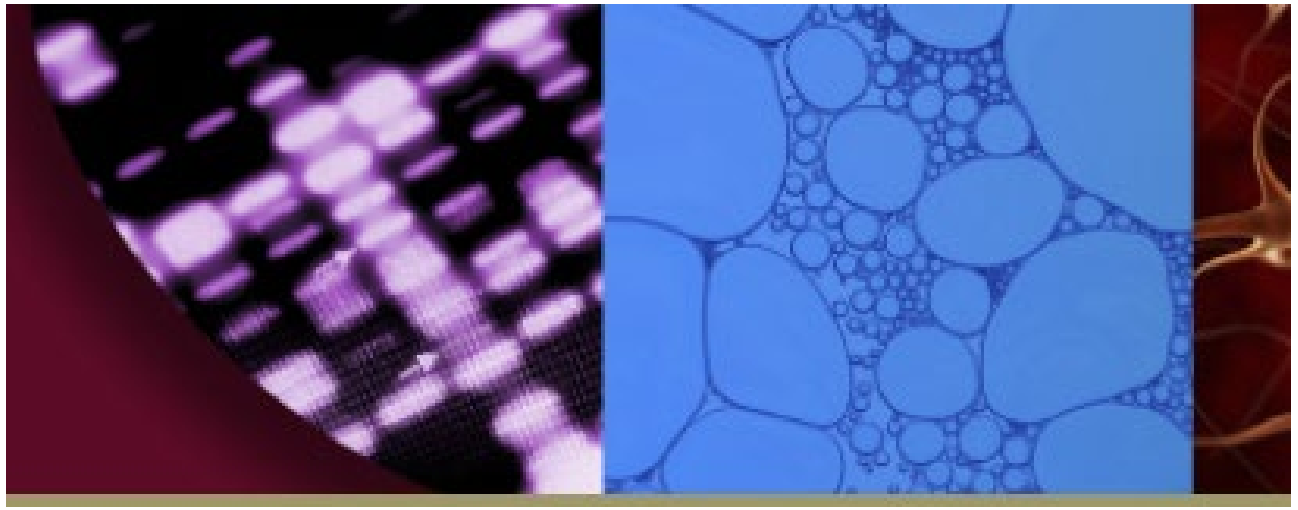
International Society for Animal Genetics

Introduction to ISAG: guidelines, comparison-test, exchange of DNA profiles



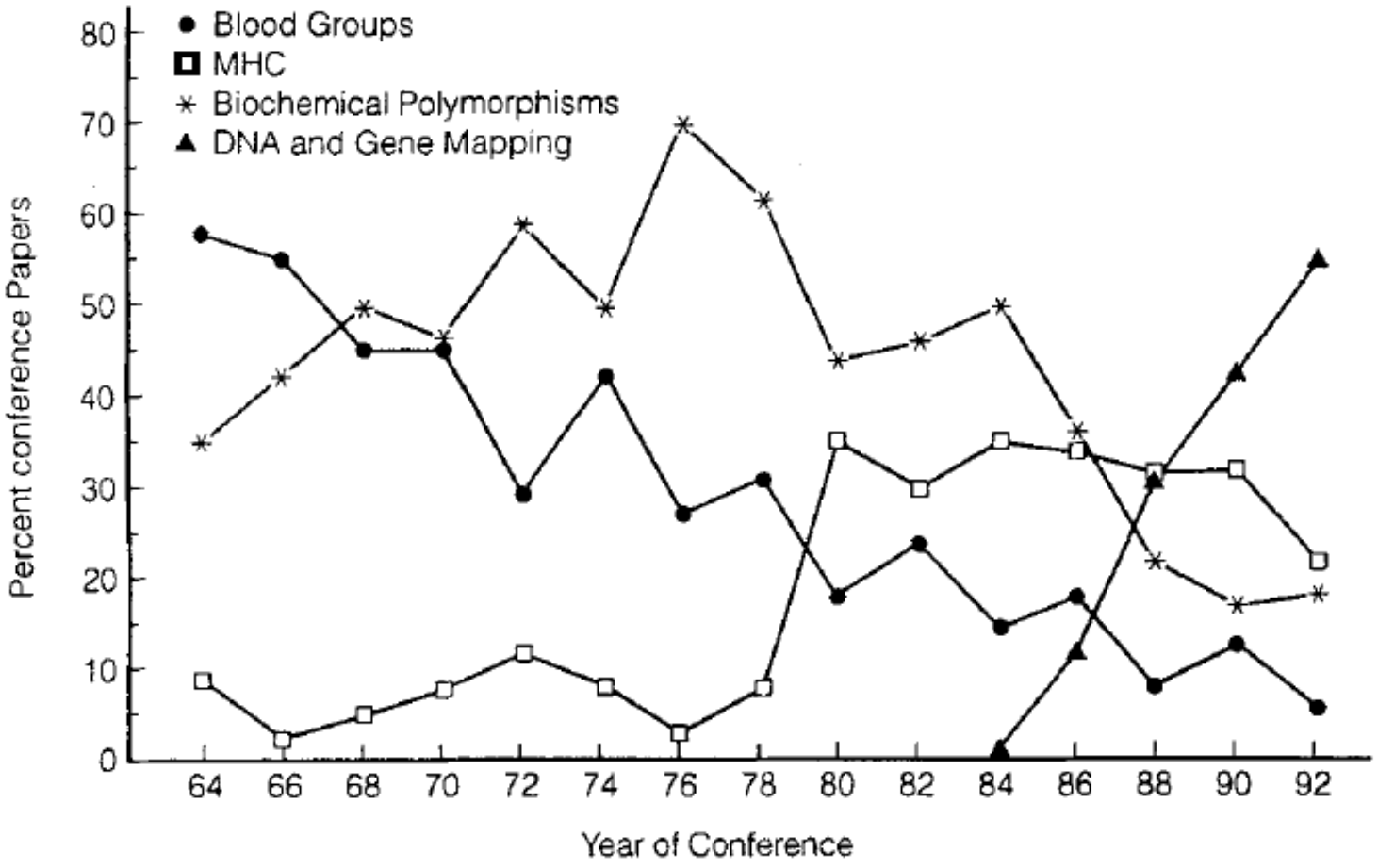
Peter DOVC, PhD

Chair of the Applied Genetics of Companion Animals Committee

History of the Society and name development

- 1954 First conference – Copenhagen
  - Beginning of international blood group typing activities
- 1966 ESABR conference – Paris
  - Establishment of European Society for Animal Blood-group Research
- 1974 ISABR conference in Davis, CA
  - Establishment of International Society for Animal Blood-group Research
- 1990 ISAG conference in East Lansing, USA
  - Establishment of International Society for Animal Genetics

Genetic marker systems and their use



Relative predominance of subjects in communications at Society's conferences.

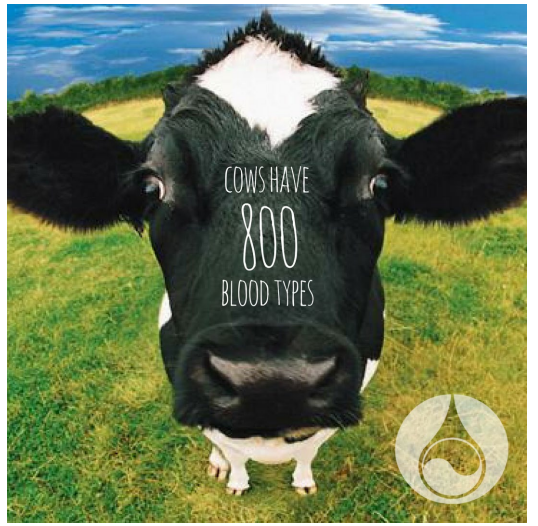
Comparison test idea

- The first **Animal *Blood Group Conference*** with four participating laboratories was held in Copenhagen in 1954.
- In the early period of comparing results between laboratories, the exchange of reagents (antisera) was crucial to ensure reliable genotyping results.
- The role of Duty laboratory has ben introduced.
- Participants have thereafter reported the results to the duty lab which compiled and circulated the results.
- The introduction of molecular markers abolished the need to exchange reagents among laboratories.

Blood Groups of some animals

Animal spp	Blood groups	
Cattle	A, B, C, F, J, L, M, R, S, T, Z	11
Goats	A, B, C, M, J	5
Sheep	A, B, C, D, M, R and X	7
Horse	8 major groups (A, C, D, K, P, Q, U, T)	Over 30
Cat	A, B, AB	3
Dog	DEA 1.1, 1.2, 4, 5, 6, 7, 8	8
Human	A, B, AB, O	4

DEA=Dog Erythrocyte Antigen



The relevance of parentage testing

- The application of molecular tools for parentage testing is absolutely necessary technical support for verification of pedigree data.
- Molecular parentage testing can reveal intentional and unintentional errors in the pedigrees and offer the chance for pedigree correction.
- In addition, the availability of molecular data allows estimation of basic population parameters (effective population size, inbreeding coefficient, genetic distances).
- The availability of molecular genetic data can be important support for the future selection strategies.

ISAG – present organizational structure

President:
Clare Gill

Secretary:
Soffia Mikko

Treasurer:
Klaus Wimmers

Executive Committee:
Martien Groenen, Sabine Hammer, Tosso Leeb, Chris Tuggle, Hans Lenstra (Ex-Officio), Ntanganedzeni Olivia Mapholi (Ex-Officio)

Committees of the Society

- Cattle Molecular Markers and Parentage Testing Committee
- Equine Genetics and Thoroughbred Parentage Testing Standardization Committee
- Small Ruminant Genetics and Genomics
- **Applied Genetics of Companion Animals**
- Ruminant Genetics and Genomics
- **Companion Animal Genetics and Genomics**
- Horse Genetics and Genomics
- Pig Genetics and Genomics
- Comparative and Functional Genomics
- ISAG-FAO Advisory Group on Animal Genetic Diversity
- Genetics of Immune Response Committee
- Comparative MHC Steering Committee
- Animal Forensic Genetics Committee
- Animal Epigenetics
- Avian Genetics and Genomics
- Applied Genetics and Genomics in other Species of Economic Interest
- Domestic Animal Sequencing and Annotation
- Livestock Genomics for Developing Countries
- Genetics and Genomics of Aquaculture Species
- Microbiomes

ISAG Companion animals Committees

ISAG Applied Genetics of Companion Animals Committee

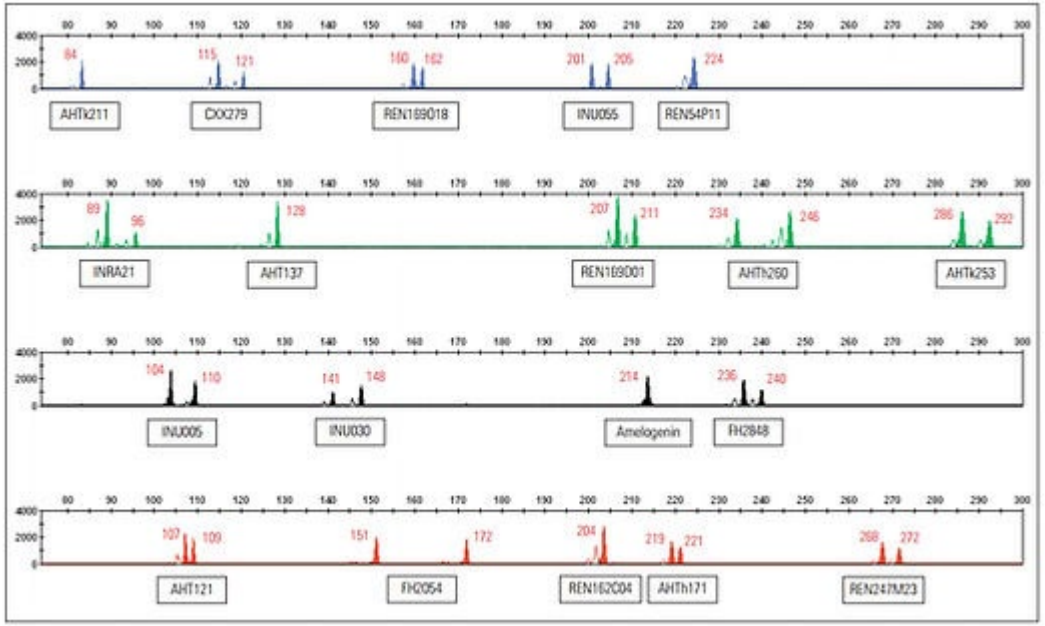
Standing Committee related to the area of Applied Genetics and Comparison Tests. The committee proposes and supervises the organization of comparison tests. During conference meetings the comparison test results are discussed. The committee establishes rules for the conduct of comparison tests.

ISAG Companion Animal Genetics and Genomics Committee

Standing Committee with a particular scientific focus.

Presently used markers (MS and SNP)

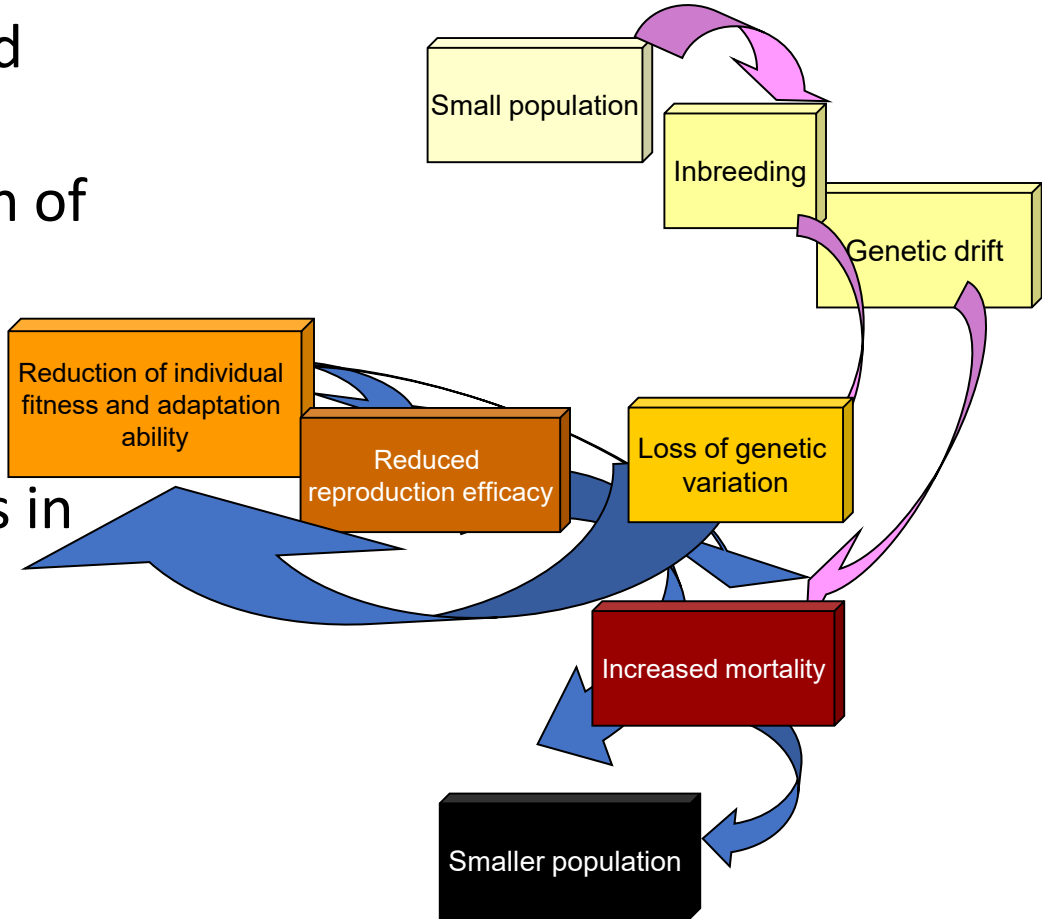
Microsatellites (STR)



Single nucleotide polymorphisms (SNP)

Problems in small populations

- All breeding populations are in the context of population genetics small populations with limited gene pool.
- Closed breeding populations experience reduction of genetic variability through generations.
- The consequence is permanent increasing of inbreeding and reduction of heterozygosity.
- The higher homozygosity in the population results in higher frequency of recessive genetic defects and reduction of fitness.
- However, in some species, the breeding practices support the reduction of genetic variability in the population (*popular sire syndrome*).



Advantages of different marker systems

- The introduction of molecular markers increased the informativity of marker systems (large number of alleles per locus and almost unlimited number of loci which can be tested)
- Unification of technologies for a large number of loci
- Adaptation of marker systems to the situation in different species/breeds
- Automatization of laboratory procedures and interpretation of results

ISAG – CT guidelines

MISSION: The aim of the Comparison Tests is to enable laboratories that genotype animal DNA to maintain high and comparable standards, to have international agreement on nomenclature and rules for kinship testing. ISAG established rules for conducting the comparison tests.

PARTICIPANTS: Institutional ISAG members, registered with ISAG can participate in Comparison Tests

ADMINISTRATION: The administration of Comparison Tests for a species is supervised by a Standing Committee which prepares the Rules of Procedure for administering the comparison test, conducting the analyses and for resolving disagreements regarding the test results.

- Announcements of the Comparison Tests is communicated by the Secretary of ISAG to all institutional members, in accordance with timelines published in the Rules of Procedure for the Comparison Test.
- The list of genetic markers subject to comparison are identified on the ISAG website, including accepted methods for reporting and relevant technical information.
- The nature, preparation and handling of samples for the test shall be identified by the duty laboratory.

Organization of Comparison-tests

Organization: CTs are performed regularly biannually. Application forms, technical details and time schedule are announced on the ISAG web page.

Material: The nature, preparation and handling of samples for the test shall be identified by the duty laboratory. The material for CT contains DNA samples from 22 animals, from which 2 samples represent reference samples with genotypes known in advance. The genotypes for reference samples are in responsibility of the duty laboratory.

Grading laboratory performance: The Genotype Rating System is established for the ISAG recommended markers. Laboratories report test results to FASS and FASS shall provide all participants with the results for all laboratories no later than 3 weeks prior to the Conference.

At the Conference, all participants shall have the opportunity to discuss the interpretation of the results

If a participant disagrees with the assignment, they can appeal the decision through a process of binding arbitration using a mutually agreed arbiter, as defined in the Rules of Procedure for Conducting Comparison Tests. Laboratories get assigned a score based on the final, agreed genotypes.

Exchange of DNA profiles among laboratories

- Genotyping of ISAG sets of markers in the laboratories which are ISAG institutional members is based on common technology (or technologies delivering comparable results) which allows direct comparison of genotyping results. New technologies shall be tested prior to their application in CT.

- Nomenclature: ISAG is permanently working on harmonization of the nomenclature for genetic markers used in CT for different species. This nomenclature is accepted from all laboratories participating in the CT.

- Basis for comparison of results: The use of standardized sets of markers (and some additional markers for some species) and standardized methodology of genotyping and nomenclature allow reliable comparison of genotyping results among laboratories and exchange of genotypic data for animals missing in the pedigree or for clarification of different results among laboratories.

Advantages of genetic testing

- Fast verification of the pedigree data
- Estimation of basic population parameters
- Possibility to extend standard marker locus analysis for loci associated with diseases and phenotypic traits
- Information base for future breeding decisions

Thanks for your attention!