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A new insight into evolution: Thermal power in animal development

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We propose a new insight into the mechanism of evolution based on our experimental works on development of starfish, emphasizing the role of energy, available in excess of minimal necessity for survival, and regard the new view as the RICH World in life.

Surplus cell mass in the starfish, *Asterina pectinifera,* was found: only 14 % of the normal egg can develop the whole development, therefore 86 % of the egg mass is surplus. The surplus energy can also be observed in tolerance toward famising: the bipinnaria larvae can survive without feed surprisingly over several weeks, though they can not become brakiolaria.

We carried out calorimetry of the starfish development using Thermal Activity Monitor (LKB 2277) with the ampoule measuring cylinder (LKB 2277-201) at 293.15K. Typically live 100 eggs were loaded in 0.1 ml artificial sea water with anti-biotics in the glass ampoule. Thermal power was as follows: 1 nW per cell (oocytes before oocyte maturation); 1.5 n W (after oocyte maturation). Significant thermal power was observed in the first 4 days after fertilization, which was promoted by using the energy stocked in the egg. The total thermal emission was 0.61 J in 2 weeks. The larvae spent the energy by 6 mJ in average in this period.

Furthermore individuals derived from the same batch shows large variety in growth rate: some individuals become several cm in diameter of body sizes, while others are only several mm after few years with enough feed. This indicates that a huge amount of plant planktons allow individuals with even low growth rate to survive.

These lead us to conclude that premise of life is surplus energy and selection based on famishing is not general in life, and to reach the new view of evolution: the RICH world in life. In the RICH World, abundant resource enriches the animal bodies, and the enriched bodies allow new life styles including variations of developmental course. Varieties of phenotypes, which are tolerant under various environment, appear and then accept gradual changes in genomic codes.

As for the emergence of life, since continuation of metabolism is premise of life, formation of nucleic acids must start because of there advantage of energy supply in metabolism, which began later to function stabilize the pattern of the metabolism as genetic codes.