A New Look at Congenital Anomalies in Calves

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"From a single abnormal animal a diagnosis of hereditary origin is impossible. Even with a number of affected animals in a single herd, a distinction between genetic and environmental origin, or a combination of the two, is often difficult." This simple statement, made by I. L. Mason, ARC Unit of Animal Genetics, Edinburgh, Scotland, expresses or implies a concept that should be known by today's bovine practitioners.

A second simple statement made by G. B. Young, ARC Animal Breeding Research Organization, Edinburgh, Scotland, expresses or implies a second concept that should be known by today's bovine practitioners: "Since different genes may act through the same paths, the same clinical disease may be inherited as a dominant or a recessive. Environmental disturbances acting through these pathways produce phenocopies."

It is no longer acceptable to regard most congenital bovine anomalies encountered in practice as "hereditary—probably simple recessive." It is clear

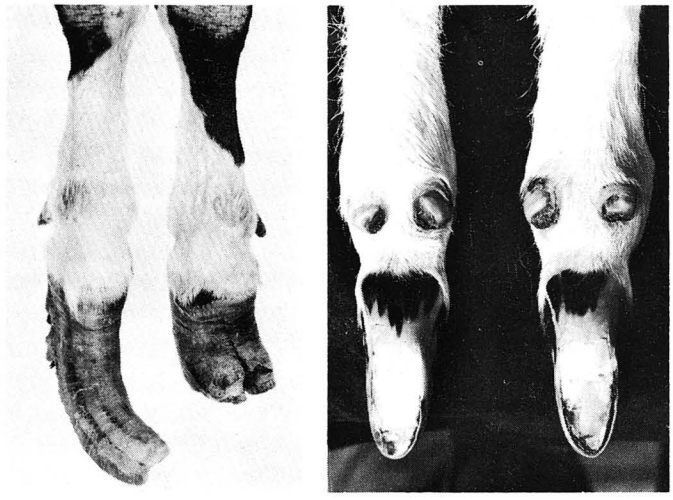


Figure 1. Syndactylism or mule foot in a Holstein calf. One or more limbs may be affected.
(Photo courtesy of Keith Huston, Kansas State University and Horst Leipold, University of Saskatchewan.)

that congenital abnormalities in their causation may be (1) genetic or (2) environmental, i.e., post-genetic, or combination thereof.

**American Breeders Service, Inc., De Forest, Wisconsin.*

Figure 2. Arthrogryposis in a Charolais calf. Affected calves display arthrogryposis, limb rotation, and cleft palate in varying degrees.
(Photo courtesy of Horst Leipold, University of Saskatchewan.)

Genetic congenital anomalies that are simple recessives and pass through successive generations in the theoretical and classical Mendelian 1:2:1 mode of inheritance are far less frequent in occurrence and less precise in their expression than once thought. Other less neat modes of genetic inheritance are recognized. Geneticists speak of dominant inheritance—with degrees of penetrance, irregular inheritance, polygenic inheritance, polymorphism, and chromosomal abnormalities. Although very rare, mutants may appear at anytime.

The harmful congenital anomaly best known to North American cattlemen is the *snorter dwarf* of the Hereford and Angus breeds. Its story is a simple recessive classic and its uniqueness is the extraordinary selection pressures exerted by breeders which mediated the harmful gene's build-up to disastrous proportions within the breed populations.

However, all dwarfs are not snorter dwarfs. There are several other less well known yet distinct types of congenital dwarfs recognized in cattle —and they are not all simple recessives.

Other than snorter dwarfism, the most frequently encountered simple recessive genetic congenital anomalies in cattle of the U.S.A. have been *syndactylism* or "mule foot" in Holsteins, *porphyria* or "pink tooth" in Holsteins, *prolonged gestation* in Holsteins, *adenohypophyseal hypo-*

plasia in Guernseys, and *fetal anasarca* in Ayrshires.

In the U.S.A. in the Charolais breed, "*double muscling*" and *arthrogryposis* are presently being encountered. Their modes of inheritance—simple recessive, dominant with partial penetrance, or other—are yet to be conclusively established. The former, "double muscling," may prove to be especially interesting, having been observed in Europe as a simple recessive in the Friesian, while in Charolais it appears to transmit as a dominant with partial penetrance. In Charolais the mode of inheritance of *arthrogryposis* is not as yet clearly established.

Remarkably, the morphological syndrome of arthrogryposis of calves, the study of which is just beginning, has almost simultaneously been competently described in North America (1) as a possible but rare simple recessive in Herefords, (2) as a manifestation of the dam's ingestion of lupine (*Lupinus sericeus* or *L. caudatus*), and (3) as a not uncommon genetic anomaly in Charolais calves!

Figure 3. Experimentally produced arthrogryposis from maternal feeding of Lupinus caudatus from the 40th to the 70th day of gestation. Lupinosis is associated with arthrogryposis, torticollis, cleft palate, and limb rotation in varying degrees.

(Photo courtesy of Wayne Binns, USDA Poison Plant Research Laboratory; Logan, Utah.)

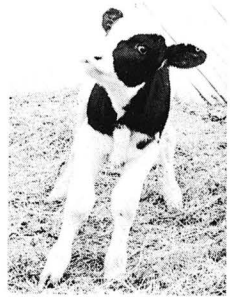
Arthrogryposis may prove to be a striking illustration of the foregoing statements of both Mason and Young.

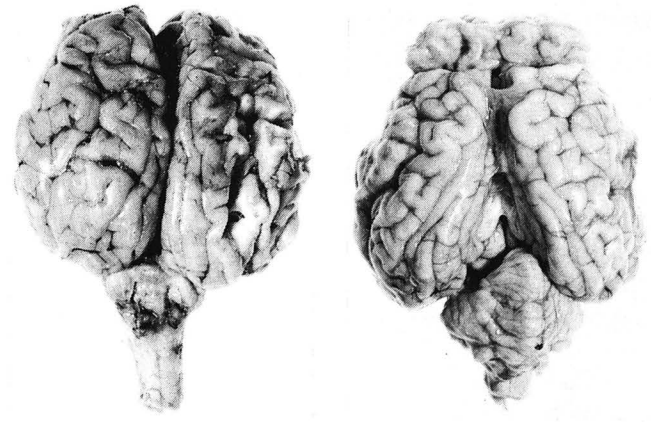
There are several anomalies in which a genetic contribution is evident but no pattern of genetic transmission ascertainable, such as *umbilical hernia*, *wry tail*, and *contracted tendons* which are all evident in newborn calves and, especially in bulls, *crampiness*, that usually does not manifest itself until maturity. Because of their benign, correctable, or endurable nature and the uncertainty of their causation, of necessity these must for the present be tolerated within the gene pool.

Modern cattle breeding researchers seem to have been impressed more by the infrequency with which they encounter genetic congenital anomalies than with their frequency.

In the past decade the most popularized and dramatic descriptions of congenital anomalies, environmental in their causation, have originated from human pathologists. The manifestations of thalidomide action upon the human embryo and the consequences of infection with the virus of rubella during pregnancy have been well documented.

Contemporaneously, veterinary pathologists have described a remarkable condition of cyclops in lambs associated with ingestion of *Veratrum californicum* during a discrete stage of gestation as well as various anomalies of baby pigs associated with the presence of the virus of hog cholera during gestation.





Figures 4, 5, and 6. At left, Cerebellar aplasia symptoms from BVD-MD at three days of age. (Below left) Note cerebellum recovered at necropsy from the same calf as compared with normal (below right).

(Photos courtesy of Gerald Ward, Cornell University and Cornell Veterinarian.)

Very recently, in calves, central nervous system defects of a nature long implied to be genetic have been observed from the virus of BVD-MD and blue tongue. Calves born in BVD-MD herds with cerebellar aplasia (and lens opacity!) have recently been reported, as have calves with internal hydrocephalus been born in a herd with serological evidence of blue tongue.

Purebreed associations, breeders and multipliers of cattle "seed stock," and the AI organizations that select, supply, and distribute widely the genetic material for creating an ever increasing percentage of the national dairy and beef herds **must** maintain rational and reasonable policies toward the problem of congenital anomalies: use of reporting systems, sifting out the genetic from the environmental, appropriate action when significant harmful genes transmitting on a significant and predictable pattern are encountered. In the case of most harmful simple recessives, this will usually mean slaughter of the bull.

Few bulls, if any, in the past, have been so unique in their superior production qualities as to justify perpetuation and dissemination of disqualifying characteristics. It does not take many worthless calves to depreciate an otherwise superior production bull who is regularly transmitting a harmful genetic characteristic. Maintaining such a sire in service by praise for his superior qualities and apology for his defect—for the "good of the breed," may have advantages, but, mostly, unilateral to the sire owner!

A residual morass consisting of "genetic junk" transmitting upon no predictable pattern that is mixed with sporadic anomalies induced by capricious insults to developing calves while in their intrauterine environment will always persist. (—a missing eye, a "de-tail," an amputated limb, an imperforate anus)

Increased awareness, more accurate diagnoses and recognition of etiology, and more precise separation of the significant in implication from the insignificant in implication, should markedly reduce the magnitude and confusion of the morass.

While maintaining an attitude of interested alertness and offering assistance and encouragement in the reporting of anomalies to sire owners and breed associations, the bovine practitioner should recognize, *a priori*, that isolated facts available will usually limit him to a morphological diagnosis of the affected individual and will not include sufficiency of facts to permit a valid genetic diagnosis.

Capability to differentially diagnose congenital anomalies as to their possible etiologies will surely grow as the pathogenesis of congenital anomalies at biochemical and embryonal levels are elucidated. Is there doubt that in the environment conscious age of the future, new knowledge as to the environmentally induced anomalies will be forthcoming?

A Hand Electrode for the Electroejaculation of Bulls
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Some bulls will start ejaculating shortly after stimulation is started, before they are massaged.

Where the maximum quantity and quality of semen is desired, before ejaculation is attempted, it is better to build most bulls up to a good erection once or twice, waiting about 30 seconds between each buildup for relaxation. This seems to serve the same purpose as one or two false mounts when semen is to be collected with an artificial vagina.

Advantages of the Hand Electrode

1. The time required for obtaining semen is reduced by more than 50%. With proper facilities and help, bulls can be semen-tested at the rate of six to twelve per hour.
2. Only the desired area is stimulated and less current is required. This relieves many of the side effects and undesirable reactions produced by the probe. It is much easier on the bull and looks much better to the client.
3. Results are more consistent. In ten years of experience, testing more than 2,000 bulls, semen was obtained from every bull.
4. Using the hand electrode, ejaculation has been produced very easily in bulls where competent and experienced veterinarians failed to obtain semen using the standard probe.
5. The penis can be extended in almost every bull regardless of breed.

Summary

A hand electrode, to replace the rectal probe, for the electroejaculation of bulls is described. Directions for its use are outlined. The advantages of the hand electrode over the probe are listed.

(The equipment is marketed by Standard Precision Electronics; Denver, Colorado.)

References

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