ceive the males late in the fall or winter. To obviate this to some extent the mare should be kept on low diet till sometime in February; then if put in a warm stable or blanketed for both liberally fed and well cleaned they will come in season whenever the weather remains warm for a few days. The duration of pregnancy in the mare is about eleven calender months, and as she conceives with very great certainty, on the ninth day after dropping her foal the time of the birth of the colt may be advanced, on an average, twenty days each year. With a little care the time of breeding may be changed in a few years to suit the conditions of the breeder. Mares in foal are better off for being worked moderately, but they should not be used on very soft ground or in deep mud; neither should they be put to excessive load or at work that requires quick motion.

Pregnant animals of all kinds are liable to be more or less constipated during the latter period of pregnancy, hence, bran mashes, roots and other light laxative foods should be used largely. Timothy hay, especially if over ripe should be fed, if at all, in limited quantities. Constipation and hard, unyielding muscles cause more trouble and loss at parturition than all other deleterious influences combined.

Milk in its natural state is composed largely of water (87 per cent.) so it stands to reason that the mare that gets but dry timothy and is watered at most twice daily cannot raise a good colt. Milk also contains a large proportion of nitrogen, and if the colt is to be properly nourished the dam should receive an abundance of roots, bran, oats and a little oil meal and bright clover hay. If properly fed and taught to eat in its own manger the colt will be ready to wean at three months old. The living colt will not only be the better but the one in utoero also, and the mare will be more certain to breed regularly than if jogged down with a long and continuous nursing. When the dam is at work the foal should never be allowed to follow her, but should remain in a box stall.

Carried off the farm by a $200, 1,900-lb horse:
Nitrogen, 31.92 lbs, at 16 cts., $5.10
Potash, 1.7 lbs, at 5 cts., .85
Phosphoric acid, 22.3 lbs, at 8 cts., 1.78

Total $6.96

By $200 worth of wheat, 1,500 lbs:
Nitrogen, 32.8 lbs at 16 cts., $5.32
Potash, 8.4 lbs at 5 cts., 42
Phosphoric acid, 126.4 at 8 cts., 10.11

Total $67.60

The bran from $200 worth of wheat carries off:
(5,300 lbs. in 16,000 lbs. wheat.)
Nitrogen, 118.7 lbs. at 16 cts., $19.00
Potash, 75.79 lbs. at 5 cts., 3.79
Phos. Acid, 144.69 lbs. at 8 cts., 11.57

Total $34.36

If the bran is returned to the land then $200 worth of wheat would remove but $33.24 of plant food.

Butter, 800 lbs. at 25 cts., value $200, carries off the farm:
Nitrogen 5.68 lbs at 16 cts., .91

Principles of Breeding.
[By J. McClain Smith, Dayton, Ohio.]

It was a prevalent opinion a few years ago, resulting doubtless from its political associations, that all men are created equal; equal, that is, not only in rights, but in natural aptitude and capacity. Of those who combined to organize the Republican party, a very large proportion sincerely believed that if you would take a hundred colored children and a hundred white children, and submit them all to the same training, and afford to all the same opportunities, the two races would arrive at substantially the same goal—that the colored children would make, on an average, as moral and intelligent men and women as the white children. Nothing can be more erroneous or more directly opposed to the uniform experience of mankind. Not only are there broad and marked race characteristics which no training can obliterate; but, even in the same race, there are family traits and personal peculiarities, disposition, aptitudes, capacities, even tricks of manner, which are transmitted from generation to generation with almost equal certainty. To say that the accumulations of the race consist wholly in material things and not also in inherited aptitudes and capacity, is to ignore alike the facts of existence, and the teachings of religion.

Given a child, whose ancestors for many generations have been intelligent, cultivated, moral people, and you may educate him as you please, or neglect him as you please, he will almost certainly turn out an intelligent, upright
man. Many children, in fact, if not a majority, are born with a character and disposition so firmly fixed in its main outlines that no subsequent training can seriously affect it. Some, by their very nature, are constrained to walk in the paths of peace and virtue; others are predestined with equal certainty to go to the bad at their first opportunity.

This was well illustrated by Francis Galton, the author of "Hereditary Genius," in one of his inquiries, undertaken to determine the respective influence of education and inheritance in determining the character and disposition, he came into personal contact, or correspondence, with nearly all the twins of England. Twin children, as everyone knows, are often strikingly alike, not only in appearance, but in character and disposition. On the other hand they are often very unlike in every particular, assuring that, when they were raised together, they would enjoy the same advantages, and be subjected, as nearly as possible, to the same discipline, and the same surroundings, the question was whether this similar education and environment tended perceptibly to modify the original differences. On the other hand, he found many twins, similar at birth, that were reared under very different conditions—one perhaps by the parents, the other by the grand-parents or some other relative. He sought to discover whether the original similarity was perceptibly modified by the subsequent training. This conclusion, after a careful and extended study, was that inherited traits in every case predominate, and that education and surroundings have so little influence in opposition to this, that it may be almost ignored in the final estimate; that where the twins were alike at birth, in character and disposition, they continued alike through all the vicissitudes of life, and that, where they were dissimilar at birth, a similar education and surroundings had no perceptible influence in changing their natural bent.

Some children, it is true, are of such a mixed lineage that they have no decided character. They are born in a state which chemists call a condition of unsalable equilibrium. A slight push this way or that determines their subsequent career. With such, education and environment are all important. But they are so because the breeding is defective. Indeed, you may say the value of the surroundings in modifying character varies inversely in proportion to the strength of the breeding. The stronger the natural bent, which is only another way of saying, the stronger the breeding, the less important the environment or surroundings, and vice versa.

How this comes about we do not, as yet, fully understand. There is little doubt, however, that inherited character and disposition are the same in kind as instinctive habits in the lower animals. The better opinion seems to be, that instincts are nothing more than the accumulated experience of the race which has become thoroughly ingrained in the organization. They are transformed uniformly in all the members of the race or family, and they exist uniformly because the same conditions apply to all, and the law of the survival of the fittest tends rapidly to exterminate those individuals who fall below the average in aptitude. There is every reason to believe, however, that if the conditions of existence should gradually change, so that the present instinctive habits in any species became useless or pernicious, they would be modified to suit the changed conditions. We do know that as they become less important they are less exact and less uniform in different members of the family. As intelligence increases, opportunity is afforded for greater divergence from the common type without serious inconvenience, or, perhaps, with advantage. In the highest animals uniformity ceases, and instinct is limited to a few automatic actions, chiefly in the very young. The accumulated experience is transmitted in capacity to learn rather than ability to do.

This, in some of its aspects, is a harsh and apparently an unjust law. But in it is founded all the power of a skillful breeder, and, I may add, all the rational trust of a moral, intelligent man in the outcome of his offspring. If it were not possible to build up a breed of animals, in which certain desirable traits are transmitted with almost absolute certainty, there would be little encouragement to spend time and thought, and money in their improvement; and if a vicious, ill-conditioned whelp of a man were as likely to get a high-minded, intelligent son as one who himself possessed those characteristics,
FARMERS' INSTITUTES.

half the incentive to well-doing would be taken away.

But whether you approve the law or not, there is no doubt of its existence and of its absolute sway. There is no use kicking against the pricks. It is the part of a wise man to submit to the inevitable. If, in some of its aspects the law is harsh, from another standpoint it is the most glorious and beneficent. Individually we can do little to elevate our nature or extend the range of thought; but if men were bred with half the care we breed our sheep, that little would not be lost, but would become a permanent acquisition of the race. Indeed, on this law of inheritance is founded the only possibility of progress and improvement.

But we are concerned with the law to-day only as it affects the control of our domestic animals, and our influence in moulding them to suit our purpose. There is a common impression, I believe, that the power of a skilful breeder is practically unlimited; that by proper selection he can mould the form as readily as the potter moulds his clay, and realize his ideal more slowly, perhaps, but as surely as the painter or sculptor. This is a mistake. The power of the breeder is limited in reproducing in the offspring what already exists in one or the other of the parents. He can take a head from this, a back and well-sprung rib from another, a soft touch from a third, and, by skilful manipulation, he can combine them all in one individual. But when he has done this—when he has combined in one animal all the good points which, in a state of nature, are scattered through the breed, he has done all that mere breeding can do. It is just as impossible by breeding to produce some new quality, or to increase the development of some quality already existing, as it would be to breathe into a statute the breath of life. Improvement, in the sense of increased development of any desirable trait, is a spontaneous matter—it is nature's response to favorable conditions in the matter of care and food. Breeding proper can only assist indirectly by avoiding combinations which would tend to diminish the quality sought for.

Take the milking quality as an illustration. Suppose we have a breed of cows the best of which yield say ten pounds of butter a week. It is desired to produce a cow which will yield fifteen pounds. Mere breeding, the coupling together of the best for this purpose, other things remaining unchanged, would never accomplish the purpose, or not at least with any certainty, or within the lifetime of any breeder. You might, and in time undoubtedly would, secure a family all the members of which would prove equal to the best of the breed as it formerly existed. That is all you could reasonably expect. The fifteen-pound cow would be about as far from attainment as ever.

The rational way of proceeding in such a case, and the way in which all great improvements have been secured in our domestic animals, is, after selecting the best animals attainable for the purpose, to afford them facility to increase their yield through better care and more abundant food, of better quality. Note those that respond most freely to the change, and discard the others. Keep this up generation after generation, affording at all times the most favorable conditions for growth in the direction desired, and breeding only from those animals which show a tendency to grow in this direction, and, if the goal is not beyond the innate capacity of the breed, you may well hope for success.

I say, if the goal is not beyond the innate capacity of the breed. You cannot make a silk purse out of a sow's ear. You cannot produce a fifteen-pound butter cow out of a breed which, from a defective organization, cannot digest food enough to make it. No matter how thoroughly a breed tends in the direction desired, to make any great results possible, this tendency must be backed by a proper physical organization.

The point I wish to enforce at present, however, is that success in breeding owes half its success in feeding. It is useless to attempt the improvement of our domestic animals by greater care in breeding unless at the same time we improve in every particular. It is folly to spend money for an animal of choice breeding, possessing in an eminent degree the qualities desired, unless we afford its offspring an opportunity to develop those qualities fully. If we aim to winter our calves at a straw stack and allow them to pick a living in summer along the roadside, it is not likely we can improve much on our native
cows. They are just what generations of such treatment has made them and are probably as well adapted to their conditions, and yield as good returns in milk and beef as any breed in existence with this treatment.

You often hear the remark that Mr. A. or B. has some fine stock which yields much milk and butter, or turns out fine beeffes; but that any stock would do as well with the same care and feed. This is a mistake. As I have said, under a system of neglect and of periodical starvation our native scrubs will probably do as well and yield as good returns or lose as little money as any breed. But they do not respond, as better-bred animals would do, to improved keep. They do not inherit the capacity to utilize the abundant ration.

Nature's first care is to preserve life and propagate the species. If the food is not more than sufficient for this, the parts and organs not essential to life or procreation are gradually reduced in size. Large digestive capacity, or a fully developed vascular system, is not necessary to a cow which never has enough to eat, or a full supply of blood. So a broad, level back, and well sprung ribs, while indicative of capacity to lay on flesh of high quality, require rich blood for their proper development. If the blood is lacking, Nature reduces the parts to correspond. And this diminished capacity is transmitted from generation to generation, with an increasing tendency to economy in nutrition.

It is a mistake to suppose that good qualities are more decidedly hereditary than bad, or that a well-bred animal is especially prepotent. Nature's ways are often inscrutable, and occasionally we find what is apparently a useless variation from the normal type propagated with extreme persistence; but, as a rule, qualities which are useful to the animal, and qualities, whether useful or not, which have been transmitted through many generations unchanged, are the most decidedly prepotent. An illustration of this was afforded, many years ago, in the attempt to improve one of the old French breeds of sheep by the use of an English long-wool ram. The French sheep were small and ill-formed, but carried a good fleece. It was thought the English ram would increase the size and improve the quality of the fleece without impairing the wool. Much disappointment was felt when it was found that the lambs showed no trace of their English sire. In seeking an explanation of the marvel it was suggested that the French sheep, though greatly inferior, were, in fact, more strongly bred, in that their qualities, such as they were, had been transmitted through many generations, while the English ram was of a recent improved breed. Assuming this to be the case, it was argued that, if the prepotency of the French sheep could be broken down, by crossing two old but diverse strains, the produce would cross more favorably with the new breed. This was done, and the results fully justified the anticipations.

Leaving out of view, then, the exceptional cases, which are in reality inexplicable, we may say that the prepotency of an animal—the influence it will exert in determining the character of its offspring—depends on the fixity of its type; and the fixity of a type depends on its age—the number of generations it has endured unchanged.

If a red Short-horn cow produced a roan, or white calf, it might cause some disappointment, but would excite no surprise. But it a Devon cow produced a roan calf, scarcely any conceivable testimony would satisfy an intelligent breeder that it was of pure Devon blood. Why? Because the red color is characteristic in one blood and not in the other—not more so than roan or white. But again, we expect, with almost equal assurance, that the produce of a Polled-Angus bull and a native cow, of any color, will be a black calf; and the produce of a Devon bull and a native cow, a red calf. Why? Because in each case the color is a race or family trait in one parent, and not in the other.

This, it seems to me, is the bed-rock in breeding. It is the foundation principle on which we must build. To develop a breed—to combine in one animal all the good points which can be found in the breed—and to develop fully its latent capacities, requires decided genius—a sort of intuitive perception of the combinations which will nick, and give each trait full room for development. But to preserve a breed once firmly fixed, or to breed up a mongrel to a high standard, through the combination of improved blood, requires only care and good common
sense. It is only necessary to remember that full development of the most desirable qualities requires abundant nutrition; and that the parent which is likely to prove most prepotent is the one whose type is most firmly fixed. This is the advantage, and the only advantage, so far as breeding goes, in a recorded pedigree. It enables us to trace the lineage, and to know that the qualities we admire in the animal before us are race characteristics, or at least, family traits, and are, therefore, certain to prove strongly preponent in a union with an animal of mixed blood. For this reason also a pure-bred animal—and by pure-bred I mean an animal of unixed blood of any fixed type—is a more desirable sire than a much better animal, individually, of mixed breeding, and a grade bull—the produce of a full-blood of any breed from a cow of mixed lineage—is likely to prove a better sire than a cross-bred animal—the produce of two pure bloods of different breeds—unless the two breeds closely resemble each other in desirable qualities. Our fat-stock shows have pretty clearly shown that, for every purpose except breeding, a three-quarters or seven-eights grade of any breed is as good an animal as a full-blood; and they are often practically better, because they are better adapted to their surroundings, and a cross-bred animal is often decidedly superior, in size, form and feeding qualities, to either of the pure breeds from which it springs. But for breeding purposes, except to couple with a full-blood, both should be rejected. For any of the ordinary purposes for which stock is kept—milk or beef in cattle, work in horses—the one-eighth or one-quarter of mixed blood is practically lost and obliterated by the three-quarters or seven-eighths of pure blood. But in breeding the case is reversed, and the slight trace of mixed blood reduces the prepotency of the animal much more than its proper proportion. A three-quarter blood bull of any breed is not usually one-half so prepotent a sire as a much commoner looking full-blood, and a cross-bred animal, for grading up inferior stock, is, in reality, little better than a scrub. The explanation in both cases is the same. There is a constant tendency on the part of all animals to breed back to the original type, which, in the case of all improved breeds, is a much inferior animal. In the case of well-bred animals this tendency is checked and controlled by the long series of generations through which the improved qualities have descended. But where this series is broken by the introduction of foreign blood, or blood possessing different characteristics, the tendency to revert is greatly augmented.

In breeding, therefore, each animal stands, not as an isolated individual, but as the representative of a long line of ancestors, each exerting some influence in generation. If these ancestors are all substantially alike in the qualities sought to be reproduced, or, better still, if the qualities show an increasing development from generation to generation, the animal will almost certainly prove very prepotent in transmitting these qualities. On the other hand, if the ancestry is a mixed lot, good, bad and indifferent—of diverse and inconsistent attributes—no matter how perfect the animal itself may be, it is, for breeding purposes, the veriest scrub.

A common illustration of this principle is found in the human family, where one parent comes of a black-eyed race, and the other is of mixed lineage—in this respect ancestors whose eyes were black, or brown, or blue, or gray indiscriminately—the children will almost certainly, at least ninety-nine times in a hundred, follow the parent of unmixed lineage; and what is true of this obvious feature is true of the entire individual; every quality of body and mind is just as hereditary, and controlled by just the same laws, as the color of the eyes or hair.

In breeding, then, the first requisite is to know precisely what you want—in cattle, whether milk or butter or beef; in horses, speed or style or strength—and to know the particular form and qualities which go along with that you seek. These select as your foundation stock, or, if it is proposed to breed up from native cows, or common mares, select as the head of your herd an animal in which the qualities you seek are race characteristics, or at least, strong family traits. Afford the offspring every opportunity for full development, and success is absolutely certain, or at least, as certain as that the combined action of certain parts in a machine will produce determinate results.

It ought to be as easy to predict, with accuracy, the quantity and quality of milk an unborn calf will yield, when it
becomes a cow, as to know the color it
will have and the general form it will
attain. That it is not possible to do so,
is an evidence that our stock, even the
best, is not bred up to its full capacity
for milk, nor so well bred in this respect
as for the more obvious traits of form,
color and general appearance.

Breed, then, so that you will be able
to predict the result; above all, do not
be misled by mere individual excel-
ence. Individual excellence is, of
course, the end to be attained. But,
let your breeding be such that you can
repeat it at will, and not as a mere
chance. In this view, remember that
an animal represents its entire ancestry
rolled or united into one. If that an-
cestry is of uniform, or increasing ex-
cellence in certain definite lines, the
breeding qualities of the animal will,
almost certainly, be true and satisfac-
tory. If the ancestry is of heteroge-
neous and diverse character, no matter
how pleasing the individual itself may
be, it is, for breeding purposes, a scrub,
and it will prove in the end a delusion
and a snare.

What Farming Would Confer if Right-
ly Followed.

[By Prof. W. I. Chamberlain, Iowa Agricul-
tural College, Ames.]

The condition, "if rightly followed,"
at once raises the question, "when and
how is farming rightly followed?" "How
should we farm?" "What general max-
ims and principles must we follow?"
These questions I must answer briefly
further on. Meanwhile I assert my firm
belief that on the whole there is no
better business known to man, at least
in the United States, than farming if
rightly followed, and that if rightly be-
gun and followed it will confer health,
comfort, increased intelligence, refine-
ment, aesthetic enjoyment, independ-
ence, individuality, increased fertility,
competence, permanence for family, own-
ership of land, and hence a place among
the future nobility of the land. These
points I shall notice one by one pre-
ently.

But to secure these great and most
desirable blessings, farming must be, as
our text says "rightly followed," and by
the right kind of a man. Good farming
implies a good farmer. He should have
health, intelligence and some capital.
Too much have been expected of farm-
ing. All other kinds of business require
some capital, or that you should work
for some one that has capital; require
intelligence, or that you work for some
one that has intelligence; health or that
you work for less than full pay. But
farming seems to have been considered
a kind of Botany Bay where all could
be sent who were not fit for anything
else. You know the saying "Any fool
can be a farmer." You know that you
yourself sometimes pick out your
brightest boy for college life, profes-
sional life or business life, and keep the
duller, steadier, plodding one for a
farmer. You know the story of the
"coon dog." The would-be seller of the
dog recommended him most highly in
that capacity. How he knew he was good
on coons was thus: "The Lord (he
said) never made anything in vain, and
as this dog wasn't good for any other
earthly thing he must be a good coon-
dog." Now I am bound to say that
farming has stood this severe test as no
other occupation could. In it sick men
have found health, poor men have found
rapte and undedicated men have
been forced to read, think, study and
become intelligent students. It is one
of the chief glories of farming that it
has been so. Some twenty-two years
ago, two years confinement and severe
application in teaching had made of your
present speaker a kind of white faced
walking skeleton, with a big congh and
a small appetite. The cough was bigger
than the man. The cough was the kite,
and the man was the tail, and it was
only a slender cord that anchored the
kite and tail to earth, and it seemed
only a question of time when the cord
would break letting both fall. People
gave me six months to die in. Well, I
went to farming, thinking I would turn
the turf over once at least before they
put me under it. A year or two later
I had regained health, and while visiting
in a town ten miles away, an old gentle-
man asked me, "are you a relative of the
young Mr. Chamberlain of Hudson,
the teacher, who died there lately of
quick consumption?" "Yes, sir," said
I, "I'm the fellow himself." "Well,
well," said the old gentleman, "I should
call you a reasonably jolly, lively red-
facee sort of a corpse, but I heard you
were dead." Yes, farming often confers
health where it is wanting. I have been
there and tried it. So also has it often
given education and always increased it
if rightly followed. It has given com-
petence from poverty, often, on new