

COMPARATIVE PHYSIOLOGY OF SUSPENSION FEEDING IN LIVING
ARTICULATE BRACHIOPODS AND BIVALVES - IMPLICATIONS FOR
LARGE-SCALE EVOLUTIONARY PATTERNS

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The hypothesis that biotic interactions have escalated over geologic time suggests that taxonomic groups such as bivalves, which developed representatives with high-energy life habits, preempted resources and drove "obsolete" low-energy groups, such as articulate brachiopods, into ecological refugia. Articulates had been the dominant benthos in a broad range of Paleozoic habitats. Modern refugia include areas of darkness and low primary productivity, such as fjords, caves, and polar regions. If the escalation hypothesis is true, then the modern articulates concentrated in these habitats should have extremely low energy budgets. The more energetic bivalves should be abundant higher in the photic zone and have higher energy budgets.

The equation Consumption = Growth (metabolizing tissue) + Reproduction + Respiration + Faeces + Excreta (nitrogenous) describes the energy balance in an organism. Energy acquisition is a critical factor for the persistence of individuals and species. Scaling equations relating particle filtration rates (consumption) to tissue mass were developed experimentally for two northern and two southern hemisphere species of brachiopods. Similar equations were developed for a northern and a southern hemisphere mussel species. The scaling equations allow correction for size differences which would otherwise confound physiological comparisons between species. Both northern and southern hemisphere brachiopod species were collected from deep, dark fjords or soft bottom habitats with Paleozoic style faunas. The mussels were collected from the same areas, but occurred higher in the photic zone.

Results indicate that the articulate brachiopods have a significantly lower ability to collect food particles from the water than do the mussels, for animals of similar body mass. These results support the hypothesis that escalated biotic interactions account, in part, for the ecological replacement of the formerly dominant Paleozoic articulate brachiopods by Mesozoic and Recent suspension-feeding bivalves.