

Japanese Innovation Policy from Phenotype to Genotype

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A Century of Paradigm Shift—from Phenotype to Genotype

The structures and functions of an organism that can be observed and measured are called its phenotype. Some parts of the phenotype, e.g., blood groups or enzyme concentration, require more sophisticated calibration than is amenable to direct observation. Nevertheless, they are in principle observable and are therefore phenotypes. The genotype, on the other hand, is defined entirely by the sequence of nucleotides that make up the DNA. For a given genotype, different phenotypes may be realized, depending on the environment in which the organism finds itself. The norm of reaction of a genotype is the pattern of the phenotypes that can be realized by placing that genotype in some range of environments.¹

Phenotype and genotype, originally biological terms, are used today in broader contexts. The earlier use had scientific connotations, based on the notion of '*scire*', meaning generally to know and ponder through determination based on direct observation. Contemporary usage denotes unconventional science, of things that are not visible and therefore cannot be discerned on the basis of numbers and data. Dealing with the invisible may forebode insecurity for some but it is as real a science as DNA ever was. One may even categorize the former as a shallow homocentric science identified basically through our five sensory organs. The latter, one may venture to suggest, is a much deeper science captured through a cognitive process of thought. It is a science that considers man to be only a part of, and not outside, nature.

Nature is not as simple as Ockham (William of Ockham, 1285-1349) and his believers, such as modern physicists once believed. Rather it is a complex weave of visible and invisible events best described with all its profundity as a web².

As all things man presumes to know, science is founded on assumptions³. Nevertheless, as Werner Karl Heisenberg, one of the architects of quantum theory, noted, it was the prerequisite for the prodigious change that occurred in the twentieth century. As was the 17 Century of Europe, the new Paradigm arouse the 20 Century. And, we are sure that this Paradigm will surely be evolved further over this century.

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¹ Evolutionary Theory of Genotypes and Phenotypes, M. W. Feldman, Emerging Synthesis in science, edited by D. Pines, Santafe Institute, Addison Wesley, 1988

² Web of Life, F. Capra, Doubleday, 1997

³ Mind and Nature: A Necessary Unity, G. Bateson, E P Dutton; 1979