Stalking the great, elusive breeding program

or: "Science, art, or luck?" and wherein the reader will experience the dangers of half-sib matings, purebred breeders hunting commercial bulls, and "the look of eagles." The first of a three-part series.

"The breeders of the time of Bakewell suspected him of possessing and concealing special principles of breeding. It is often believed today that successful breeders have some mysterious method of which others are ignorant. Instead, the principles of the successful breeder have been exceedingly simple. . . . The difficulty is not so much in knowing the principles as in applying them." S. Wright (1920)

by Dr. C.C. "Chuck" Chamberlain
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The science of genetics is a distinct area of research and study in which the author was not trained and in which he claims no specific expertise. On the other hand he has listened to, talked with and at times argued with those trained as geneticists.

At the same time he has watched with more than passing interest some of the great artists in the field of animal breeding. These were men and women with an uncanny gift for looking at prospective parents and selecting the two they thought were compatible to produce superior offspring. More often than not they had little or no formal training in the field of genetics, but they had an uncanny livestock sense. Almost always they readily admitted to some luck along the way.

There have been numerous articles in livestock publications in recent years concerning genetics and animal breeding programs including those in the *Angus Journal*. There are several basic principles that have to be understood and accepted.

The first of these is the independent and random segregation of genes, and the equally independent and random union of any one sperm cell with an ova or egg cell. With the present advances in the identification of hereditary units (DNA and genes) and the development of gene splicing, we may in the future be able to "tailor make" genes for specific traits and not have to depend on the "independent and random selection" theories. However, that is a future development.

Another factor geneticists depend on is the "biological distribution curve" or the so called "bell shaped curve" and the law of averages. For example, assume a group of 100 animals were placed in the same pen and all had equal access to the same feed. The pen has an average daily gain of three lb. per day, but in that pen there were an animal or two who gained as little as one lb. per day and an animal or two who gained as much as five lb. per day. If you plotted the gains of all 100 animals the range would be from one to five lb. per day but with most of the animals gathered around three lb. per day. Now if this had been a pen of bulls and we were selecting for ADG in the feedlot as a single selection trait, we might select as sires only those animals who had an ADG of 4.5 lb. per day or better when we used these bulls as sires. We might increase ADG of their offspring in the feedlot, but it might come at the expense of other valuable traits such as mothering ability, marbling scores, and adequate finish at desirable market weights if these are not related to ADG.

On the other hand, if there's a relationship between two characteristics —for example, milk production of the dam and weaning weight of the calf— we might get improvement in milk production of a bull's daughters if we selected him on the basis of his weaning weight assuming the bull calf was not creep fed. Thus, selection for any single trait may or may not have an effect on other desirable or unde-

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Editor's note: Teacher, feeder, butcher, breeder might summarize the career of Dr. C.C. "Chuck" Chamberlain. Only a 31-year devotion to the U.S. Air Force and its active reserve program is absent from the couplet above.

He learned the cutting trade in a meat market "on the corner" then went on to cut for a national chain while attending graduate school.

While pursuing his master of science degree at the University of Michigan, he assisted with some of the first work focusing on the effect of plastic wrap on meat color. He earned his MS in 1948 in animal nutrition. The following year he joined the staff of the University of Tennessee retiring as Professor Emeritus in 1982. His PhD. in animal nutrition was conferred by Iowa State University in 1959.

Dr. Chamberlain taught courses in feeds and feeding, animal nutrition, breeds, and production management. He was awarded the 1971 Outstanding Teacher Award, College of Agriculture, by Gamma Sigma Delta.

The Chamberlain family continues a 30-year tradition with Angus and maintains a small herd presently. Two sons enjoyed show steer careers with both overall champions and breed champions to their credit plus the added distinction of achieving an 80 percent Choice grade, Yield Grade average of 3 on their entries. The Chamberlain herd today continues as a family enterprise.

Dr. "Chuck" describes himself as an advocate of the "pick them when they are ripe" concept as opposed to feeding for a stipulated period of time or to a definite, pre-determined weight.

"This meant selling heifers when they had .3 to .4 inch backfat over a 60-day period. By following this approach, 70 percent of the Angus heifers tested graded Choice with a Yield Grade of 3, fed with only 500-600 pounds of concentrate during 120 days of feeding corn silage," he says of the program.

His research emphasized economical feed efficiency to reduce production costs and dealt with high forage, low grain feeding regimes.

Below is the first of three articles written both as an examination of breeding philosophies he's observed and an analysis of his own selection decisions bearing on the Chamberlain Angus herd.

sirable traits.

The AHIR program is based on sound genetic principles, but it does not predict the results of a specific mating. Let's say we are interested in maternal breeding value and select a proven sire with a MBV of 108, with an estimated accuracy of .98 based on over 500 daughters. However, if we checked the values of each of those 500 daughters we might find one or two with MBV of 95 and one or two with MBV of 120.

Now what happens if we mate him to only two or three cows in our herd? We might get all bulls, but let's assume we get one or two daughters. They could end up with MBVs anywhere from the low of 95 to the high of 120. On the other hand, if we bred enough cows to end up with 25 daughters of the bull we would expect them as a group to show definite improvement over their dams and the average MBV of the 25 to be close to the 108 value of the sire. Let's not belabor the science of genetics further but proceed to art of breeding.

To paraphrase Alvin Sanders, " . . . there is no greater art than that involved in successfully mating two animals, nor a greater artist than the successful animal breeder."

Why do some breeders consistently come up with superior animals while others with similar resources and access to the same sires only occasionally come up with the superior animal?

Ask why a di Vinci painting is consistently worth six or seven figures while that of an average artist may be worth only a few hundred at best. It's in the skill of the artist.

A few years ago the author stood with a prominent breeder looking at a heifer just made junior champion. The breeder also had a champion bull in his show string. I commented that he would probably mate the two. To my surprise he said no, that he intended to mate the heifer to a bull in his show string that had stood third in his class. When I asked why, he said it was a feeling that had developed since watching both as calves and as they came to puberty, that the two complemented each other and "belonged together."

He went on to say that he expected the third place bull to "out breed" the champion and would give him an equal chance in his herd. Two years later I watched and read the record of

Just what is a breeding program, anyway?

A major problem facing the beef cattle industry is to sort out the most useful cattle and place them into effectively designed genetic programs, says Dr. Marvin Koger, professor of animal science at the University of Florida and one of the industry's most respected animal geneticists.

Fellow animal scientists Richard Willham and Bret K. Middleton describe a breeding program as a complete system of management designed to bring about genetic change in a group of livestock.

"The design and conduct of a creative program involves developing a complete management system and making it work in a practical situation."—putting principles into practice, then.

If it was a static situation, how much easier the process would be. But as Drs. Willham and Middleton point out, one must "go with the flow" making decisions before all the facts are crystal-clear, before the deeds and decisions have borne fruition, and trying to plan ahead while adjusting to an ever-changing set of resources and environment. Consider this analysis by Willham and Middleton:

> "The form of most breeding programs is cyclic, with one round of genetic change being layered on the previous round. The cycle involves the production of a set of offspring, their evaluation, and the selection of parents to produce the next offspring set. The order in beef systems for any one year is the calving of a set, the yearling evaluation of the previous set, the selection of the next parents, the breeding of these selected individuals for the next set, and the weaning evaluation of the current set.
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> "This cycle is repeated yearly over time. Genetic change in the subpopulation is the cumulative differences between the adjacent set of calves. This assumes no environmental fluctuations where other methods of evaluating genetic change must be used."

Some might conclude: "Well, you can be in a wreck before you know it."

Stockmen can select parents for traits which contribute to increased profit or they may select for traits that provide little monetary returns. Some selection might be directed to lowering costs; selection for polled to eliminate the expense or loss from dehorning is an obvious example.

But the nettlesome concern from most seed stock producers continues to involve the overall dimensions of their goals . . . directions . . . plans down the road. Dr. Chamberlain in the parent piece suggests careful structuring of short-, medium-, and long-term goals, striving for harmony and complementation. Here's how Dr. David Kirkpatrick, assistant professor of the University of Tennessee, states the challenge:

> "In order for a beef producer to make genetic improvement in his herd with respect to economically important traits he must: 1) analyze the performance of the present herd in order to provide a benchmark for those traits, 2) set a goal and develop a definite breeding plan to achieve that goal."

Willham and Middleton would substitute "direction" for "goal" contending, "the word 'direction' is used rather than 'goal' since 'goal' implies a fixed object of reference. Really, a breeder is making directional change in the mean performance of a biological population in time and space. There is no fixed object at the end; there is no end in adaption of livestock to systems of production that benefit man."

Which brings us to the concept of "system."

Dr. T.C. Cartwright presented some insight to this approach, one of the newer industry catch-phrases, during the Beef Improvement Federation Workshop, November, 1984, at the Winrock International Center, Morrilton, Ar.

Beef cattle production systems, says Dr. Cartwright, involve plant production and harvesting synchronized with animal production and harvesting. This dual nature of beef production is made even more complex by the fact that generations span years and beef production is segmented into phases.

The theory has developed somewhat parallel to the development of com-

puters which are necessary for most systems applications, Cartwright suggests.

"System" refers to a set of interacting bodies under the influence of related forces. It's broadly inclusive but bounded by definite limits. Systems analysis may be defined as the process of examining an activity by mathematical means in order to define its goals or purposes and to discover operations and procedures for accomplishing them more efficiently. The purpose of all this effort should be to examine breeding procedures that will lead to producing beef cattle more efficiently or profitably.

Cartwright lists as "primary" those elements of production that have a predominate effect on the overall outcome and also exert a pervasive influence on other correlated elements. He limits these to size and age, maturing rate and size, and milk production.

"Ancillary" elements are related more closely to structural and physiological soundness and exert a more confined effect on the primary elements. However, they may not be secondary in selection importance, necessarily, as in the polledness trait.

Cartwright points out traits which contribute positively to the reproductive phase of cow production are often not the same as, and may be antagonistic with, those traits that contribute to growing and finishing steers. There are interactions or "trade offs," a well-known fact of a breeder's life.

Few agricultural commodities are produced under a wider array of conditions than beef cattle, especially the cow-calf phase. Contrast its nature with dairy production and the Holstein breed, specifically.

Tremendous strides in genetic improvement in milk yield has been possible because of the Holstein's wide distribution, large numbers, similar production conditions, good records, extensive A.I., and a well-organized sire testing and data analysis system by both producers, the breed association, and A.I. companies.

Environment plays, in Cartwright's view, a determining and critical role as systems analysis is applied to a beef herd and its dimensions. The result? A herd highly tailored to the resources surrounding it.

Once the herd is on track and close to its best or optimum in size, maturing rate, and milk production, Cartwright suggests the producer can then begin shifting attention to secondary traits such as easy keeping or low maintenance.

Solving or at least blunting the nutritional demands of a cow-calf operation requires coping with the seasonal nature of the feed supply. Changeable weather, markets, and nutrition are the producer's greatest challenge to his overall strategy. Options to cope with these facts of life generally means reducing risks, in Cartwright's view.

The picture becomes more fuzzy with economic factors. A beef cattle operation is not necessarily a commercial enterprise separated from other interests. Some herds and enterprises are held together by tax considerations, land speculation, or personal satisfactions. These economic bases determine and condition the decisions and selection practices.

Some conclusions on the systems approach:

- There is an optimum set of traits that best mesh with each set of production conditions—fitting cattle to the environment.
- These traits may also mesh with one another to form a larger optimal set—selection for yearling weights improving weaning weight averages.
- Increasing efficiency of production involves increasing herd gross revenue or decreasing herd input (costs) or both.
- Selecting for optimal levels of primary production elements tends to improve herd revenue while selection for secondary traits such as soundness tends to decrease inputs—the outlyers versus the easy-keepers.
- The intermediate values for primary elements of production tend to be optimal but vary for different production conditions. For example, when nutritional quality and availability improve, the optimal values of primary production elements increases—better feed, then a higher level of maintenance. Nature tends to penalize extremes.
- Moving genetic potential up or down will affect herd production which in turn counterbalances net herd productivity both biologically and economically, as in the Holstein example. Expressing its genetic potential requires new nutritional or financial efforts to keep up.

the resultant heifer from the mating of the junior champion female and the third place bull. She became a champion or reserve calf champion at every show where she was shown.

What did that breeder see in the third place bull that no one else saw? He couldn't explain it, but he saw *something* and the third place bull became a featured herd sire in his sales. A year or so later, I sat beside that same breeder at a consignment sale. When one heifer came in the ring he suddenly showed interest watching her closely and finally started bidding and bought the heifer which sold, price-wise, about a third way down the sale.

When I asked him why he bought that particular heifer, he simply said, "she will go with last year's champion." Her first two calves by the champion produced a class-winning female and a reserve calf champion bull. In the ensuing years I spent more than a few hours with him going through his herd as he talked about projected matings. When pressed for reasons, he occasionally would mention pedigrees or certain close-up individuals in the pedigree. On other occasions, he would talk about breeding conformation strength to strength but just as often about breeding strength to weakness. But more often than not a phrase came out: "they simply belong together." The eye of this artist wasn't infallible as he readily admitted, but he saw something there often enough to stay at or near the top for nearly two decades until health finally forced him out of the business.

Let me cite another example of the combination of the science, art and luck of a breeding establishment. At the time I stopped there it had already enjoyed over two decades of being at or near the top.

The farm manager and I looked at the featured young sire who had been a popular show champion, had already proven his siring ability on his first two crops of calves and was the result of a half-sib mating. The farm manager related how the three factors had blended to produce the young bull.

His sire had been getting some age on him—it was before the advent of A.I. He had consistently sired good females as had the grandsire, but neither had consistently sired good bulls. The farm had nearly 100 half sisters of the "old bull" and the pros and cons

Continued on Page 107

Continued from Page 104

of making some half-sib matings had been discussed by farm personnel because they knew enough genetics to know the dangers as well as the possible advantages. The owner, the farm manager and the herdsman all had the "gut feeling" there was an outstanding herd bull in the old bull so they hand-bred the old bull to the nearly hundred half sisters.

The three men had each listed 20 of the females they expected to produce the "young herd bull." Ten females were on all three lists and five more on two lists. The science of genetics came into play in using the half-sib matings and betting on the law of averages.

The art came in on the lists of females. The luck was another story. The dam of the young bull wasn't on any of the three lists of females to produce the herd bull. They had expected two "purebred herd bulls" and ten commercial bulls and 20-25 top quality females out of the half-sib matings.

They got one top flight show and breeding bull in the young sire, plus there were nine commercial bulls and 30 females they kept. Of the nine commercial bulls, five were later "hunted down" by purebred breeders because of their record in siring show steers. These were taken back into purebred herds. The science of genetics of concentrating gene pools by half-sib matings proved itself in these five bulls where the artistry of phenotypic selection had failed. Luck included the dam of the "young bull" in the mating list.

On that inspection trip, the farm manager finally took me to a barn on another farm to look at another bull. He was one of the first sons of the young sire. He was a little different from the then accepted show ring cattle. However, there was a "presence" about him and a look to him that Ken Litton used to call the "look of eagles." The farm manager indicated that he would not be shown because he "didn't fit" the accepted standards of the day. However, he and the herdsman wanted to use him, but the owner did not.

There had been several arguments about the bull. Again luck intervened. It had been an exceptional feed year. They had originally planned to cull 50 females but because of the abundance of feed the owner had reluctantly agreed to allow them to use the

bull on the 50 "cull cows." Two years later 11 of 14 calves shown by that establishment over the show season were the result of mating that bull to the 50 "cull cows." The "artistic sense" of the farm manager and herdsman had prevailed over the realism of "show type."

Almost a year ago my sons and I were discussing which A.I. sires to use. A 13-year-old cow was the focal point of the discussion. One son finally asked, "If you could determine the sex of the calf what would you choose?" The answer, "a heifer." Why? Because the 13-year-old cow over the years had exhibited strong maternal characteristics: a calf every 12 months, calving ease, weaning weights consistently in the top 25 percent, and a persistency of lactation for close to 10 months.

This led to further discussions. We wanted to make some expansion in cow numbers, so we decided to concentrate on MBV. We intend to keep most of the females for the next two years and this would give us a group of young females that should have above average maternal values. We finally listed the following criteria in potentially selecting sires to use A.I. and went to the 1984 Angus Sire Evaluation Report.

1. MBV of 105 with 85 percent plus accuracy on over 100 daughters. This meant we would go with older, proven sires and eliminate the younger sires.
2. Minimum weaning and yearling weight increases of +20 and +30 lb. respectively with 90 percent plus accuracy.
3. We wanted at least one potential A.I. sire with birth weights of 2.5+ or less with 90 percent accuracy so he could be used on heifers.
4. Sires who had one or more sons in one of the A.I. herd bull studs and whose sons were accepted by both commercial and purebred breeders.
5. Sires whose daughters we had seen that fit into the 1,000-1,300 lb. range as mature cows with adequate muscling and body capacity.

With these criteria and because of the small size of our herd, we finally selected three bulls, all of which happened to have different bloodlines. Two of these produced increases in birth weight over six lb., but also with considerably larger increases in weaning and yearling weights. The third had the lower birth weight but also lower weaning and yearling weights. Unfortunately, there was no carcass data available on any of the three selected sires in the 1984 Sire Evaluation Report.

Because both sons had shown steers extensively in 4-H and there was a carcass show following the "on foot" show, we were all concerned with carcass values. We finally found a sire with very acceptable values on carcass cutability, USDA grade and retail yield, well above the weaning and yearling minimums, below on birth weights and near 100 on MBV on his daughters from his first and second calf crop, so we added semen from him to the three selected MBV sires and a fourth bloodline. This bull also came close to the criteria we had set for 12-15 month old bulls: that is, 1,000-1,300 lb. with a fat covering of less than .3 inches; at just over 13 months he had weighed just over 1,500 lb. with a fat covering of .5 inches.

For 1985 and 1986 we will concentrate on these four bulls. As the 1987 breeding season approaches, we will

re-evaluate our program to decide basically one of three directions to go: 1) crisscross these MBV sires on the daughters kept which will concentrate MBV gene pools; 2) use half-sibling sires on the daughters to concentrate gene pools from a specific sire; and 3) to add other sires to specifically correct weaknesses that may develop.

I am not saying that this program is the direction everyone should go. I am saying that it is a program thoroughly thought out to fit our situation at this time. We are depending on the *science* of genetics in the criteria used in selecting the herd sires; on the *art* in determining which sire will be used on each female; and we are hoping for some *luck* in the resultant matings. We added a modifying economic criteria that the cost of semen and certificate should be in the range of $100 or less per calf.

You may, and probably will, select different criteria than we did, that is, from MBV and carcass values. But I challenge you to set down and establish breeding goals for the short term (2-3 years), the intermediate term (3-10 years) and for the long term (over 10 years) and then select a specific breeding program to achieve them. Take into consideration 1) your merchandising program for bulls and females and your steers; 2) the economics of cost of production and anticipated sale price; and 3) the ultimate goal of livestock production in general, cattle more specifically, and Angus cattle in particular.

You may choose sires on the basis of growth rates, show ring winnings or the ability to sire show winners, specific type characteristics to correct specific deficiencies or faults in your females, or because you believe the calves will be merchandisable or any of a number of other reasons. Determine what your criteria are and then select sires and a breeding program to achieve it.

One of the strengths of the Angus breed has been some diversity of type and toleration of the same. It permitted us to make the change in type that we have accomplished in the past 25 years. If, as some meats people are predicting, in the future we should go to totally boneless, prefabricated steaks and roasts that can be made of any desired weight and/or thickness then we may have to rethink our ultimate goals. Until then we still have to be concerned with the size of meat cuts the retail purchaser will buy, and for superior quality, that means USDA Choice.

The author starts these articles on the premise that a marketable steer which will provide high quality cuts of desirable size is the ultimate goal of the beef business in general and Angus beef in particular. Then we'll proceed to indicate the kind of parents needed to produce that steer. Hopefully I will challenge your thinking in the direction we should be moving in the Angus breed. If your goals end up different from mine, that's your privilege and I will respect your ideas and goals even though I may disagree with you.

However, I challenge you to set some specific goals, determine the kind of cattle it takes to achieve those goals and then set up a breeding program that will produce the kind of cattle you have set as a goal. Concentrate the gene pools and obtain consistency.

It's not an easy task nor one easily achieved. May someone in the future say of you: "Now there was an artist and a breeder who knew how to use the "tools of the trade" to achieve a goal."