

Axiom Bovine-Ovine-Caprine Genotyping Array

A single genotyping array for conducting high-resolution genotyping for bovine, ovine, or caprine samples



Highlights

- Expert design: developed by key opinion leaders in the community
- Informative: includes parentage markers from existing in-market arrays, allowing compatibility with previous studies
- Inclusive: a single array for three species
 - Bovine: 54,560 markers
 - Ovine: 54,236 markers
 - Caprine: 60,034 markers

Applications

- Construction of high-resolution genetic maps
- Genetic improvement of pure lines
- Fine mapping of quantitative trait loci (QTL)
- Calculation of breeding values
- Parentage analysis

A comprehensive solution for farm animal genetics

Axiom™ Bovine-Ovine-Caprine Genotyping Array (Axiom_Ovicap) for animal genotyping was designed through the Expert Design Program at Affymetrix, now a part of Thermo Fisher Scientific. The array includes single-nucleotide polymorphisms (SNPs) that were identified by the United States Department of Agriculture Agricultural Research Service (USDA ARS),¹ International Sheep Genomics Consortium (ISGC),² and the International Goat Genome Consortium³ for each of the three different species (bovine, ovine, and caprine, respectively). The content for caprine includes SNPs located within the four casein genes implicated in milk production. The array also includes markers for ovine and bovine parentage analysis.

The 96-format, high-density array offers the power and resolution for a wide range of applications in animal breeding and genomics that include studying marker-trait association, evaluating pure lines, and identifying multiline reference populations, as well as research applications for genome-wide analysis. A key benefit of using Axiom™ genotyping arrays is the ability to genotype samples without experiencing batch-to-batch variability, marker dropout, or missing data, which have been observed when using other genotyping products. The array manufacturing process guarantees delivery of arrays within two weeks of ordering, ensuring production facilities can process samples in a timely fashion, deliver genotypes, and meet critical breeding deadlines.

Array content

Markers that have been previously validated and associated with desirable traits are very important in maintaining and breeding elite commercial populations. The bovine content includes 54,560 markers that are uniformly spaced across the bovine genome, with marker annotations aligned to the *Bos taurus* UMD 3.1 genome. The array incorporates 191 bovine parentage markers identified by the International Society for Animal Genetics (ISAG). The most informative markers (44,705 markers) within the bovine content have been validated by the Council on Dairy Cattle Breeding (<https://www.cdcb.us>), allowing comparison between genotypes identified by Axiom Ovicap Genotyping Array to those from previous studies. It also provides the ability to continue existing projects, while making use of the latest and most informative content, to extend the usefulness of the study.

The caprine content on the array includes 59,999 markers that were identified by the International Goat Genome Consortium in milk and mixed breeds (Alpine, Saanen, and Creole) and meat breeds (Boer, Katjang, and Savanna). An additional 35 markers implicated in milk production and identified in Norwegian dairy goats are included on the array.⁴ All 60,034 markers were designed on the array. The Axiom genotyping array overcomes all the design limitations of the in-market array³ where an 11% loss during probe synthesis has been observed, resulting in dropped SNPs. Dropped SNPs can have an impact on marker association studies where markers associated with important phenotypes may not be identified during genotyping.

The ovine content on the array includes 54,236 markers that were selected by the International Sheep Genomics Consortium, with markers derived from three separate sequencing experiments. The global sheep diversity panel includes animals from 74 diverse breeds sampled from Asia, Africa, South-West Asia (the Middle East), the Caribbean, North and South America, Europe, and Australasia. The array content was augmented with an additional 583 markers for parentage testing and traceability in globally diverse breeds of sheep. These include 163 highly informative parentage markers (MAF ≥ 0.3) in 48 ± 5 breed groups⁵ that enable accurate parentage testing and traceability in many of the world's sheep breeds.

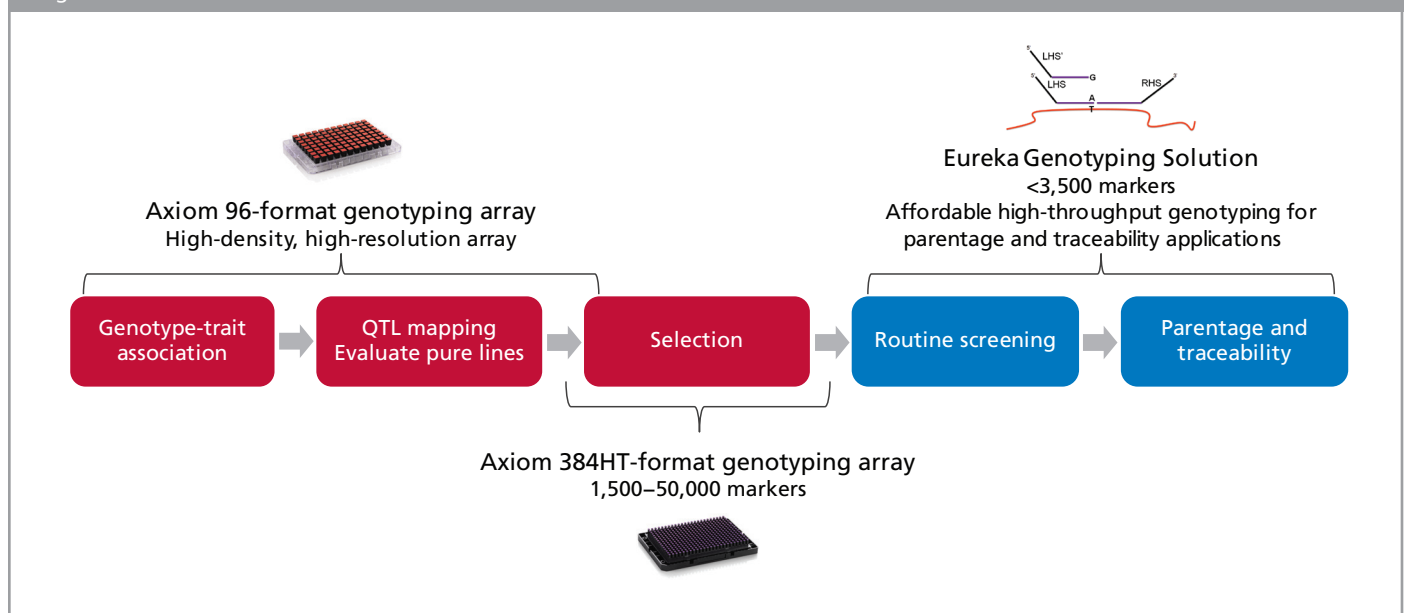
Genotyping solution continuum for animal genetics

The high-density Axiom Ovicap Genotyping Array can be used to analyze samples from different populations and transfer markers of interest to Axiom™ 384HT myDesign™ Custom Array or Eureka™ myDesign™ Genotyping Panel. The lower-complexity Axiom custom arrays and Eureka genotyping panels can be designed in as few as six weeks and allow the selection of a subset of targeted markers. Eureka™ Bovine Parentage Panel with 122 ISAG parentage markers is an example of a Eureka genotyping panel that allows for affordable parentage identification. The capability to use a larger number of markers in parentage assignment at an affordable cost can accelerate genetic improvement in bovine by increasing pedigree accuracy.

Automated genotyping and classification

Genotyping is performed using Axiom™ Analysis Suite software in a convenient 96 format. With one-click analysis, hands-on time for genotyping is reduced, minimizing costs and time to results. Data from Axiom Ovicap Genotyping Array is analyzed using Axiom Analysis Suite software, as per the *Best Practice Supplement to Axiom Genotyping Solution Data Analysis User Guide* (P/N 703083 Rev. 3). The number of polymorphic markers per species depends on the number of samples and breeds genotyped on the array. Data is automatically clustered, assigned genotypes, and classified into six categories for easy visualization.

The continuum of the genotyping solution for animal genetics from Affymetrix. Axiom Genotyping Solution with high-density Axiom arrays is ideal for applications such as genotype-trait association, QTL mapping, and pure-line evaluation. In routine-use applications, such as genomic selection in routine breeding where higher throughput is required, the Axiom 384HT format offers the capability to genotype 50,000 markers and many thousands of samples per week. Applications such as traceability, parentage, and identification of recessive alleles can leverage the genotyping-by-sequencing-based Eureka genotyping assay at a much higher throughput across targeted loci.



References

1. Matukumalli L. K., *et al.* Development and characterization of a high density SNP genotyping assay for cattle. *PLoS ONE* **4**(4):e5350 (2009).
2. Kijas J. W., *et al.* Genome-wide analysis of the world's sheep breeds reveals high levels of historic mixture and strong recent selection. *PLoS Biology* **10**(2):e1001258 (2012).
3. Tosser-Klopp G., *et al.* Design and characterization of a 52K SNP chip for goats. *PLoS ONE* **9**(1):e86227 (2014).
4. Dagnachew B. S., *et al.* Casein SNP in Norwegian goats: additive and dominance effects on milk composition and quality. *Genetics Selection Evolution* **43**:31 (2011).
5. Heaton M. P., *et al.* SNPs for parentage testing and traceability in globally diverse breeds of sheep. *PLoS ONE* **9**(4):e94851 (2014).

Ordering information

Part number	Product description	Details
550627	Axiom Bovine-Ovine-Caprine Genotyping Array	Contains one plate with 96 arrays. Reagents and GeneTitan™ Multi-Channel Instrument consumables must be quoted separately.
901606	Axiom GeneTitan Consumables Kit	Contains all GeneTitan instrument consumables required to process one array plate
901758	Axiom 2.0 Reagent Kit	Includes all reagents (except isopropanol) for processing 96 DNA samples

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