environment, and inheritance of useful acquired characters, and the Darwinian, which claims the working out of useful structures by the influence of selection on small fluctuating variations—are perfectly harmonized, also the gap between Darwin and Wallace is closed. And now that harmony can be secured between the champions of these three great masters, we may well turn to some more useful work. And right here, the words of Auguste Comte, though written seventy-eight years ago, apply so well to what I have said that they are here quoted, and I fully and freely indorse them and am quite sure that Darwin, Wallace, and Lamarck would all have done the same. He writes:

If we conceive all possible organisms to be successively placed during a suitable time, in all imaginable mediums, the greater part of these organisms would of necessity finally disappear and leave only those surviving which could satisfy the general laws of this fundamental equilibrium. It is probable that after a succession of analagous eliminations, the biological harmony must have established itself little by little upon our planet, where we still see it continually modifying itself in a similar manner.

I have here given only a passing glance over some of the most prominent features of the action of these forces of heredity which too often seem not to have been placed in the right perspective to obtain a comprehensive view of the subject, and in closing would say that the intricate and most perplexing laws of evolution and heredity are now being traced out with great rapidity, especially since the advent of the more general plan of direct study and experiments of the biological forces themselves, the generalizations drawn from very numerous useful and painstaking special experiments on widely different subjects, and a more general knowledge that all motion, all life, all force, all so-called matter are following the same law of heredity found in plants and animals—a forward movement towards attractions through lines of least resistance.

COÖPERATIVE BREEDING.

By Prof. OSCAR ERF, *Manhattan, Kan.*

Glancing over the farm animals to-day one cannot help noticing a large percentage of inferior animals. They lack character and quality in general. This condition is due largely to the unstable attitude of breeders not selecting wisely and not staying with a particular type or breed. Furthermore, the purpose for which the animal is bred is oftentimes not clearly fixed in the minds of the breeder, and, even if this is true, it is often diverted by popular sentiment. Successful breeding depends on stability to remain with and to work for a fixed and clearly defined purpose. Animals of old, well-established breeds reproduce themselves with more uniformity than do those of breeds of more recent origin. To breed a certain

class of animals for a long time in the same direction and for the same purpose fixes the characters and increases the prepotent powers. Prepotency is the superior strength of character with which certain animals are endowed to reproduce their character in the offspring. This is plainly seen in the offspring of males of strong characters when mated with females of inferior stock. For instance, Mr. Cruikshank's Champion of England was at the head of a lineage of descendants among which were the greatest Shorthorns of the last quarter century. The Holstein bull, Jacob, is directly or indirectly responsible for breeding some of the greatest milkers of that breed, and so one might name a large number of individuals of each class of animals that possess strong, prepotent characters. Such animals in nearly all cases have ancestors that have been bred along one line for a long period of time and generally for a special purpose.

The practice of cross-breeding which is sometimes advocated has a degenerating effect, although for one generation if the animal is intended for the butcher, it may prove to be extremely profitable. Cross breeding seems to set free in succeeding generations weaknesses and undesirable qualities that were apparently dormant in well-established breeds and is thoroughly unreliable in developing offspring of such quality as one might expect. Cross breeding comes nearest to being successful when well-bred males are used on common grades. In nearly every case the main traits of the males will be noticeable in the offspring. As a matter of fact, this is the way herds and breeds are developed and improved by discriminate breeders and at times under certain peculiar conditions. We have for illustration the Jersey breed established on the Isle of Jersey, and the Guernsey breed of the Isle of Guernsey. Their improvement has been mainly brought about in early days by the environment and close breeding of the animals, and later on by the laws prohibiting importation of animals. The breeding was carried on for a definite purpose on both of these islands. This purpose was to obtain the greatest amount of butter fat for the least amount of food, and it is well known how successful the people of the Isle of Jersey have been in accomplishing this result.

The Holstein-Friesian breed was established in communities where close breeding was practised. It is true that environment had something to do in bringing about efficiency and developing character, but the fixing of character was due mainly to the breeding. The fact that the farmers have worked together more or less in communities has given England its fame and greatest advantage in originating such excellent breeds adapted for its own as well as a great many other conditions. This indicates to us that successful breeding is largely due to coöperation. Study the conditions as you may find them, and wherever you see any marked improvement or the establishment of a successful breed, you will find that it has been accomplished by a law or by coöperation.

As a science, animal breeding may be said to date back to the time when Robert Blakewell commenced to breed Longhorn cattle, Black cart horses and Leicester sheep in Northern Scotland.

He introduced a system of letting out males for breeding purposes and assisted his breeder friends in mating and selecting animals which had the characters he desired, and we may all read of the great transformation that has taken place by his method of breeding. One can cite a great many systems of coöperative breeding that have been adopted throughout European countries, nearly all of which added materially to the improvement of stock. If it is wise to adopt such systems in European countries, why is it not well to introduce them into this country to a greater extent than has been done in the past?

Improvement in breeding has largely been stimulated in the past twenty or thirty years by the judging of animals and the awarding of prizes at county and State fairs and stock shows. However, this improvement has not been entirely along legitimate lines. The judging of breeding animals to a type that is pleasing to the eye and profitable to the packer has always been practised by the average show ring judge, disregarding the more important point relating to the pedigree of the animal. While I believe there is room for common-sense work in the way of stock judging, there are more important factors which need to be taken into consideration.

The practice of fitting breeding animals for show purposes is not as a rule conducive to good results. Some have been bred and fattened to such an extent that in many cases it has materially interfered with the perpetuating of a good, healthy and profitable offspring. We ought to lay more stress than we have in the past on unperceptible characteristics, many of which are apparent to the judges only in a limited way, while there are others of which they have no knowledge. For instance, prepotency, including those necessary features, strong constitution, ability to produce offspring that thrive profitably and remain healthy under existing conditions. While it is almost universally conceded that the condition of the animal generally indicates more or less the profitableness as a feeder which frequently cannot be verified, yet to my mind I question whether the average judge is correct.

The misleading feature of awarding prizes to breeding animals from mere external appearances, as is so frequently done, works contrary to good breeding principles, yet when the average breeder has breeding animals for sale he never ignores the seemingly all-important point that they have won prizes—if such be the case—apparently putting the matter to the buyer as if that particular fact were a merit to the animal for breeding purposes. When an animal is awarded a prize in the show ring it should be awarded on its pedigree, including performances, prolificacy, and quality of offspring.

In the past too much credit has been given to the judgment of the man in the show ring who knew actually nothing of the performance of the cow, but judged her entirely on outward appearances, which resulted in degenerating the milking quality of the breed. Likewise, we have conditons that are still more absurd in the line of poultry judging. The points upon which a fowl is

judged under the present system depends entirely upon its feathers, its shape and color, its comb, wattles and legs, leaving out those very important points pertaining to prolificacy, ability to produce meat economically, hardiness, and proficiency in producing eggs. Hence, it is evident that the show ring practice of selecting animals for breeding purposes does not comply with the laws of good breeding. A reliable and complete pedigree such as can be produced only by a good breeding society, leaving out much of the personality or the ideas of a judge should determine the animal for breeding purposes. Many have realized the fact that, if time and money were available, much could be done in this direction, but individual effort can accomplish little owing to the time and expense required in reaching favorable results.

Prof. W. M. Hays in an article on plant and animal breeding, says:

Our promising stock of Red Polled cattle is widely distributed, one herd here, another there, possibly hundreds of miles between. The herds of milking Shorthorns are scattered around the earth but centered nowhere. How can the breeders of these cattle gain knowledge of one other? How can they measure the breeding power of the parents and different blood lines? The fairs are almost misleading to the breeder of cattle in combining milk and beef. The milk-giving power cannot be measured by the show ring judge, and he must judge on the quality which he sees; hence, he is tempted to select those with good beef outlines, hoping that he may not do injustice to those with superior milking qualities. Here, breeding valuations to be useful must comprehend more than one quality. They must include the ability to transmit both good beefing and milking qualities together with the vitality to resist tuberculosis, the tendency to live long and be prolific. An owner of a herd of milking Shorthorns or of Red Polled cattle who is isolated will do well to retain the excellence of his herd unless he has unusual facilities to travel and study the herds from among which he must choose his bulls. Most of such herds have been sooner or later seriously injured as general-purpose cattle by the selection of a bull weak in dairy qualities. The herds of these classes of cattle, if they were collected into a few counties, would go forward rapidly to the success which they might merit. And what a blessing it would be to this country fifty years hence if this were now done. Large numbers under similar conditions, where records of prepotency may be kept, compared and used, are necessary in animal breeding. Plans ought to be formulated for the production of a strain of hogs with a very large amount of tender, lean meat, abundant fecundity, strong bones, early maturity, large growth from a given amount of food and with sufficient uniformity of color and form to distinguish the breed. All these intrinsic qualities and the facts as to the animal and form should be recorded for future reference.

He says that in order to adopt this plan there are two difficulties to overcome. One is the use and elimination of a very large number of animals required to find a few foundation parents with the strongest power to produce the strongest breed of hogs. A number of breeders coöperating can best take advantage of large numbers of animals. The other difficulty is the long time which must elapse before hogs are produced from which are eliminated nearly all but the desired qualities, and which are sufficiently uniform to sell as pedigreed hogs for pedigreed breeding and upgrading purposes.

It is plainly evident that organized effort must be brought to bear in some way for the general improvement of stock. State laws may be inaugurated. County coöperative associations may be

organized and inspectors appointed for each particular breed and purpose of breeding, whose duty it is to see that all rules and laws of the association are enforced and to keep a record of performances prepotency, and results obtained from different mating, in short, to specify a complete working pedigree from which logical conclusions can be deduced, and from which laws can be formulated, barring out to a large extent personality or individuality, which is the great obstacle to coöperation. If such a system can be carried out it would be putting it mildly to say that it would be of inestimable value in the future. The investment would undoubtedly be great at first, but the interest would be ten-fold in the future.

"FADS" IN BREEDING.

By Hon. JOHN DRYDEN, *Toronto, Canada.*

A "fad" in connection with operations in breeding very often represents some quality considered essential among breeders because it has become fashionable. Why this is the case would be as difficult to answer as to explain satisfactorily why the ladies of our day insist on wearing a special kind of head-gear, which is not only unpleasant to behold, but is decidedly uncomfortable and difficult to control. In either case, it is sufficient to know that it is in fashion; no inquiry is made as to its utility.

Take for instance the present day shape and turn of the horns of the popular Scotch Ayrshire cow. These horns stand almost straight up from the head, and are certainly not ornamental, but they are *fashionable*. In an ugly bull they may be useful for his own defense, but not the slightest aid to the owner's escape. I am told that when the horn is not naturally of correct form it is trained by the use of pulleys and weights. I am sure no one would be found to declare that this has the slightest utility. Nor can it be said that this form has any special beauty that one could desire it, yet it must be present because it is fashionable—I call that a "fad."

Take, if you will, the extreme covering of the whole face of the Shropshire ewe with wool. It is of no real service, it is difficult to shear, and of little value, and besides is often accompanied with a raw, bad back, yet to-day it is practically invaluable. I call that a "fad."

Then, an imported animal is assumed to possess some charm not found in an animal equally as good but born west of the Atlantic Ocean. It may be no better in form, in breeding, in color, or in constitution, yet the imported animal will be sought after solely because of its birthplace, while the other is entirely neglected. I call that a "fad."

There was at one time a great craze for a red color among Short-horns. It did much damage because it forced out of use desirable