# Conservation of Germplasm of Domestic Species

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The attempted improvement of animals and plants through breeding is largely a process of conserving the best genes. By selecting superior individuals to become the parents of the next generation the relative number of desirable genes in the group may be increased. No geneticist claims that the genes themselves are improved but the relative numbers of useful and harmful genes are so recombined that the animals and plants serve man's needs better. Rarely a new gene appears through mutation, and if the character which it engenders is useful to man it may be maintained by breeders, thus incorporating something new.

It is out of place, however, to think of a new breed or variety as a new entity, unrelated to its parent generations, as Harwood seems to have done when he entitled his book on Luther Burbank, "New Creations in Plant Life." A mutant character is indeed new, but it is only one among many characters which compose the plant or animal. Furthermore, most new varieties do not include a mutant but are new assemblages of old characters.

## Wild Ancestors

Nature has provided many strains of useful plants and animals which man has simply appropriated and propagated. An example in Indiana is the wild turkey, of which the domestic bronze breed is a lineal descendant, unchanged to any great extent. Examples of appropriated fruits are wild plum, paw paw, persimmon, and the brambles. Many desirable strains of organism have been imported from distant lands and either propagated in the pure form, or crossed with other strains in order to combine desirable characters from two strains into one. An example is the Regal lily, which was secured by a mule caravan sent for that purpose into western China. The Chinese hog *Sus indica* (1), having short head and legs, prolific and easy to fatten, was imported into southern Europe in ancient times, whence it was brought to America to become the principal ancestor of our lard type hog.

Thus, while it would gratify our self esteem to think that breeders have built up all of our varieties and breeds from incipient wild strains, the facts teach us that the wild strains often were superior. A further example is the wild ox of Europe, *Bos primigenius* (2) or urus. Unfortunately it is confused in the literature with the European bison, *Bos bonasus,* which differed very little from the American bison, and was distinct from the urus. This wild cow was described by Pliny, Tacitus, and Baron Herberstein, as being six feet tall, black to gray, light around the muzzle and down the back, having no long hair as in the bison. A horn from one large urus held twelve quarts. Although the wild form became extinct in the 17th century, this type was the ancestor

of the Holstein and Galloway breeds and possibly of all the European cattle.

Likewise the Arabian horse seems to have been an outstanding type even before man tried to improve it. Ridgeway (3) thinks the Arabs did not develop the breed, since they do not know the principles of breeding but consider the mother to be all-important. He says they secured them from the Egyptians, who had gotten them from the Libyans, and the Libyans in turn had found them as an indigenous breed of North Africa. To this agrees an account of Herodotus about the Egyptians trying to drive out the invaders known as the Shepherd Kings. They could not drive them out until they had secured horses from the Libyans.

### Early Neglect

The first white settlers in Indiana brought with them live stock which had descended partly from these superior strains. But because of poor feeding and housing and absence of selection, both in Europe and America, they had deteriorated. Bidwell and Falconer (4) say that often the likeliest heifers were sold to the butcher. A contributor to the magazine called the "Cultivator," 1838, describes the native cows as follows: "They are a mixture of every breed . . . such perhaps as they were before science and attention had improved them. . . . This mixed breed are not very celebrated for anything; some of them are good milkers as far as quantity is concerned, but as for quality of the milk and aptitude to fatten they generally fail. . . . They are small, short bodied, thin and coarse haired, steep rumped, slab sided, having little aptitude to fatten or to lay the fat on the right place. . . .

"The weight of cows when slaughtered averaged 450 pounds; steers weighed 600 pounds, and oxen 875 pounds."

A similar report is given by N. S. B. Gras (5) as follows: "Observers agree that the live-stock in America up to 1790 was treated with inhuman neglect, partly an inheritance from Europe and partly a necessity of the times and circumstances. Even as late as the 1870's it was necessary for the Grange to encourage careful treatment of live-stock. But little special fodder was grown for animals and shelter was either inadequate or non-existent."

The hogs brought by the early settlers were descendants, not of the Chinese hog, but of the wild boar of northern Europe, *Sus scrofa*. These long-nosed, sharp-backed, late maturing swine roamed the woods, subsisting on grass and acorns, and were contemptuously called "razor backs" and "elm peelers."

### Effort to Improve

Improvement of these lamentable conditions came about partly by the improvement of prosperity. When barns and fences were built and enough land was cleared not only for grain but also for hay, live stock received better care.

But the improvement of the animals themselves, the securing of individuals with better germplasm, came largely by importing improved breeds from Europe.

Modern breeding methods began with Robert Bakewell in England about 1760. At that time, English cattle were very heterozygous, due to the practice of mating native cows with bulls imported from other countries. Having traveled widely over England, Bakewell chose the best cattle he had found; a bull from Mr. Westmoreland and two heifers from Mr. Webster, and used these three individuals as the sole parents of his herd. Mating their offspring among themselves and keeping only the best, he soon had cattle which attracted much attention.

The Collings Brothers and Thomas Bates, who were breeding shorthorned cattle, heard of Bakewell's success and followed his methods. They kept records of their individual cattle in herd books, and after some years these books were closed; that is, after this time no animal could be recorded as a member of the breed unless both of its parents had been so recorded. The first Shorthorn herd book (6) in the United States was compiled by Lewis F. Allen of Black Rock, N. Y., and published in 1846. In 1882 it was purchased by the herd association for $25,000.

This close breeding, the mating of near relatives, was necessary in order to predict what characters the calves would have; to insure that they would closely resemble their parents. But close breeding must be accompanied by selection because some inferior calves are produced thus and they must be discarded. But the better the germplasm of the parents, the fewer will be the defective offspring.

In 1825, Edward Talbott (7) brought from Kentucky to Jefferson County, Ind., two young cows and a bull, of Colonel Sanders' 1817 importation of Shorthorn cattle. It is hard to say whether this was the first such importation into the state but it was among the first.

Beginning about 1832, the county fairs exhibited live stock of the improved European breeds, and these, having been bought by farmers, were crossed with native cattle and resulted in a great improvement in size, early maturity, and quality of beef. The invention of the cheese factory in 1851 led to interest in improving dairy cattle.

The breeds of sheep and goats were mostly developed in Europe, like the cattle. The hog breeds, however, were mostly built up in this country, largely from imported stocks, both *Sus scrofa* and *Sus indica*.

## Early Corn Breeding

The early settlers of our state seem to have given better care to plants than to animals. Corn, *Zea mays*, the principal crop, had been developed by the Indians into all the types which we have today, namely flint, dent, flour, and sweet, and they gave careful attention to the selection and drying of seed. Thus the white settlers had a good example set before them and most of them followed it.

The American Indians practiced rather rigid seed selection and had fairly definite standards. The ears were selected each fall before frost and the husks braided together such that a braid would contain about 50 ears. These braids were hung up to dry before being stored.

A corn secured from the Mandan Indians at Mandan, N. Dak. by Oscar H. Will of Bismark in 1882, having been grown by these Indians

for at least 200 years previously, was grown extensively in the Northwest as the highest yielding corn in that area until 1935, or until higher yielding hybrids replaced it.

### An Innovation

The advent of hybrid corn was the most outstanding event in Indiana farm genetics. The repeated inbreeding of corn by East and Shull, working independently, showed that the species could be analyzed, the various characters appearing in different plants in pure form. Among the various strains which appear during this process, two desirable ones are selected and allowed to cross, the resulting progeny being known as hybrid corn. According to a conservative estimate, hybrid corn yields 12 bushels more per acre than open pollinated corn, other factors being equal.

Since the principles of heredity apply to all species, breeders at once tried to secure similar improvement in other plants, and also in animals. But difficulties are encountered in that some species, wheat for instance, if crossed at all, must be pollinated laboriously by hand. Another difficulty is that much discarding is necessary in order to develop pure strains for crossing, and in the case of farm animals, this elimination is much more expensive than in corn.

The 1936 Yearbook of the U. S. Department of Agriculture contained an article entitled "Livestock Breeding at the Crossroads" (8) which was radical in that it advocated crossing of breeds. "Breeds developed for the same purpose are arbitrary division fences. . . . Their ancestors have lived for over a century in an animal society where mixing of the two germplasms constitutes a breach of etiquette punishable by condemnation to the butcher's block."

This criticism, although packed with dynamite, was ignored by the vested interests, the breeders, until the U. S. D. A. started to act upon it. They crossed pure breeds of cattle, postulating that a breed has been made similar to a strain of corn, through inbreeding and selection. Their report was that this imitation of the corn breeders was succesful; that the resulting heterozygosis resulted in greater milk yield and other improvement. But at this juncture the herd associations raised a hue and cry which has not entirely subsided even now.

A significant effort in hog breeding is being carried on by the state experiment stations. A breed of hogs is inbred at one station, another breed at another station, with the result that different strains are produced which differ greatly in merit. The few good strains which are kept for breeding are largely homozygous and uniform, and crossing with a similar strain from another breed gives an increase in vigor, comparable to hybrid corn.

### The Present Situation

The principal method of animal breeding, however, continues to be the maintenance of the breeds, registering the pedigrees of individuals and mating within the breed. While the breeders have rendered a service to agriculture, their pay often is not in proportion to the

amount of service given. Some of them, who are good at promotion, sell all of their males for breeding, and at a high price. But since variation is going on all the time, the inferior animals should be slaughtered lest the breed deteriorate.

On the other hand, a gifted breeder who is not so good as a salesman may not be able to sell at prices high enough to be remunerated for his work. Then he may cease to register his animals, with the result that they receive the inferior classification of grades, regardless of their true worth.

The chief tools of the breeders continues to be shows and auction sales. Often the characters by which excellence is judged have little or no real value. The writer recalls a small herd of registered hogs. Only one sow was a good mother, being very careful in lying down not to lie on a pig. But she never would have received first place in a show because she had curly hair. If the breeding stock had been selected at a show, the best sow would have been discarded.

Whether we like it or not, farm animals of the pure breeds, the ones which are registered or eligible to registry, often do not sell higher than others except in times when money is plentiful. But at an auction where much publicity has been given, pure bred animals often sell for several times as much as others, demonstrating that it is promotion rather than germplasm which attracts high prices.

But can breeders pledge that a pedigree is a reliable badge of superiority? Our best farm animals are to be found within the pure breeds but are all of the pure bred animals superior to others? This guarantee could be made if enough care had been exercised in selecting the individuals to be registered, refusing to register any but the best. Breeders who are committed to this program are public benefactors, and some method should be worked out to insure that they will be well paid.

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