Sizing things up

GENE TALK

Mark Young

The exception proves the rule, they say.

What this apparently contradictory statement really means is animals differing from a general rule are "exceptional" and worthy of attention. It is these animals that are sought in breeding programmes. One example is the "curve-bending" growth some animals show.

They grow faster post-birth than their birthweight would suggest yet are not large as adults. This follow-up article on genetic size-scaling (GSS) considers how relevant this theory is in practice.

One key definition required is "adult size" yet sexes may differ in this. Typical weights of the sexes can be averaged, or female body size can be used given these are the key production units on farms.

Body composition is also important. Better predictions of performance are reached if adult size is adjusted to constant fat percentage (about 15%) so using adult bodyweight of "thin" (low fat percentage) ewes may underpredict performance while that of fat ewes may overpredict.

GSS predicts that animals burn the same amount of energy per gram in their lifetimes. Smaller animals, with shorter lives, burn energy faster per gram of bodyweight a day.

A 300kg cattle beast is five times heavier than a 60kg sheep but it doesn't need five times more feed a day, other things equal. GSS predicts it needs about three times more feed a day (50.73 = 3.2).

Such differences in metabolic rate impact on veterinary treatment.

Drug doses for each kilogram of birthweight differ between sheep and cattle but this is not to assume a 400kg cattle will need 10 times the dose of a 40kg sheep. If in doubt, check with your vet.

Animals follow similar patterns of development for bone, muscle and fat. Typically, young mammals have a higher bone percentage and lower fat percentage while older animals have the opposite but some exceptions do occur through need – *see sidebar*.

A sheep that is 40% of adult size is expected to be of similar carcase composition to a beef animal at 40% of its adult size. In practice, other things may not be equal – for example, seasonal variation in feed quality and quantity. Slow-growing animals typically have a lower fat percentage than expected.

You can give Beef + Lamb New Zealand Genetics or SIL your thoughts on this topic by emailing: silhelp@sil.co.nz or by leaving a message on 0800-silhelp (0800 745 435).

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Farm system pressures

Animals adapted to polar regions have evolved for energy-dense diets early in life to lay down fat quickly to survive a cold climate. Some seals have more than 50% fat in their milk to drive this.

The best example of where GSS helps is in understanding the pressures in farming systems for reproduction in sheep versus cattle. Both evolved under a 365-day Earth year with seasonal feed supply. Onfarm, we want them to lamb or calve every spring.

Pregnancy and lactation easily fit within a 365-day year for sheep with time for a dry period. However, for cattle predicted lengths of pregnancy and lactation sum to more than 365 days. So to calve every year a cow must get pregnant while lactating and be both pregnant and lactating for some months. Cows are capable of this but are under more pressure than sheep to perform to this level every year.

Added to this is the extra load on some animals through selection for higher productivity. Modern dairy cows are an extreme example where they produce more milk than a calf needs. This puts more pressure on getting cows pregnant at the same time every year.

Beef cows run in less favourable environments may be under equivalent pressure at breeding time. Twinning may be "a bridge too far" for an annual calving beef cow herd.

Some traits show less variation within species than expected from body size and GSS. The most notable example is pregnancy length. Dog breeds differing in size 25 times – for example a Great Dane, 75kg, versus chihuahua, 3kg – have pregnancy lengths that vary little, typically 60-65 days. GSS theory predicts such different sized animals would have very different pregnancy lengths – 164 days for a 75kg adult, 70 days for 3kg. Why pregnancy length does not differ much within a species is not clear.

Dogs are an extreme example. From a wolf ancestor extreme variations in size, shape, colour and temperament have been bred. No other species has been changed so much by humans guiding breeding for utility (terrier versus wolfhound for hunting) or for fashion whims in pet breeds. In theory all dog breeds can interbreed – one definition of a species – even if physically improbable for extremes in size.