

one point is not unduly emphasized, to the detriment of others, or the faults hidden.

It seems to be a fact that certain female lines are more successful than others. In every variety of animal whose pedigrees we have investigated, almost all the best winners seem to be derived from only one or two roots in the female. This curious fact should certainly be acted upon when starting a stud, and only the females from such successful line purchased as stock. However plain in appearance she may be, and however comparatively costly, the mare which has bred winners, and which belongs to a female line which breeds winners, is worth several bred in any other way, however taking they may be. Only a close study of pedigree, then, can enable us to invest capital to the best advantage.

Another curious thing is that some strains "nick" better than others. The fact that cross-breeding can take place between strains, as well as between species, is often overlooked. It is often as disastrous, from a show-breeder's point of view, to cross strains as it is to cross varieties, and the result is nothing less than a mongrel—an alloy. When a stud has been carefully and successfully bred for several generations, the inmates of the stud constantly become hall-marked, as it were, with certain characteristics which have become inbred in them, and make them easily recognizable among others. They may, then, truly be called a strain. Now, every man, either consciously or unconsciously, puts greater value on certain points than others, and allows them to weigh with him when making his selection. Whether it be shoulder, feather, weight, quality, or what not, his stud will give evidence in a few years of his predilections. Now, experience seems to show that if animals of two strains are crossed, each of which is bred for certain and different characters, the progeny, in all likelihood, will revert, i. e., will inherit the good points of neither. The only exception to this rule is when two strains are bred for the same good points, then members from each will "nick," and the offspring will be likely to possess the characters which it will inherit from both sides. It may be suggested that breeders of any one variety of animal are all striving for the points indicated in the standard. So they are; but one man will be breeding for bone, another for quality, a third for color, and each strain will be apt to strongly transmit the characters for which it is being specially selected. It is advisable to always go to one strain for both sexes of breeding stock, as in this way the thread can be taken up at the stage reached by the stud from which the animals are purchased, without any risk of causing reversion by bringing in alien blood.

The novice may possibly be puzzled to know, when he studies a pedigree, what value to attach to inbreeding in the back part. All our show animals are more or less inbred—generally more—and there is nearly always an appalling amount of consanguineous mating in the early days of a breed. For how great a number of generations the specific hereditary tendencies of the first generation can be felt, is a point not yet cleared up. As far as we can tell, there seems to be no limit to the number of generations which may intervene between the reappearance of an ancestral character, and Darwin pointed out that the result of a cross could be felt for as many as twelve generations, at the end of which time the proportion of foreign blood is only in the ratio of 1 in 2,048. When dealing with pedigree stock, it has been stated, with what truth we know not, that the tendencies of the fourth remove and backwards will not be felt unless raised to the surface through a direct channel. Thus, to reap some benefit, say, in the eighth generation, from some gross inbreeding which has been practiced in the back part of the pedigree, a cross must be resorted to which will bring in one or more strains in the first three removes of the animal whose name appears so often far back in the pedigree, to make a direct channel, as it were, through which the mass of blood and the valuable characters it contains can be brought to the surface.

This leads up to reversion. The tendency to reproduce a character which was lost during some former generation, is strong in every class of animal, and is one of the greatest hindrances with which the breeder will have to contend. As we have just stated, a cross can be practically bred out in a dozen or less generations, and must not be confused with true reversion or the reproduction of primeval characters, which seems to be almost unlimited in the extent of time over which its action can extend. Very little is as yet known of the rationale of reversion, and it is probable that, rather than being a reproduction of, or return to, an ancestral type, it may be a new or spontaneous variation. In any case, the result is the same to the breeder, as these reversionary animals are often what he would call a "flow" type. At one sweep, so to speak, the points that have been so carefully bred for many years are obliterated, and apparently without reason a colt appears with the very undesirable characteristics of his ancestors. Reversion may be partial, or it may be, as far as we can judge,

total. The big-headed, straight-shouldered, thin-tailed, dun-colored pony, with dorsal band and shoulder and leg stripes, is apparently the counterpart of his forefathers long before the days of their domestication. On the other hand, we may get a reversion only in color, or eye, or disposition, or some minor character, the significance of which may well be overlooked.

It is said that reversionary types, if bred together, produce a large proportion of progeny of the parental type, showing that their germ cells are pure.

A number of characters which may be undoubtedly numbered among those peculiar to a very remote ancestor of our horses are terribly bred-in in some modern breeds, for instance, the "pig" eye of the Shire. Among the external atavistic characters which constantly crop up in all varieties are "bad" manes: i. e., manes with a tendency to stand erect, and which will not lie flat; "rat" tails, curly tails and manes, "fiddle" heads; thick, stiff necks; mealy bay color, convexity of frontals, presence of first premolar (wolf tooth), and many others.

As already hinted, it has been observed that one of the most frequent causes of the stimulation of reversion is crossing. If two pure (and therefore presumably inbred) varieties of animal are crossed, it is extremely probable that some of their progeny, when bred from, will reproduce some or many of the long-lost characters of their ancestors. This is particularly noticeable in sheep, and it is a well-recognized fact among flockmasters that half-bred ewes mated with a ram of a third and different breed will be extremely likely to throw a proportion of (1) black, (2) parti-colored, or (3) horned lambs, the first of

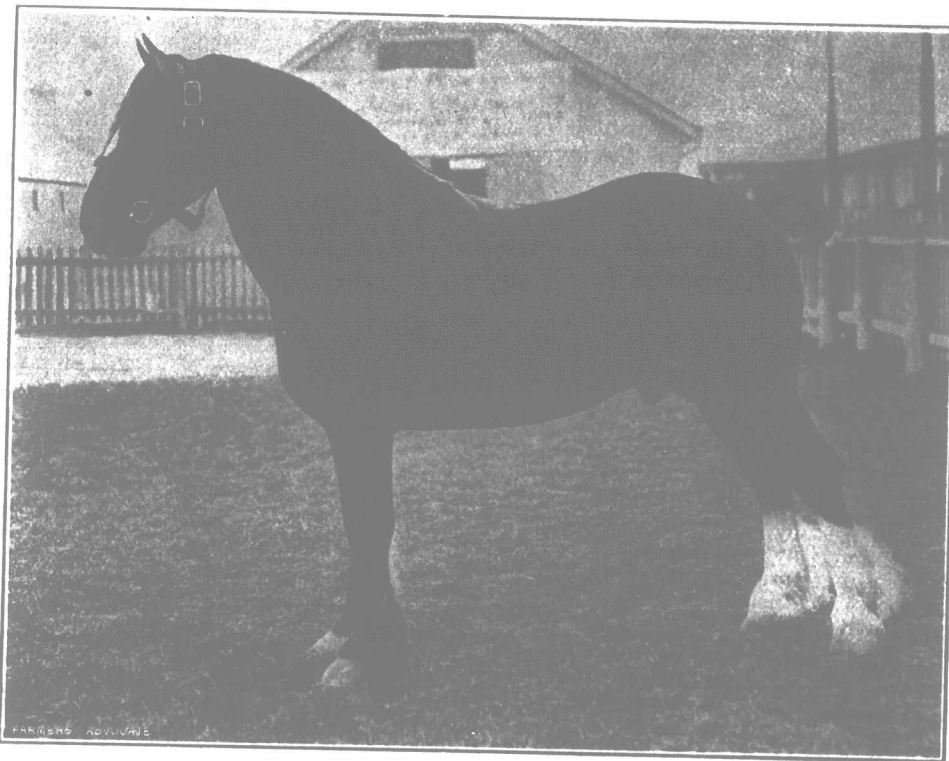
early stage of its existence, becomes first a fish-like creature, with bilobed tails and three-gill pouches. This is succeeded by a marsupial stage, when the embryo has many of the characteristics peculiar to the newly-born undeveloped marsupial. We have it on the authority of Professor Ewart that up to near the time of birth, a horse embryo has long hairs only on the end of the tail, thus suggesting that a completely-haired tail is a comparatively modern acquisition.

If we support the recapitulation theory, it is surely not impossible to believe that foals may be born when their development is slightly incomplete and they have not had time to adopt the modern livery. This would at once account for the dun color. Why crossing should lead to an earlier birth, is not exactly apparent, unless it can be proved that the period of gestation is normally longer in pure, inbred, domesticated varieties of animals, and that as the type gets higher, as evolution continues, so the period lengthens. Darwin gives statistics to show that such is the case among the highly-specialized Merino sheep, as compared with Southdowns and cross-breeds, the difference between pure-breeds in the two varieties being on an average of six days. Cross-breeds with seven-eighths Southdown blood gave the same result, half-bred Merino-Southdowns going four days shorter than pure Merinos. The value of this information is somewhat discounted by the same writer finding the period shorter in the improved breeds of pigs than in common, half-wild pigs. However, the whole matter is at present wrapped in mystery. We should account for partial reversions as arrested development of certain parts. Total cessation of development before a certain stage would, of course, result in a

dead foetus, and the dun-colored, partially-striped condition is possibly the earliest in which we can have a living foal. A phenomenon with which every breeder is familiar is the prepotency of certain individuals, and we will examine into the nature of prepotency or dominance, as it is now more frequently called. Nearly 40 years ago Darwin investigated the subject at some length, and admitted that it "is extremely intricate." It has been thought that spots, or marked variations, are always prepotent, and it has always been associated with inbreeding, a common opinion being that apart from inbreeding it is impossible. The fact stands out that certain males and females, however mated, seem

to stamp their characteristics on their offspring in a remarkable degree. By reason of the greater number of progeny for which a male is responsible, this sex usually gets the credit of greater prepotency; but there is no reason to believe—in fact, there is absolute proof—that the phenomenon is not unduly limited to one sex.

Prepotency may be, like reversion, partial or total; i. e., the young may be undistinguishable from one of the parents, or they may only possess certain characters, inherited from one parent. For instance, the offspring of a Shorthorn bull and a Polled Angus cow are almost invariably polled, showing that the polled character is in this case dominant; the ass is generally admitted to be prepotent when bred with the horse. The result of recent experiments throws a new light on the subject. It has been proved that when crossing two varieties differing from one another in certain definite characters, in the case of each of these pairs of characters there is one which in the first cross prevails, to the exclusion of the other. Thus, if white Leghorn fowls are crossed with brown Leghorns, the chickens will invariably be white in color, as white color in Leghorns is dominant over brown, and it is certain that every character (with certain exceptions) in every class of living organism is subject to the same law. Thus, if we can once ascertain and list the dominant characters in horses, we can gain some idea of what to expect when crossing individuals. In certain crosses, such as the Angus-Shorthorn, cited above, the transmission of definite characters will invariably be the same. Breeders must therefore note which characters are transmitted in the first



Royal Prince [3802].

Four-year-old heavy-draft stallion. First-prize, Canadian National Exhibition, Toronto, 1906. Owned by Hodgkinson & Tisdale, Beaverton, Ontario.

these being probably total reversions to their original progenitors. Crossing of varieties, strains, and even families, is to be strictly avoided if it is desired to perpetuate the modern type, as reversion will occur in a degree proportionate to the severity of the cross.

In certain ways atavistic animals may be made use of. If in an inbred strain such an animal appears, as sometimes happens without apparent stimulus, and if this strain is deteriorating in constitution and stamina from excessive consanguineous mating, the hardy, healthy horse may prove a valuable outcross, and will, it is believed, transmit some of its constitution and qualities, and revive the degenerate strain without the dangerous recourse to outside blood, which is the only other alternative.

The writer has often dimly felt that atavism might, perhaps, be merely the result of birth before complete development, but without definite data and costly investigation it is, of course, impossible to even hazard a guess as to whether there is the slightest foundation; statistics would be required of the exact period of gestation of the stock bred, for the theory, first of all, numerous in large show studs, with slight description of each individual animal and information as to its subsequent career. If it could be proved that successful prizewinners, i. e., animals furthest removed from the ancestral type, were always carried longer than animals of less advanced type, the theory would be on a fair way to being proved. We know that the embryo, in its development, epitomizes the history of the ancestral forms of its species. The horse embryo, at an