and with a completed application form is sent to the service provider. An animal’s genetic makeup may also be determined by testing a blood or semen sample.

**At the laboratory**

Once the sample is received, the next step is to extract the DNA. This process is made up of several steps, some of which include cleaning the material, adding a number of chemicals, incubating the sample, and then finally checking the quality of the extracted DNA. After the DNA has successfully been extracted, the sample is processed on a genotyping platform. Genotyping identifies the individual sequence data or genetic variants at many sites across the genome and is referred to as genomic data. For a 50K SNP Chip, this process identifies genetic variants in DNA at 50,000 sites across an animal’s genome.

**Genomic selection and prediction equations**

Genomic selection involves using genetic markers scattered randomly over the entire genome to identify genes associated with a desired trait. For example, for a trait like marbling, no matter where the genes are located, if they influence marbling, they can be identified.
controlling this trait are located in the genome, they will be identified by using many genetic markers. To identify the location within the genome for these genes, variations known as single nucleotide polymorphisms (SNPs), which are associated with desired traits within the genome, are marked. Prediction equations generated by the CRC quantify the importance of each SNP and the overall value of all SNPs associated with a certain trait.

**Generation of a genomic value**

The generation of a genomic value requires genotyping providers to send the raw genotype to the Animal Genetics and Breeding Unit (AGBU) in Armidale. At this stage the genotype is quality checked and stored on file. Genomic prediction equations are then applied to the genotype to generate a genomic value, which estimates the breeding value based on DNA information alone.

**BREEDPLAN EBVs and genomic values**

The purpose of prediction equations is to estimate the breeding values of individual animals, so that cattle breeders can select the best animals. BREEDPLAN already performs this task for phenotypic measurements and pedigree information. The genetic evaluation system is now in place such that if an animal is recorded in BREEDPLAN, its genomic value is integrated with pedigree and phenotypic information. This process produces a BREEDPLAN Estimated Breeding Value (EBV) for this particular animal. Adding in genomic data simply increases the accuracy of that BREEDPLAN EBV.

A symbol affixed with the animal’s EBVs denotes that genomic values have been integrated (see symbol in example below). The increased accuracy of such BREEDPLAN EBVs allows producers to be more confident in their selection. Further information on BREEDPLAN EBVs and incorporation of genomic information is available in the fact sheet, 'Beef CRC prediction equations: improving productive traits with DNA.' and start of joining details on all cows. It is strongly recommended that seedstock herds supply DC EBVs with sale bulls and females, and that bull buyers request DC EBVs. This will enable beef producers to select animals with superior merit for reproductive rate.

**Table 1:** An example of BREEDPLAN EBVs where Beef CRC genomic prediction equation information has been incorporated.

<table>
<thead>
<tr>
<th>Trait</th>
<th>EBV</th>
<th>Acc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving Ease Dir (%)</td>
<td>+1.3</td>
<td>39%</td>
</tr>
<tr>
<td>Birth Wt. (kg)</td>
<td>+4.3</td>
<td>64%</td>
</tr>
<tr>
<td>200 Day Wt. (kg)</td>
<td>+42</td>
<td>59%</td>
</tr>
<tr>
<td>400 Day Wt. (kg)</td>
<td>+77</td>
<td>55%</td>
</tr>
<tr>
<td>600 Day Wt. (kg)</td>
<td>+102</td>
<td>53%</td>
</tr>
<tr>
<td>Milk (kg)</td>
<td>+17</td>
<td>50%</td>
</tr>
<tr>
<td>Scrotal Size (cm)</td>
<td>+2.8</td>
<td>54%</td>
</tr>
<tr>
<td>Carcase Size (cm)</td>
<td>+59</td>
<td>51%</td>
</tr>
<tr>
<td>Eye Muscle Area (sq. cm)</td>
<td>+7.8</td>
<td>57%</td>
</tr>
<tr>
<td>Rib Fat (mm)</td>
<td>+0.3</td>
<td>53%</td>
</tr>
<tr>
<td>Rump Fat (mm)</td>
<td>+0.6</td>
<td>42%</td>
</tr>
<tr>
<td>Retail Beef Yield (%)</td>
<td>-0.2</td>
<td>43%</td>
</tr>
<tr>
<td>IMF (%)</td>
<td>+3.8</td>
<td>42%</td>
</tr>
</tbody>
</table>

**Further information**

The Beef CRC website (http://www.beefcrc.com) and the SBTS/TBTS webinar series (http://sbts.une.edu.au/Webinars/webinars.html) have additional information on BREEDPLAN EBVs and the use of DNA technology for beef cattle breeding.

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![March 2011 Angus GROUP BREEDPLAN](image)

**Traits Observed:** BWT, 200WT