

duce them. Species-typical influences may be typical because they are passed on in the germ cell, because they are part of a larger reproductive system, because they are created or sought by the organism itself, because they are supplied by conspecifics or other organisms, or because they are otherwise stable aspects of the niche. These associations must be investigated if we are to understand the differences between uniform and variable traits; our understanding is not improved by the circular tactic of explaining observations or conjectures by varying the amounts of genetic programming necessary for their occurrence. The prediction of the future presence of a trait, which is often the issue in the nature-nurture debate about humans, is not properly accomplished by identifying the trait with the genes (by computing heritability coefficients, by detecting it in baboons or in hunter-gatherers, by declaring it adaptive, and so on) but rather by understanding the developmental system well enough to allow us to say whether the entire system, or an equivalent one, will inevitably be present in the future. Careless inference not only hinders investigation of the question at hand, it also prevents a satisfactory integration of development with evolution. Although slips like these are sometimes discovered and corrected by vigilant scholars, what is needed is correction of the conceptual system that generates them in the first place. Later, I will point out the missed opportunity that such confusion represents, and argue for a radical reconceptualization.

GENETIC IMPERIALISM

Conventional dualism fails, then, because it rests on an incoherent mix of ideas; there is no consistent way of distinguishing features that are programmed from features that are not. Replacing the dichotomy with a continuum (some traits are more genetically programmed than others) does not solve the problem; the same inconsistencies are found in such conciliatory-sounding formulations as in strictly dichotomous ones. The other way of construing the genetic program is to declare that the genes determine the range of possibilities: They set the limits on development. As in conventional dualism, the mechanisms whereby the genes supposedly do this are obscure, but this does not deter some from claiming that norms of reaction are genetically determined (Freedman 1979:150; Mayr 1961). According to Scarr (1981), the range of reaction is the “expression

of the genotype in the phenotype” (p. 16), and the “genotype has only those degrees of freedom that are inherent in its genes” (p. 17). Although she claims that it is incorrect to say that “heredity sets the limits on development” (p. 17), that is exactly what is entailed by the notion of genetic degrees of freedom. This is all quite ironic because the array of phenotypes that could be associated with a given genotype is just the array in which all differences are *environmentally* determined. The environment, after all, is seen as “selecting” the particular outcome. The norm of reaction is therefore a nice demonstration of the joint determination of the phenotype. Every organism incorporates “information” from genes and environment in a complex that cannot be partitioned as variance is partitioned. But such mundane truths do not seem to be the point here, which is rather a kind of metaphysical urge to contain ontogenetic variety within genetic boundaries.

The problem with this imperialistic version of developmental dualism is that it is vacuous; a genotype has just those developmental possibilities that it has (though who is to say what they are). Used this way, the program no longer has empirical content. It is more like a symbol of ultimate faith. Or it may be only a fancy way of saying that potential is finite. In fact, one variant of this idea is “programmed potential”: Mayr (1961:1502) claims that “the range of possible variation is itself included in the specifications of the code” of the genetic program. But because the range of possible phenotypes is defined by the set of genotype-environment *pairings*, what is the point of attributing that range to just *one* member of the pair? And why insist that the range be fixed at fertilization? Potential must be a developmental concept if it is to be useful. It cannot be treated as a fixed quantity somehow inscribed in the genome (Horowitz 1969; Lewontin 1984). As many have noted, it is just this idea of fixity that has led people to draw conclusions about things such as intellectual potential from heritability figures.

A given genome may certainly have several developmental possibilities. But those possibilities vary with the developmental state of the organism and the context. Traditional notions of maturation, readiness, and embryonic competence turn on the realization that possibilities must emerge in ontogenesis. A bee larva has at one moment the potential to become a queen or a worker but a short time later the worker-to-be may no longer aspire to royalty. Its genes are the same, but its effective poten-