Breakthrough Moments In Epigenetic Development

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In my thesis, I refer to the key findings of my undergraduate thesis, in which I clarified and structured the concepts related to epigenetics, including **genotype**, **epigenotype**, **extended phenotype**, and **extended epiphenotype**. Furthermore, I proposed a scheme illustrating the three stages of epigenesis: gene expression, advanced epigenesis, and extended epigenesis. These concepts collectively form the conceptual framework of epigenesis, understood as a theory of organismal development. There are at least three major turning points in the course of this process: (1) the boundary between the epiphenotype and the extended phenotype; (2) the boundary between the extended phenotype and its environmental form, and (3) the boundary between the extended epiphenotype and the cultural gene.

Referring to these findings is essential for integrating novel research threads related to the mechanisms of **phenotypic differentiation** across successive stages of epigenetic development. Consequently, I focus on demonstrating the influence of two opposing forces shaping epigenetic events: **genetic determination** and **ecosensitivity**. This analysis requires two types of argumentation: the first addresses the world of organisms, while the second relates to human organisms equipped with culture. In humans, the presence of a cultural gene or extended phenotype amplifies the impact of ecosensitivity, enabling highly individualized development.

Particularly significant epigenetic events are illustrated through two conceptual "windows," which I will explore in the thesis. These windows highlight crucial moments where epigenetic diversity is generated due to the specific conditions under which an organism develops. In the first window, I examine the influence of environmental conditions. In the second, I demonstrate how cultural diversity affects organismal development. In both cases, the process of epigenesis involves changes in the mechanisms governing the formation of physiological and morphological traits. These mechanistic changes operate in two ways: advantageously and disadvantageously. A detailed analysis of these moments of epigenesis is feasible by categorizing types of diversity into **excess**, **insufficiency**, and **stress**.

Furthermore, I tentatively propose a set of hypotheses that describe mechanisms of diversity generation during the key stages of epigenetic development:

Hypothesis 1 (regarding moment 1): Behavioral adaptation occurs as a response of the organism to environmental variability. This adaptation takes place when the force of genetic determination is balanced by the influence of ecosensitivity.

Hypothesis 2 (regarding moment 2): Variability in behavioral responses arises due to significant differences in the gradients of environmental change. Here, the influence of ecosensitivity moderates (weakens) genetic determination.

Hypothesis 3 (regarding moment 3): Differences in cultural gradients lead to variations in responses to environmental change. In this case, ecosensitivity predominates over genetic determination.

By addressing these hypotheses, I further develop the conceptual framework of the theory of epigenesis, building upon earlier findings. This framework reveals not only its underlying structure but also incorporates factors driving diversity and variability in the world of biological species, including humans.