POINT OF VIEW

Dominance

A general tightening of word meaning and usage in science is necessary from time to time. Careless use of the word atom or neutrino, etc., would not have resulted in success for the release of atomic energy. Nor will loose use of "genetic code" versus "codon-decode" (RNA codons decoded to amino acids) result in successful molecular genetic engineering.

Even reconsideration of "tried and true" (?) words in classical genetics may be pertinent. Dominant (or dominance) is such a word that needs tightening. Students, teachers, and researchers will be less confused if we are more specific[1]. Blood groups, for example, may be said to be "dominant" when they are really codominant to other alleles. But they may be dominant to some subtypes or to the absence of factors detected in that system. Further, they may be codominant in the dosage sense of the presence of one gene heterozygous with a null allele yielding one phenotypic result, and another phenotypic result when homozygous.

Dominance is a relative term. It is relative to the technique used in detecting it. The dilute lethal mutant in mice is "recessive" when only coat color is considered along with the delayed lethality. But if the serum is analyzed with gel electrophoresis, the gene is a codominant, with three phenotypes.

Another consideration about dominance can be even more confusing. A listing of particular mutants of interest may be made, with some of them indicated as dominant, some as codominant, and some as recessive. – To **what** are they dominant or codominant or recessive? Similarly, what is really meant by the statement that "this mutant gene is dominant"? – Basically it means that this gene is dominant to its normal allele! Otherwise such statements are confusing. It has already been shown that with multiple alleles, each diploid combination of the various alleles must be specified as to dominance, since the same gene might be dominant to one allele, but recessive to another.

We use "dominant" as applied to the character **or** to the gene. This **dual** usage, predominant in classical genetics, leads to confusion in some situations. The *character* can be "dominant" while the *gene* may be epistatic (or hypostatic). In one example given in a textbook (Miller, 1991, Survey of Genetics, 2nd edn., Ginn Press 160 Gould Street/Needham Heights, MA 02194), the *character* black is dominant to the *character* white in a particular stock of chickens. An F_2 of the cross of purebred parental types yields 3/4 black and 1/4 white progeny! Almost any geneticist would say "Of course black is dominant to white!" But full analysis, *including wild type* (black and red, i.e. eumelanin and phaeomelanin), disclosed that the "dominant" gene for black is really hypostatic to the gene for white (!) because they are not even alleles! This recessive white gene, when homozygous, blocks melanin in the feathers. To what is this white gene recessive? – To the normal allele contributing to melanin production – not to the black gene! This stock of white chickens has two independent mutants "dominant" black and "recessive" white (epistatic to black). This white stock in a cross with wild type yields an F_2 with a 9:3:4 ratio typical of a dihybrid that includes a recessive epistatic gene.

Isn't all this just as clear as black and white?

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[1] See also: Miller, W.J. and Hollander, W.F. (1995). Three neglected advances in classical genetics. *BioScience 45*: 98-104.