The Joint Alpharma-Beef Species Symposium titled “Redefining the replacement heifer paradigm” was held at the Joint Annual Meeting of the American Society of Animal Science, American Dairy Science Association, Canadian Society of Animal Science, Western Section of the American Society of Animal Science, and the Asociación Mexicana de Producción in Phoenix, AZ, July 15 to 19, 2012. The symposium was designed to explore emerging concepts regarding development and maturation of replacement beef heifers. There are several aspects of beef heifer development that continue to receive attention because of the importance of the development system performance outcome. One important aspect is the development and functionality of the hypothalamic-pituitary axis to influence the endocrine matrix that stimulates reproductive development. The development of the hypothalamic-pituitary axis is imperative for heifers attaining puberty, which is a primary outcome of development programs. The attainment of puberty is a developmental and production issue that warrants discussion. The heifer development system that is implemented often has profound effects on beef heifer development. Multiple development systems are commonly used in the beef industry to develop heifers, but a comprehensive review of all systems was not feasible; however, substantial differences are identifiable and comparisons between systems were made.

One of the production goals of the replacement heifer system is to improve the genetic base of the cow herd as heifers are integrated. Currently, genetic emphasis in the beef cattle industry is identifying feed resource efficiency as a cow-performance and environmentally important trait. The implications and outcomes of selection for residual feed intake (RFI) in young and growing heifers on puberty and reproductive outcomes has considerable impact. Addressing the implications of heifer development systems as they pertain to heifer longevity in the cow herd also has substantial implications to overall and continued success of heifer development. Cost–benefit comparisons among development systems validate science-based heifer development systems. Ultimately, heifer development systems must incorporate both physiology and growth with resource allocation and economic viability.

The initial speaker of the symposium, Chad L. Gasser (Southern Utah University, Cedar City, UT), addressed the basic physiology processes related to beef heifer development. Reproductive development to attain puberty in the beef heifer is a multistage process. Initiation of reproductive development begins prenatally; postnatal growth encompasses periods of dynamic follicular and hypothalamic-pituitary-ovarian axis development but also includes periods of static equilibrium (Gasser, 2013). Considerable attention has been directed at the timing of BW gain relative to heifer reproductive development. Multiple strategies to accelerate attainment of puberty and the underlying mechanisms that influence the outcome of systems were addressed; high-concentrate feeding during the postnatal period to early-weaned heifers was a specific topic of discussion. Gasser (2013) concluded that nutritional management during the early postnatal period can affect frequency of LH pulses, accelerate ovarian structure and functional development, and attenuate the estradiol-LH negative feedback loop, shifting the peripubertal period to a younger age and accelerate the achievement of puberty.
Two presentations addressed systematic approaches to beef heifer development systems. Rick N. Funston (University of Nebraska, North Platte, NE) and Rachel L. Endecott (Montana State University, Bozeman, MT) discussed extensive heifer development systems and the systemwide implications of heifer development, respectively. Many heifer development systems subscribe to the paradigm that beef heifers should be at least 60 to 65% of mature cow BW at the initiation of the breeding season. Extensive heifer development systems result in heifers that exhibit compensatory BW gain during subsequent grazing periods (Endecott et al., 2013). Extensively developed heifers weigh less at breeding, have greater BW during breeding and similar pregnancy rates, achieve similar BW at calving, and have similar percentage of females calving in the first 21 d of the calving season compared with conventionally or intensively developed beef heifers (Endecott et al., 2013). All the previous variables indicate that a decrease in BW attained during development is not detrimental to heifer performance if a compensatory period is available and that the nutritional stress does not occur during the breeding season (Endecott et al., 2013).

Beef heifer development systems can affect herd retention rate and cow longevity (Endecott et al., 2013). The use of extensive heifer development systems can increase heifer retention rate in the cow herd leading to increased productivity and longevity compared with conventional development systems. However, continued nutritional restriction after development increases herd fall-out rate and potentially negatively impacts mature cow size (Endecott et al., 2013). Economic analysis of extensive system developed heifers indicates increased net returns for extensive systems because of greater pregnancy rates and decreased feed costs compared with conventional systems (Endecott et al., 2013). Studies from multiple locations indicate that restricting BW gain by limiting DMI has increased economic advantages, potentially creating heifers that are better suited to maintain themselves as cows compared with programs that develop heifers to a greater target BW (Endecott et al., 2013).

The emphasis on feed efficiency in the cow herd analysis includes the development and selection of replacement heifers. Ron D. Randel (Texas A&M University, Overton, TX) discussed RFI and its relationship with heifer development. Residual feed intake has become the more favored selection tool because it is genetically independent of growth traits and mature BW issues and is only related to feed intake (Randel and Welsh, 2013). Selection of beef heifers based on RFI has several consistent outcomes such that low RFI heifers have a leaner body composition, which leads to a longer time to reach puberty and conception. The delay in puberty may be associated with less fat deposition (Randel and Welsh, 2013). The physiological age at the time of RFI evaluation profoundly affects the RFI–reproductive development matrix in that early maturing heifers are penalized whereas late maturing heifers are benefited in the selection process because the most efficient heifers reach sexual maturity at an older age (Randel and Welsh, 2013). As such, low RFI heifers in early maturing breeds are reported to have late calving dates compared with high RFI heifers, but Brahman heifers evaluated for RFI demonstrated no difference in calving interval from first to second calf (Randel and Welsh, 2013). In Brahman heifers, there is a relationship between RFI and insulin response to glucose challenge; however, there was no relationship between RFI and IGF-1 or the hypothalamic-pituitary-ovary axis (Randel and Welsh, 2013). Residual ADG (RADG) may be an acceptable alternative selection tool to RFI because reproductive parameters were not affected by RADG classification.

Development of beef heifers to achieve puberty and retention of beef heifers in the cow herd are key characteristics essential to the beef cattle enterprise. The Joint Alpharma-Beef Species Symposium titled “Redefining the replacement heifer paradigm” examined challenges to developing heifers: achievement of puberty, application of viable extensive development systems, valid selection criteria, and herdwide implications of heifer development systems. The symposium identified current challenges to past paradigms and how those challenges are changing the way beef heifers are developed to adapt to changing industry dynamics.

**LITERATURE CITED**

