The Use of Insulin-like Growth Factor I (IGF-I) as an Indicator Trait in a Genetic Evaluation for Feed Efficiency

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The objective of this paper is to provide an expert scientific recommendation to the U.S. Beef Industry, on the value of IGF-I as an indicator trait for residual feed intake (RFI) based upon current knowledge of the relationships between IGF-I and RFI in *Bos taurus*, *Bos indicus* and crossbred cattle.

It is recognized that feed intake and the efficiency of nutrient utilization are of great importance to the beef cattle industry and the development of a genetic evaluation for these traits is critical. The ratio of feed intake to gain (feed conversion ratio) has traditionally been used as a trait to evaluate feed efficiency in growing cattle, however, ratios are not suitable for use in selection programs. Residual feed intake has been proposed as a more desirable trait to use in breeding programs focused on improving feed efficiency. The rationale is that RFI addresses the biological efficiency of animals and that selection for RFI, growth and compositional traits can occur independently and simultaneously. Residual feed intake is defined as an animal's actual feed intake minus its expected feed intake. Efficient animals are those that consume less feed than expected based on their size and growth rate.

We recognize that the cost of measuring feed intake continues to limit wide-spread implementation of selection programs that target feed efficiency. However, the accumulation of accurate feed intake phenotypic data in large numbers will be essential for successful implementation of objective breeding programs that focus on either feed consumption or efficiency. The concurrent use of genetic markers or physiological indicator traits that are predictive of RFI will help to reduce the cost of developing RFI as a useful feed efficiency trait. It has been proposed that the hormone IGF-I can be a useful indicator trait for RFI. Additionally, there is a commercially available test for measuring IGF-I levels in cattle.

Blood or serum insulin-like growth factor I (IGF-I) has been shown to be genetically correlated with RFI, in *Bos taurus* cattle, suggesting that this hormone may be a useful indicator trait for RFI. Moreover, the genetic evaluation program for beef cattle in Australia currently uses IGF-I measurements, along with RFI phenotypic data, to generate estimated breeding values for RFI. However, studies involving *Bos indicus* and crossbred cattle both in the U.S. and Australia have shown that the relationship between RFI and IGF-I observed in *Bos taurus* cattle is not always consistent across breedtypes. It is important to note that even in *Bos taurus* cattle, IGF-I accounts for about 35% of the genetic variation in RFI. Thus, 65% of the variation in RFI appears to be unrelated to IGF-I. Recent work in Australia has also shown lower correlations between IGF-1 and RFI than reported earlier and there seems to be indications of an age of calf fed by test result interaction. Additionally, research has indicated there are possible unfavorable relationships between IGF-I and other economically relevant traits (e.g., marbling, reproduction traits) and further research is warranted to fully understand possible genetic antagonisms to the use of IGF-I as an indicator trait for RFI.

Based on our current assessment of available information, it is our opinion that circulating IGF-I should not be used as an indicator trait for RFI in genetic evaluation programs at this time. However, we do recommend that additional research be conducted

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to further evaluate genetic and phenotypic relationships between circulating IGF-I (and IGF-I binding proteins) and RFI in diverse breedtypes, and that genetic relationships between IGF-I and growth, product quality and reproductive traits in beef cattle be fully evaluated.