

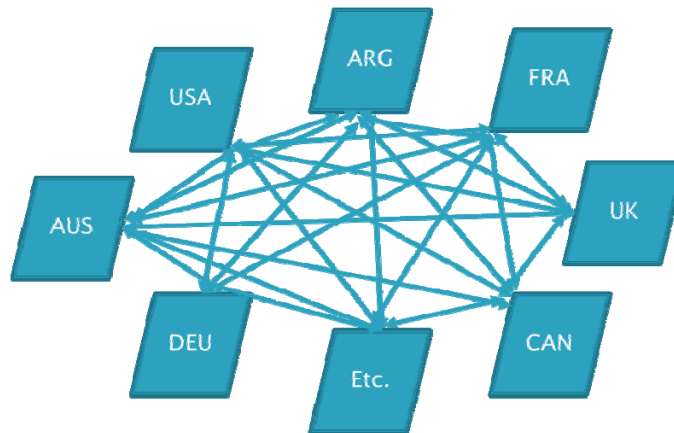
Proposal for a Genotype Exchange Parentage SNP Exchange (GENOEX-PSE) Service

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Background

Organizations in charge of parentage verification have been successfully exchanging the means to verify parentage amongst themselves for decades. However, the exchange of material internationally, whether through microsatellite results or blood types, has been manual and bilateral, requiring constant interaction with foreign counterparts and manual handling (see Figure 1 for an example). These organisations have also been adopting new technologies into their work for decades. Now, Single Nucleotide Polymorphisms (**SNPs**) technology is being adopted by these organizations, and there are new opportunities to streamline and automate the exchange of SNPs useful for parentage verification.

Figure 1: Traditional flow of parentage verification material

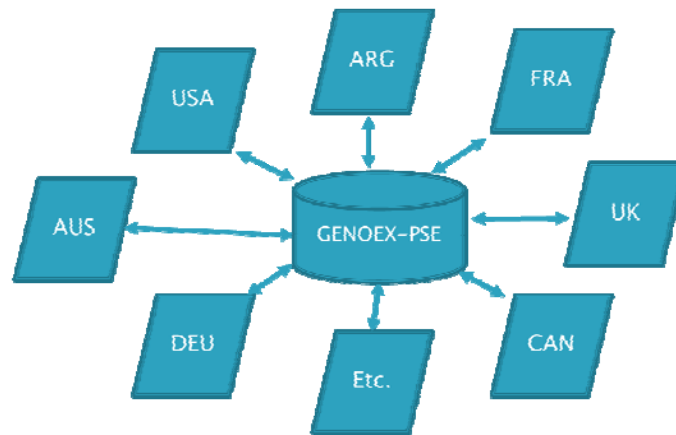


In view of the global benefits associated with an international platform for the exchange of SNP data, the International Committee for Animal Recording (**ICAR**) has approved a financial contribution to the Interbull Centre for the purchase and installation of the BC|SNPmax Data Management System from BioComputing Platforms in Finland (www.bcplatforms.com). While this data management system offers substantial flexibility in terms of services that could be offered to Interbull and/or ICAR members, this current proposal focuses solely on the exchange of SNPs useful for parentage services within dairy and beef cattle breeds.

Proposed Concept of SNP Exchange

In this current proposal, the goal of ICAR, Interbull and Interbeef is to facilitate and streamline the work of organizations in charge of parentage verification by sanctioning the establishment of a database for the storage and exchange of SNP data at the Interbull Centre. To accomplish this goal, a **Genotype Exchange Parentage SNP Exchange (GENOEX-PSE)** service and database is envisioned at the Interbull Centre. The proposed database and service is not a replacement for national authorities or historic providers of parentage verification. The concept proposed is one of a “bucket” of genotypes with only parentage SNPs with only authorized parties contributing to and withdrawing from that “bucket”. The current proposal does not include the provision of services that perform parentage analysis in its own right, nor does it seek to enable new entrants to gain easy access to parentage SNPs. This proposal for GENOEX-PSE simply streamlines the process that has gone on for decades by organizations that have been in charge of parentage verification in populations of dairy and beef cattle. Figure 2 shows this proposed flow graphically as compared to the current status depicted in Figure 1.

Figure 2: Proposed flow of parentage verification material



Underlying Principles

1. GENOEX-PSE is a tool to facilitate only the exchange of SNPs useful for parentage analysis. It is not a replacement for existing service providers.
2. GENOEX-PSE does not include the possibility for the Interbull Centre to carry out parentage analysis. Any such new service in the future would require approval from ICAR as well as Interbull and/or Interbeef.
3. The SNP information exchanged via GENOEX-PSE must only be used for parentage analysis and use for estimating genomic predictions is absolutely forbidden.
4. GENOEX-PSE is entirely a voluntary initiative allowing various countries to enter when comfortable.
5. The member organization(s) of ICAR within each country shall inform ICAR of the authorized organization(s) responsible for parentage verification. ICAR shall compile the list of authorized organization(s) within each country but will not act as judge in the case of a dispute within individual countries about providing parentage services. Such disputes must be settled at the national level for participation in GENOEX-PSE services.
6. Within the GENOEX-PSE service, it is recognized that the providers of parentage SNPs have the right to remove any submitted data in the future if they withdraw from the service.

Service Eligibility

Service eligibility will be granted only to the organizations described below:

1. Organizations officially in charge of parentage certification in each of the ICAR member countries¹, or otherwise traditionally providing parentage certificates. The list of such authorized organizations by country shall be compiled and maintained by ICAR. The number of such organizations in each country depends, among other things, on the number of breeds, and the rules governing the pedigree (herdbook) or non-pedigree (non-herdbook) animals in any specific country.
2. Organizations that, in their capacity as the official body in charge of genetic/genomic evaluation services in each of the ICAR member countries, and are under contract with one or more organizations identified in 1 above for providing parentage certification services. In such cases, each authorized organization identified in 1 above must inform ICAR of the contractual arrangement. ICAR shall compile and maintain the list of the contracted service provider associated with each authorized organization by country.
3. Laboratories that are accredited by ICAR/ISAG for providing parentage verification services and are under contract with one or more organizations identified in 1 above for providing

¹ A country with one or more resident ICAR members that provide identification, herdbook and performance recording

parentage certification services. In such cases, each authorized organization identified in 1 above must inform ICAR of the contractual arrangement, which therefore would allow the designated laboratory access only to SNP parentage data from GENOEX-PSE required to perform parentage certification services for the population of animals limited to that authorized organization.

GENOEX-PSE Expert Group

In order to define all details of a technical nature, including data quality standards, relative to the GENOEX-PSE services, ICAR shall appoint an “Expert Group” to help the Interbull Centre staff in the delivery of the proposed services. The GENOEX-PSE Expert Group shall be composed of one representative from:

1. A member nominated by the ICAR Board to act as Chairperson
2. ICAR Parentage Recording Working Group
3. ICAR Genetic Analysis Working Group
4. ICAR Breed Associations Working Group
5. Interbull
6. Interbeef
7. Interbull Centre

All GENOEX-PSE Expert Group recommendations associated with the GENOEX-PSE services shall be presented to the relevant ICAR bodies for final approval prior to implementation.

Proposed Service and Number of SNPs Exchanged

The proposed concept of a “bucket” for the exchange of SNP genotypes required for parentage analysis allows for flexibility in terms of the number of SNPs to be included. The minimum requirement for parentage verification shall be those approved by ISAG (approximately 200) but the GENOEX-PSE Expert Group may also define a larger number of SNPs useful for parentage discovery (approximately 800) involving multiple breeds of dairy and beef cattle, as well as additional SNP required for the use of microsatellite markers (approximately 1000 specifically nearby). It is understood that the combined group of all SNP for possible exchange would not lead to accurate imputation for inclusion for genomic predictions and, in any event, any such use of the exchanged SNP genotypes is strictly prohibited. Each authorized organization as defined under Service Eligibility above shall determine which groups of SNPs (i.e.: parentage verification versus parentage discovery versus microsatellite) they, or their contracted service provider, will upload into and download from the GENOEX-PSE database. Only organizations uploading any additional SNPs for parentage discovery and/or for use of microsatellite marker information shall have access to downloading those same SNPs submitted by other countries.

User Rights and Obligations

As defined under Service Eligibility above, each organization authorized to use the GENOEX-PSE service shall have full access to and maintain control over the data it uploads to the associated database at the Interbull Centre.

User rights:

1. Access to GENOEX-PSE for uploading and downloading of its own data.
2. Access to GENOEX-PSE for downloading the SNP genotypes required to perform parentage analysis services for animals under its responsibility/authority, which will primarily be males in A.I. but may include other males and potential dams. The groups of SNPs included in the genotypes for downloading must be consistent with the groups of SNPs uploaded, depending on whether the parentage services are restricted to parentage verification or also include parentage discovery and the use of microsatellite marker information.

User obligations:

1. Agree to use the data only for parentage analysis and other uses, especially for genomic predictions, are strictly prohibited.
2. Commit to uploading its data, when any exists, on a regular basis.
3. Report any pedigree conflicts identified through data received via the GENOEX-PSE services to the authorized organization in the animal's country of birth.
4. Follow ICAR rules and regulations related to the GENOEX-PSE services including policies established by Interbull and/or Interbeef;
5. Follow ICAR/ISAG accreditation rules and regulations;
6. Follow the ICAR quality assurance standards for the SNP and microsatellite data as established by the relevant ICAR bodies.

Resolution of Data Conflicts

The GENOEX-PSE service shall include a mechanism to report data conflicts back to those organizations involved with the submission of any genotype involved with the conflict. Two types of data conflicts are considered:

1. Conflicts arising from different SNP and/or microsatellite data being submitted for the same animal. In such cases, the data quality assurance measures recommended by the relevant ICAR bodies (i.e.: DNA and/or Parentage Working Groups) will be used to resolve the conflicts.
2. Conflicts arising when the SNP and/or microsatellite data is inconsistent with the reported information for the animal's pedigree. In general, the integrity of animal pedigree information lies in the hands of the authorized organization in the country of birth of the animal. In principle, all parentage conflicts, and parentage discovery results when available, should be communicated directly to the authorized organization (as compiled by ICAR) in the animal's country of birth by the organization that identified the parentage conflict. The resolution of such conflicts will remain the responsibility of the authorized organization in the animal's country of birth and any modified pedigree information would subsequently flow to Interbull and/or Interbeef services, if applicable.

Service Fees

The Interbull Steering Committee shall be responsible for establishing a non-for-profit fee structure associated with the GENOEX-PSE services and will have the right to modify such fees as needed from time to time in the future. The general aim of the established fees is that the Interbull Centre shall cover its costs associated with the development and maintenance of the GENOEX-PSE database as well as the provision of any related services. Each organization with service eligibility to use GENOEX-PSE would sign a service agreement and shall pay a fixed annual service fee to the Interbull Centre.

Expanded Services in the Future

The establishment of the proposed GENOEX-PSE database and services is the first of various possible services that can be offered using the BC|SNPmax Data Management System installed at the Interbull centre. The expansion of services, both in terms of applications and scope, will depend on the interests and demand of the members of ICAR, Interbull and Interbeef. Two specific areas of potential interest in the coming years include (a) Interbull Centre offering parentage analysis services directly over and above the "bucket" concept of the proposed GENOEX-PSE service, and (b) expansion of the GENOEX-PSE service to include the exchange of higher density SNP genotypes for the purpose of genomic predictions in beef breeds and/or dairy breeds with more limited population sizes. All such services would be offered on a voluntary basis and would only occur if, and only if, the national authorities/service providers decide to request such services from ICAR/Interbull Centre.