Cattle Testing

Introduction:
Unistel Medical Laboratories was established as a “spin off” company by the University Stellenbosch. In 1999. As an academic department, the Department of Human Genetics offered a “one stop” human genetics testing service to the private sector from 1985 till 1999. As times changed research funding became more problematic, focus areas of The Department of Health of both at provincial and national level changed and this impacted very negatively on the survival of an academic department of Human Genetics. It was also realized that there was a big need for genetic testing in the area of animal breeding and with expertise in this area readily available, it made good sense to include these genetic tests in the menu of the “spin off” company, Unistel Medical Laboratories (Pty) Ltd.

Norms:
In any genetic testing facility it is critically important that very specific norms be instituted and followed. This is true for both human and animal testing procedures.

On the human testing side no diagnostic testing services may be offered unless all scientists, technologists and technicians are registered at the Health Professionals Council of South Africa (HPSCA). All tests offered must comply with the highest scientific standards, must be standardized and validated, both internally and externally via quality assurance schemes.

In the animal genetic testing industry there are no similar requirements and norms that should be adhered to. Unistel has however set an internal norm that is totally in line with the requirements in human genetic testing. All staff performing animal genetic testing must hold a suitable academic qualification, must undergo an “intern” training period of at least one year and must be signed off by a senior supervisor. All tests offered must be standardized, validated and subjected to peer review quality assurance.

Standards:
In any industry these are standards to be conformed to and these are of critical importance especially where results and data are exchanged on an international basis. This makes sure that all genetic testing laboratories world wide “speak the same language” and results of tests can be accepted and used in laboratories internationally. One of the most important genetic tests in the cattle industry is the DNA profile analysis that is essential for individual animal identification and breeding confirmation. The DNA-profile became vitally important when it replaced the previous blood typing technology as means of identification and parentage confirmation round 1990’s. As for blood typing, there also had to be international standardization for DNA testing. The International Society of Animal Genetics (ISAG) took this responsibility to co-ordinate and recommend the selection of DNA markers to be used as standards across the industry. The first step was to reach consensus on the actual DNA markers to be used and the number of DNA markers that would offer the most accurate results and also provide sufficient variation. A panel of 11 DNA markers was identified, recommended and accepted internationally. To facilitate the free exchange of data, a bi-annual “ring test” is conducted by mediation of a dedicated committee of ISAG members who co-ordinate the process.
A rotating duty laboratory distributes DNA samples of twenty (20) individual cattle of various breeds. A consensus, standard STR-DNA-marker profile for each animal is used as reference.

Each laboratory that participates in the bi-annual ISAG co-ordinated standardisation “ring test” completes each of the 20 different DNA profiles in their laboratory under the unique environment conditions in that laboratory. As conditions vary from laboratory to laboratory and country to country the absolute results of a DNA-profile will vary from laboratory to laboratory. This makes the exchange of data problematic as the DNA profiles will not be compatible.

For example in three different laboratories the DNA marker values at STR marker:

An ISAG reference sample with allele 151/ at marker TGLA122 was processed with 3 different sets of conditions (A: Primer X, Instrument X; B: Primer Y, Instrument X; C: Primer X, Instrument Y.

Left below: Small differences in chemicals, equipment and conditions lead to large differences in fragment sizes. Comparison is impossible.

Right below: Thanks to ISAG standardisation, the allele call is the same, irrespective of the fragment size.

Tabulated the correction can be illustrated as follows:
Three different laboratories the DNA marker values at STR marker ETH 10 may be 217 and 221 in lab A; 215 and 222 in lab B and 211 and 219 in lab C.

The consensus marker values for this particular animal at marker ETH 10 is 215 and 221. Lab A corrects the ETH 10 values from 217; 221 to 215 and 221. Lab B corrects their ETH 10 values from 215, 222 to 215 and 221 and finally Lab C corrects their values 211, 219 to 215 and 221.
<table>
<thead>
<tr>
<th>DNA Microsatellite</th>
<th>ETH 10</th>
<th>TGLA 227</th>
<th>BM1824</th>
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</thead>
<tbody>
<tr>
<td>Laboratory A</td>
<td>217</td>
<td>78</td>
<td>180</td>
</tr>
<tr>
<td>Laboratory B</td>
<td>215</td>
<td>77</td>
<td>179</td>
</tr>
<tr>
<td>Laboratory C</td>
<td>211</td>
<td>79</td>
<td>180</td>
</tr>
<tr>
<td>ISAG Reference Profile</td>
<td>215</td>
<td>79</td>
<td>180</td>
</tr>
</tbody>
</table>

After calibration to ISAG reference profile
| Laboratory A      | 215    | 79       | 180    |
| Laboratory B      | 215    | 79       | 180    |
| Laboratory C      | 215    | 79       | 180    |

Now all the labs are "speaking the same language" and DNA-profiles can be exchanged freely. This process is completed for each DNA-marker in the panel recommended and each of the 20 individual animals. All participating laboratories in the ISAG standardisation "ring test" therefore has a standard panel of DNA markers and a consensus "bin" for each marker that is identical for all laboratories that participated.

Every two years the ISAG committee meets during the ISAG-congress where all the "ring test" results are analysed standardized and validated setting the standard for the next two years.

Until the 2015 "ring test" the ISAG recommended bovine panel of markers consisted of 11 STR markers. For the 2015 "ring test" it was recommended that the standard number of STR markers be increased to 12 and 4 optional additional markers were added for use in difficult cases. All the "ring test" results of 2015 were recently discussed at the 2016 ISAG congress in Salt Lake City where all results, corrections and validations were approved. In total 84 laboratories world-wide participated of which two were from South Africa. Unistel was one of the two.

Participation in the ISAG "ring tests" facilitated the standardisation and validation of the DNA profiles issued by Unistel and confirmed their acceptability and exchangeability with laboratories internationally. These DNA profiles are not compatible with DNA profiles issued by laboratories that did not or do not participate in the ISAG international standardization "ring tests".

**Protocols:**
Unistel Medical Laboratories recognises the lawful ownership of all samples and DNA data as being that of the client that submitted and paid for the specific tests. Unistel only acts as custodian of the data and samples and therefore cannot and will not share data with or refer samples to a third party without the specific written consent of the particular client.

**Services:**
Unistel offers a complete DNA testing service for DNA profiles, parentage validation, genomic referrals for 150K testing and more than 50 genetic disorders, traits of economic importance (polled testing, marbling, tenderness, milk quality) and quantitative traits.

*The DNA profiling services conforming to the ISAG corrected standards are offered for all horse, sheep, goat and cats breeds and even pigeons.*

Unistel remains committed to providing a world class service to all clients, building a treasured and trusted long term relationship with clients and always "walking the extra mile" to assist all clients.