

## PUREBRED?

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Purebred! Sounds Great!

A notion of “purity” and connotations of cleanliness, neatness, stability, uniformity, worthiness and admirable values click through our mental processes. After all, that’s what we learn in biology, especially the genetic section, don’t we? Well, maybe it’s colored a bit by the horticulturalists’ and stock breeders’ influence, and dog and cat fanciers who want pedigree papers and conformity to some arbitrary standard. Poultry and small pet fanciers have about the same attitude, but rely less on papers. But “purebred” is jargon—at worst meaningless in the context of conflicting usages, and contemptuous in use by a more sophisticated group—breeders or teachers versus laymen or students. At best, it is peculiar to the biologist’s profession of one type or another.

What *does* purebred *mean*?

The dictionary says “bred from pure blood”. Useless! Either the definition is circular or implies no blood parasites or infection.

The dictionary also says of a recognized breed “kept pure for many generations”. Also useless for similar reasons.

The dictionary further says “of a lineage established by registration records”. In other words, of a closed breeding group selected and bred according to some arbitrary criteria.

Well, how *do* we use it in the genetic context?

Students quickly learn to apply “purebred” to the  $P_1$  generation of Mendelian families, and to their homozygosity. The corollary to their homozygosity is that they can form only one kind of gamete. Therefore, they *must breed true*! This, then, is the most frequent biological usage of the term. Note, however, that such homozygosity applies only to one or a few characters of interest. The stocks are *not* purebred for blood types, enzyme polymorphisms, or many other characteristics.

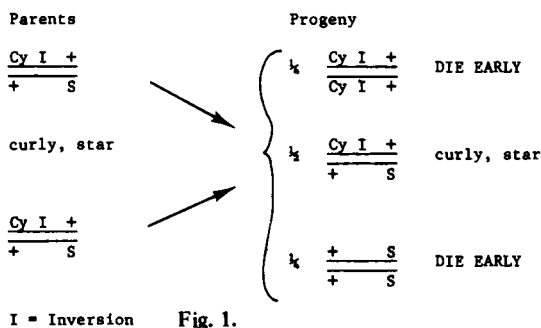
Some characters usually assumed to be of concern for a breed’s characteristics, and therefore, most pertinent to be uniform, are not uniform.

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Color, for example, deliberately is allowed to vary in shorthorn cattle, French poodles, and Andalusian chickens. Even more variation is allowed in performing breeds such as German Shepherds, thoroughbred and Arabian horses and homing pigeons. Some vary in spite of rules on uniformity. For example, Holstein-Friesians may have red and white progeny instead of the standard black and white. Many more examples could be cited.

So homozygous is not always what is meant by "purebred". The breeder of registered palomino horses would grow increasingly antagonistic if the geneticist insisted the palomino does *not breed true*, but segregates chestnuts and cremellos, as well as, palominos, and, therefore, is not purebred. Likewise, codominant lethals like creeper chickens, crested ducks, hairless dogs, gray sheep, roan and white horses cannot breed true--the homozygotes for the mutant gene die before classification.

Academically, there is a further trap, since some rare conditions *do* "breed true", but are *not* homozygous! Combined curly wing-star eye stocks of *Drosophila melanogaster*, the famous vinegar fly or pomace fly used so extensively in genetics, breeds true in the sense that only one phenotype is seen each generation. The balanced lethal is a sophisticated example of genetically linked codominants. The star-eye stock is unfixable; progeny of star-eyed parents segregating 1/3 normal and 2/3 star-eyed. Curly-wing stock similarly is unfixable, moreover, it is 100% associated with an inversion of the chromosome which is known to prevent recovery of crossover strands when in the heterozygous state. The offspring which are double mutants (curly, star) of the cross of these unfixable stocks breed true among themselves! Because of the heterozygous inversion, no normal strands occur among



progeny from this trans (repulsion) phase of the mutants. Nor can homozygotes develop enough to be classified. All that are seen generation after generation are curly-wing-star eye flies (Fig. 1).

Purebred is not likely to disappear from our language or usage. But, hopefully, we have learned that purebred is a relative term of contradictory usages and is *jargon!*