Genetic Improvement

The Wrap Up

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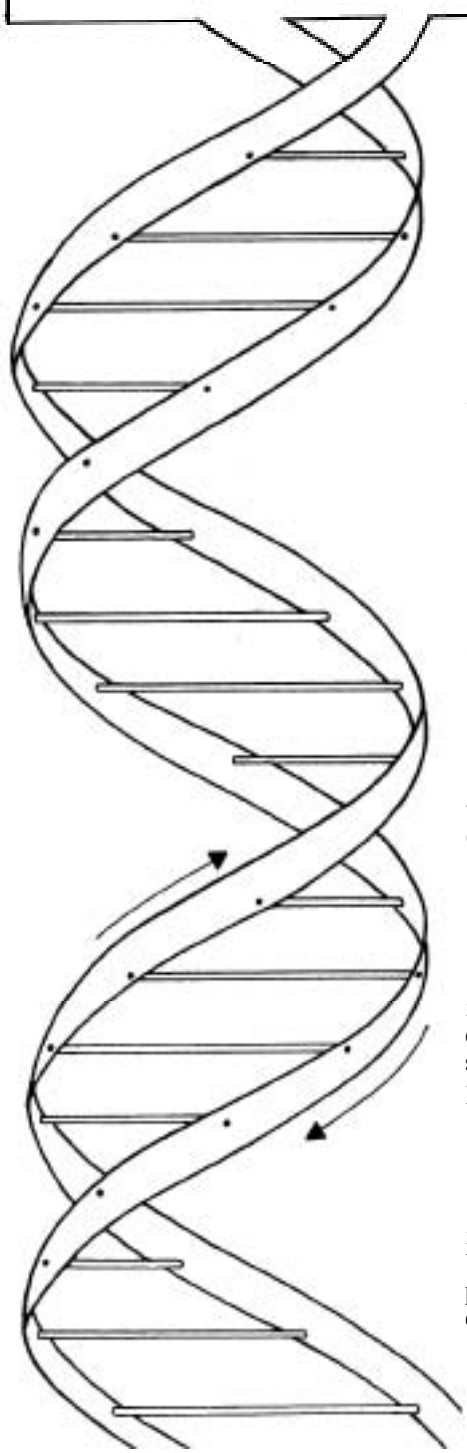
Editor's note-If you've not tuned in earlier do so now-then refer to the five preceding articles in this series dealing with genetic improvement. In them authors Wilkes and Dr. Turner have given you a clear, concise, easy-to-understand look at a complicated subject-genetic improvement. And although complex, it's a subject with which you, as breeders of seed stock, need to be familiar. Your application of genetic principles could mean the difference between your herd's success or failure as an important source of seed stock. And as an important source of money. So read on. You can't afford not to.



The First Five

-a recap of the five preceding articles.

Genetic Improvement to Insure the Future of Purebred Cattle
October 198 1, ANGUS JOURNAL

A lion's share of our market cattle in this country is crossbred. Does it make sense to keep purebreds to produce those crossbreds or should we do away with purebreds and use crossbred breeding cattle to produce crossbred market animals?

The preferred answer, at least to purebred breeders, is obvious. But to survive, purebred breeders must be able to satisfy the needs of the commercial market. Genuine genetic improvement may be the surest and safest way to do so, and that improvement hinges on an understanding of basic genetics.

Genetic lmprovement-Trait Evaluation and Selection
November 1981, ANGUS JOURNAL

To improve a breed or herd or an individual offspring, the first thing to be considered must be the component parts of net worth or value. The successful purebred breeder must know how to evaluate and select for those components, those traits that are responsible for his product's value.

Genetic Improvement-Aids to Selection
December 198 1, ANGUS JOURNAL

In breeding beef cattle, choosing traits for which to select is only part of the battle. Once the choice or choices have been made, a breeder must have some way to accurately establish each animai's breeding value for those desired traits. Here authors Wilkes and Dr. Turner discuss methods that can help take the guesswork out of that process.

Genetic Improvement-Mating Systems
January 1982, ANGUS JOURNAL

To date this series had dealt primarily with selection. And although selection is obviously important in genetic improvement, the mating system used by a cattle breeder also plays a critical role. With that in mind the authors discuss both random mating and the non-random systems of inbreeding, linebreeding and outbreeding as well as mating on the basis of phenotype.

Genetic Improvement- Factors Affecting its Rates
February 1982, ANGUS JOURNAL

This ties together much of the information presented in the four preceding articles. Because it is technical, it requires a little extra effort on the part of the reader. The rewards, however, could be substantial. The payoff comes when breeders understand the theories behind genetic improvement, put those theories to practice in their herds, then reap the benefits through subsequent calf crops.

As we began writing this, the last article in the series, we were reminded of the famous who-done-it novel wherein the last word in the last chapter was the key to the entire book. Without that last word the book was meaningless-and for those readers who cheated and read the last page first, the rest of the book wouldn't have been worth reading. Unfortunately, these authors cannot promise you that kind of suspense. The principles of quantitative genetics simply cannot be condensed into one word.

We have tried to condense the subject into six short articles although we have been aware all along that our treatment of the various topics was far from complete. We have no doubt that some readers would disagree with our observations-that's okay. We were aware from the beginning that we would have to skip the underlying theory and center our discussions on the practical aspects of genetics. We are convinced, however, that if a solid understanding of the underlying theory could have been established beforehand, the generalizations which we presented would have flowed naturally from it. So, rather than dealing with the theoretical foundations which are mathematically complex and difficult to present, we attempted to go straight to the heart of the matter, realizing all along that some readers would not be convinced. For those who aren't convinced, and even for those who are, we challenge you to investigate the theoretical foundations.

Because we cannot see the genes, we cannot detect a carrier without a progeny test or at least a blood test. We are left with the illusion that these carriers are secretly infiltrating our *gene pool and that someday they will mount their offensive and wipe out the population. Very simply stated, this is not true!*

Thus far in this series we have dealt exclusively with quantitative inheritance. That is, we have dealt with traits that are measured in terms of quantity (pounds, inches, etc.) and are affected by many pairs of genes as well as by environment. We have tried to explain how improvement in such traits can be accomplished most efficiently. This is often a very frustrating area of study for students who find it difficult to modify their notions of the more simplified approach to genetics which they receive in their introductory genetics courses. For the cattle breeder it is also frustrating because it is impossible to know by measuring the phenotype, exactly what the genotype is. Because of the large number of genes which affect these traits, not to mention the environment, the simple genetic principles which we all learn in our basic biology class become inadequate. To account for this, we apply statistical procedures and before long we have a whole new subject, deeply complex, which we call statistical genetics. Many people who don't understand it prefer to ignore it. Others, realizing it's importance, prefer to become more aware of the principles (if you're reading this article, you obviously fall into the latter category-good for you). We cannot overemphasize the importance of these principles. If you have been improving your cattle genetically, you have been applying them whether you wish to admit it or not.

The future will belong to the efficient and the efficient purebred cattle producers will be those who have outlined a program of genetic improvement based on economically important traits and have designed this program so that the records kept (which must be accurate) are not riddled with bias from mating systems or other management practices that render them less than ideal.

QUALITATIVE TRAITS
-an entirely different subject!

Whether it's good or bad, when most of us think of genetics we are thinking of the genetics of qualitative traits. These traits include such things as black versus red, horned versus polled, mulefoot versus normal, marblebone versus normal and so on. Why is it that when we think of an animal as being "genetically defective" we are thinking of an animal affected by dwarfism or mulefoot or marblebone and not a bull with a yearling weight of 500 lb.? Isn't a 500 lb. yearling bull just as "defective" as a mulefoot carrier, or a dwarf? While most breeders would agree that he is, we nevertheless spend more time worrying about the categorical-type of defects and not enough time worrying about this other very important class of defects. The reasons for this seem pretty clear. Namely, we feel confident that we could detect an animal which is defective in growth traits and subsequently cull it. Having done this, we feel our problem is solved. On the other hand, if an animal is a carrier of some dread disorder, we fear that we may not realize that it is indeed defective. If we then select it to become a parent, we live with the fear that we will pollute the entire population. For some reason, most breeders believe that such defects tend to spread-to become more common. Because we cannot see the genes, we cannot detect a carrier without a progeny test or at least a blood test. We are left with the illusion that these carriers are secretly infiltrating our gene pool and that someday they will mount their offensive and wipe out the population. Very simply stated, this is not true!

If we take the case of a defect being controlled by only one pair of genes, as is commonly the case, there is no reason to believe that the "bad" gene will spread any more than the "good" gene will spread. As long as the carriers have not been endowed with exceptional merit in other traits more so than "clean" cattle, the frequency of the "bad" gene will remain constant. In fact, the frequency will probably decrease a bit because we obviously cull all affected individuals and usually cull their heterozygous parents as well.

The widespread use of A.I. does not alter this result. To point this out, let's take an example where the frequency of carriers of some dread disorder is 2%. Now we have no reason to think that the frequency of carriers in the subpopulation of A.I. bulls is any higher than 2%. Given this, it seems reasonable that the gene frequency would remain stable. The concern among cattle breeders is that, by chance, this group of carrier bulls will sire more than 2% of the A.I. sired calves. This is a possibility. As such, it is a risk we have chosen to take. The question you must answer for yourself is this: Is it any less risk to allow superior animals to stand idly by while they are progeny tested for these rare disorders? Your colleagues who attended the meeting at the North American last fall addressed this very question and concluded that the latter risk is more dangerous. As geneticists, we tend to agree. You may not agree. If so, it is certainly your prerogative to use only those bulls which have been proven free from these disorders.

We have no doubt that certain Mendelian disorders (named after Gregor Mendel who first discovered the true nature of inheritance) will continue to receive a lot of ink in this magazine and many others. There's nothing wrong with this as long as we base our thinking on scientific information rather than emotion and heresay.

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It has been said that the guillotine is a sure cure for dandruff, but then, so is dandruff shampoo. The point is, we should put these defects in the proper perspective. A little "shampoo" is certainly in order, but the "guillotine" is quite unnecessary.

As we come to the close of this series our thoughts should turn to the future. You've read the articles, agreed with some parts, disagreed with others and we hope that, in general, you have found the material enlightening.

So what? Knowledge is a potentially great asset but the world is full of intelligent bums. What any organization needs are people with knowledge and the desire to put that know-how to work.

As we've stated before, this hasn't been a how-to series and we didn't intend it that way. Our aim was to cover basic quantitative genetics principles in hope that it would help build a base for improvement in your herd in the genetics area. Most breeders have sound health, nutrition, physiology and management programs, but few have seriously addressed their goals or direction for genetic improvement, so you are not alone. But if you don't start, you will have to compete with those who have.

The future will belong to the efficient and the efficient purebred cattle producers will be those who have outlined a program of genetic improvement based on economically important traits and have designed this program so that the records kept (which must be accurate) are not riddled with bias from mating systems or other management practices that render them less than ideal. Now you might respond that you are making selections and trying to improve your cattle, but hasn't almost every breeder of purebred livestock since the beginning had improvement as one of his goals? Certainly! So the question then becomes one of time. Following the principles outlined in the series should not only aid genetic improvement in your herd but should reduce the time it will take to realize such a change.

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We feel that theprinciples outlined in the previous articles can be understood and used by anyone who can also understand how to complete the various forms for the association or other routine tasks of purebred cattle management.

"The longest journey begins with a single step." You may find yourself reading ads in this very magazine from breeders who have been involved in performance testing programs for many years and thinking even with great conviction there is no way this "gap" could be closed even if you started tomorrow running as hard and fast for as long as you could. But fortunately this is not the case. There are two principles to recall here. One, performance testing cattle doesn't make them better, it only makes you more informed. Second, as a herd progresses the amount of useful genetic variation becomes less and the going gets tougher.

It's much like a tractor in a pulling contest. The closer the driver gets to the goal, the tougher the pulling becomes. If you're still back at the starting line you can reach and potentially pass your competitors if your tractor is finely tuned and your driving skills are superior. So don't let the fact that some breeders have been involved in a genetic improvement program longer than you be a deterrent to what you know is right and possible.

The principles are simple. The only hard thing is to keep them simple. Some folks would have us believe that there is some kind of magic or hocus pocus involved with genetics. We feel that the principles outlined in the previous articles can beunderstood and used by anyone who can also understand how to complete the' various forms for the association or other routine tasks of purebred cattle management. Our advice would be to stick to scientific principles that have been proven over time and have paid off time and time again.

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Successful people never quench their thirst for knowledge. We believe nothing is more critical to improvement of a herd or a breed than breeders who are knowledgable of quantitative genetics principles and how to apply them. It has been said that anyone who thinks they understand what's going on is simply not totally informed. The more you learn the more questions you should have which in turn is the basis for additional knowledge . . . and so it goes. In the hopes that we may have whetted your appetite to delve a little deeper in this area we are suggesting the following references for your further study. This list is by no means complete but represents what these authors have found convenient, helpful, easily read and well done. You may have other sources. The important thing is to move forward.

BEEF CATTLE BREEDING, Agriculture Information Bulletin 286, USDA, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 001-000-03744-7. *ANIMAL BREEDING PLANS,* Jay L. Lush, Iowa State University Press, Ames, Iowa. *BREEDING AND IMPROVEMENT OF FARM ANIMALS,* Warwich & Legates, McGraw-Hill Book Co., N.Y. GENETICS *OF LIVESTOCK IMPROVMENT,* John F. Lasley, Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632.

For those loyal readers who have been patiently awaiting that final word which brings forth the solution to the riddle, will you be disappointed if we choose two words to conclude?

Get Started! A