience physical difficulty of mating with the wild-type majority within a population. If this frequency-dependent selection against reversal is solely responsible for polarity conservation in snails, the evolution of reversed species should be enhanced in externally-fertilizing snails which need no copulation and in other spilarian animals with the genitalia in the mid-plane. However, the opposite is the case; left-right reversed species have evolved only in snails that have to copulate for reproduction. Our experimental evidence indicates that most snail mutants of situs inversus do not develop into the mirror-image of the wild type and fail in early morphogenesis, because of quantitatively weak asymmetry in spiral cleavage. In a population, however, a substantial amount of additive genetic variance is present in this quantitative asymmetry, which must be a polygenic character, while the wild-type polarity is determined by the single nuclear gene. Our artificial selection for strongly asymmetric spiral cleavage therefore evolves sinistral snails that normally develop as well as the wild-type dextrals. Equivalent selection for sinistrality easily occurs in a wild population once the sinistral phenotype exceeds 50%.

All Welcome

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