Introduction

When the International Society for Animal Genetics (ISAG) held its 24th International Conference in Prague in July 1994 the Society was able to celebrate the 30th anniversary of the formation of the European Society for Animal Blood Group Research (ESABR) which also took place in Prague. After two changes of name, ESABR developed into what we know today as ISAG. This paper will try to describe the developments which led to the formation of ESABR and the philosophy behind it all.

Early animal blood group research

Studies of animal blood groups were initiated in 1900 by Ehrlich and Morgenroth, i.e. in the very same year that Mendelism was rediscovered and the first human blood groups were described. At the same time they introduced the immunization technique which has been utilized ever since to advantage for the detection of blood groups in many species. In the following period up to 1939 experimental studies of animal blood groups took place in many laboratories in Europe and the USA. In Gottingen, Germany, Schermer and Kaempffer made elaborate studies of horse blood groups and Kaempffer (1935) was probably the first to utilize blood groups for parentage tests in an animal species. These and other similar activities in Europe were interrupted or destroyed during World War II. Irwin (Fig. 1) and co-workers at the University of Wisconsin, Madison, USA initiated blood group studies on birds and cattle in the 1930s. In cattle these studies resulted in a number of important papers by Ferguson (1941), Ferguson et al., 1942 and by Stormont (Fig. 2) (1950, 1952) and Stormont et al. (1943, 1951) which demonstrated the occurrence of a large number of antigenic factors on cattle red cells determined by genes at at least nine different loci. Professor Irwin (1947) introduced the term immunogenetics for that part of the science of genetics which utilizes immunology as a tool for studying genetic characteristics and variation.

Why animal blood group research in Europe?

In the beginning of the 1950s there was an obvious interest among European animal breeders and geneticists in taking up immunogenetic studies. These were expected to open new possibilities for research in population genetics and facilitate the search for markers of genes influencing production or disease. However, the main reason why funds became available for animal blood grouping was a very practical one. An acute need had arisen for accurate animal identification and for solving cases of disputed parentage in cattle. By 1950 artificial insemination had reached wide application in all the major European dairy countries. The discovery by Polge and co-workers in 1949 that bull semen could be stored frozen and used later for artificial insemination (AI) convinced officials and leaders of AI associations that accurate methods for pedigree control were essential.

Young Europeans visit the Madison laboratory

In the Nordic countries Professor Ivar Johansson of the Royal Agricultural College, Uppsala and Professor Karl Rottensten of the Royal Veterinary and Agricultural College, Copenhagen had maintained close contact with the Department of Genetics at Madison and knew about the work by Professor Irwin’s group. Discussions were taken up with the Nordic AI associations about cattle blood group research and they agreed to sponsor studies in Madison for one young scientist from Denmark, Norway and Sweden.

Mikael Braend of Oslo (Fig. 3), Agner Neumann-Serensen of Copenhagen (Fig. 4) and Jan Rendel of Uppsala (Fig. 5) were selected for studies in the Madison laboratory. Each spent between 8 and 12 months in the laboratory in the period 1952–1953 and all three overlapped for about 2 months, which established a friendship which later proved very useful in the building up of Nordic and European cooperation on animal blood group research. In 1954 the Madison laboratory had an additional European guest scientist: Jacob Bouw (Fig. 6), Wageningen, The Netherlands.

Besides Dr Irwin (who was then department chairman) the main teachers of the European guests were W H Stone (Fig. 7) and T W Miller, then senior graduate students. The Department of Genetics was a very active place. There were professors covering a wide variety of subjects such as plant genetics, animal breeding, human and population genetics, reproductive physiology, cytology, immunogenetics and microbial genetics. The atmosphere was ideal for cross-fertilization of ideas. Coming from specialized small colleges of agriculture and veterinary science with then rather narrow interests, the European guests found the environment very stimulating. Each week there was an all-embrazing graduate seminar in genetics where the numerous graduate students from many different countries met with their professors for discussions. Irwin's group comprised no fewer than nine graduate students and guest researchers. In addition to learning cattle blood grouping the students participated in research projects leading to publications on the immunogenetic relationship between the A, J and R antigens in man, cattle and sheep (Neimann-Sorensen et al. 1954) and on the epistatic action of genes controlling the R, O and J blood groups in sheep (Rendel et al. 1954). The four European visitors all had the opportunity to meet with Clyde Stormont, who was one of the pioneers of cattle blood group research. He had then long since moved from Madison to Davis, California.

The second comparison test and meeting was held in Uppsala. at which one additional country was represented, namely Finland through Gunvor Lindström (see Fig. 35). In addition Osterhoff, who was then a graduate student at Uppsala, also participated (Fig. 9). He later developed an animal blood

The interest for cattle blood grouping was also great in several other European countries. When the first established laboratories had developed sufficient amounts of their own reagents, institutions which intended to set up laboratories received as gifts reagents developed by the laboratories in Copenhagen, Oslo, Uppsala and Wageningen in much the same way as these had received sera from the Wisconsin laboratory. The Copenhagen laboratory played a particularly important role in this regard. Tribute should be given to Neimann-Sørensen and the department head Professor Moustgaard (Fig. 8) for their generosity.

One of the major objectives of all the European animal blood grouping laboratories was to provide a service to the livestock industry. Another objective was naturally research in which the laboratories developed different interests and specialities. Work was started also in species other than cattle. For instance Andresen of Copenhagen initiated work on pigs in 1955 (Neimann-Sorensen et al. 1956). Podliachouk was early in a position to describe 11 blood group factors in the horse (Eyquem et al. 1956). The service typing in cattle often provided the economic basis for the laboratories and their research.

Early blood group meetings and comparison tests

The involvement in service typing made it imperative that the test results were reliable and repeatable. The Scandinavian laboratories operated in close cooperation from the very beginning and the Dutch laboratory soon joined. A meeting for comparing typing reagents took place in Copenhagen in late 1954 with Bouw, Braend, Neimann-Sorensen and Rendel. Ninety-six different blood typing reagents, supposedly detecting 42 different antigenic specificities, were then tested against blood from 40 different cattle. The results were very encouraging with good agreement for most of the antisera compared. In ESABR and ISAG this little meeting has subsequently been referred to as the 1st Animal Blood Group Conference. This somewhat elevated status is the reason that the second Prague conference is said to be the 24th Conference of Animal Genetics, and that the Prague meeting in 1964 was the 9th European Blood Group Conference rather than the first one.

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grouping laboratory at Onderstepoort, South Africa. The third meeting took place in Oslo. In addition to the comparison tests, these early meetings were used for discussions on techniques and exchange of preliminary research results. The Oslo meeting was also used to discuss the future Nordic cooperation with representatives of the national AI association. The idea of having a central Nordic laboratory for reagent production with satellites in the other Nordic countries was finally given up. Finland would, however, continue to buy reagents from Copenhagen rather than produce antisera themselves. It was agreed that cooperation in other respects should continue with unaltered support from the AI associations.

The Helsinki meeting in 1958 brought the question of standard reagents a step further. This meeting was attended by 10 European laboratories. New to the circle were Belgium (Bouquet) and Czechoslovakia (Matoušek; Fig. 10). Neimann-Sørensen proposed a procedure for selecting and handling standard reagents and Braend commented on the results from the USDA blood typing repeatability and standardization tests which were started in 1956 and in which the laboratories in Denmark, The Netherlands, Norway and Sweden had participated since the second trial (see 'The American connection', p. 7). The meeting felt that, as the traditional European comparison tests had become very large and a burden on the laboratory arranging both this test and the annual meeting, the procedure should be changed. In the future one laboratory designated as the duty laboratory for a given year's comparison test would send 40 samples of blood to each collaborating laboratory. The participants should thereafter report the results to the duty lab which would compile and circulate the results. It was also recommended that the USDA test should be carried out once rather than twice a year. In addition it was decided to start selecting standard reagents and a committee was selected for preparing this and other matters concerning European collaboration. The committee was composed of Drs Braend, Oslo; Neimann-Sørensen. Copenhagen; Rendel, Uppsala (Göttingen and Munich), The Netherlands, Norway, South Africa, Sweden, UK and Yugoslavia (Ljubljana) took part in the comparison test, and all except Yugoslavia were represented at the meeting. In addition to Osterhoff of South Africa there was one other overseas participant: Dr Stone of Madison. At the meeting the point was raised about the desirability of selecting standard reagents to be used as references particularly by new laboratories intending to develop batteries of test sera.

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and Schmid, Munich (Fig. 9). The group of people in Europe interested in animal immunogenetics was thus for the first time represented by an elected body, called the 'steering committee'. The person on the committee who was in charge of the standard tests was called the 'executive member'.

The formation of a European Society is discussed

In January 1959 the committee elected at the Helsinki Conference met in Copenhagen to discuss the procedure for the selection of international standard reagents (Copenhagen 1959). A procedure was worked out and applied for the first time during the preparation for the Munich Conference. Under the leadership of Schmid, the Munich laboratory tested no less than 89 different 'candidate reagents' for 25 antigenic factors in cattle against 268 blood samples from 13 countries. Standard reagents were thereafter selected for 15 antigenic factors, while no candidate for the remaining 10 fulfilled the requirements. Through this selection of standard reagents the 6th Animal Blood Group Conference in Munich (1959) has become a milestone in European collaboration in the field of animal immunogenetics. The meeting was successful also in other respects. It was attended by about 40 scientists from 15 countries representing 21 institutions. The four main papers on the agenda dealt with relationship between blood groups and quantitative traits in cattle and poultry. The country reports showed an emerging interest in biochemical genetics and in addition to cattle work was presented on chicken, dogs, elk, pigs and reindeer. The Conference resulted in printed, bilingual (German/English) proceedings of 111 pages (Munich 1959).

The 7th Conference in Edinburgh, UK, 1960 (Fig. 11) The Edinburgh meeting was organized by Hall and co-workers at the Animal Breeding Research Organization and was attended by more than 40 scientists coming from 17 countries, representing...
29 different institutions including the Food and Agriculture Organization of the United Nations (FAO) (Edinburgh 1960a). The coverage was wider than ever before. Several papers were given on protein polymorphism and reports on species other than cattle were well represented. The Edinburgh meeting came to play an important role in the future European cooperation.

At the business meeting (Edinburgh 1960b) there were three major issues for discussion:

1) questions related to comparison tests, standardization and future meetings;
2) the relations with EAAP; and
3) the question of whether the cooperation could continue as a group of friends or whether some form of society would be required.

The first issue was easily resolved. It was decided that the next meeting would be held in Ljubljana in two years’ time, that Braend should continue as executive member for two years, and that the committee should be extended to five people with Bouw as the new member. It was furthermore decided that what had so far been called ‘standard reagents’ should more appropriately be named ‘reference reagents’. The two other issues caused more concern.

The chairman of the Study Commission on Animal Genetics of EAAP had proposed that the European immunogeneticists should cooperate with EAAP as an affiliated group sending a contact member to EAAP meetings. As the European immunogeneticists were a group of friends rather than a formal body several participants expressed doubts about the proposal. However, in the end it was agreed that Neimann-Sørensen should continue as the unofficial EAAP contact of the group (see also ‘Contacts with international organizations’, p. 7).

The FAO had recently shown interest in animal blood group research and its applications (see also ‘Contacts with international organizations’, p. 7). On behalf of FAO Rendel had in 1959 visited several North American laboratories to discuss international co-operation. In the subsequent report to FAO (Rendel 1960) it was stated that the formation of an international organization of scientists interested in animal blood groups seemed desirable. In the ensuing discussion at the Edinburgh meeting many views and opinions were expressed. (After 35 years it was certainly very amusing to read again the well formulated minutes from the meeting put together by Hall and co-workers, Edinburgh 1960b.) Obviously the time was not yet ripe to form an independent international organization on animal immunogenetics, particularly as there were no representatives at the meeting from the important North American laboratories. It seemed preferable to postpone the matter and continue as an informal group of friends. In the discussions the need for funds for bringing together a truly international group was stressed by many speakers. Dr Kestevan, then Director of the Animal Production and Health Division of FAO participated in the meeting and responded later on by having FAO arranging such an international meeting in 1963 (see ‘Contacts with international organizations’, p. 7).

The Edinburgh meeting was the first one in which Neimann-Sørensen did not participate. He had functioned as the informal leader of the group, for instance in correspondence with the North American laboratories about nomenclature. Unfortunately he had to give up active work in immunogenetics. In early 1962 he took up a demanding post as leader of the Danish National Cattle Research Institute and professor at the Royal Veterinary and Agricultural University. Thereafter Braend became the spokesman of the committee.

At the Edinburgh meeting it had become obvious that sooner or later some kind of a formal Society had to be formed. The cattle comparison and standardization tests involved much work and soon similar activities would be needed in other species. At the same time the conferences grew larger. The major question was not whether a Society should be formed, rather when it should take place and whether the Society should be international or European. Mikael Braend and myself were in principle in favour of a fully international society particularly as our conferences had become more and more international. The general feeling was sounded out informally. It should be recalled that in the beginning of the 1960s the world was in the midst of the Cold War. Some East European colleagues felt that they might encounter difficulties in participating in a fully international society. There was also fear in some quarters that the US influence might be too strong in an international society: pragmatism was called for. In preparation for the next Conference at Ljubljana, Yugoslavia (now Slovenia) the steering committee developed the strategy that a European Society should be formed. It was understood that when circumstances allowed this could become fully international.

The 8th Animal Blood Group Conference in Ljubljana, 1962
This meeting attracted the interest of many scientists: there were approximately 120 participants, several from overseas (Canada, Japan, South Africa and USA). In addition to reports on the cattle comparison test and the test for reference reagents, 36 papers were presented by scientists in 31 institutes belonging to 19 countries, including one from the USSR (Ljubljana, 1962).
General agreement was reached on formation of a European Society for Animal Blood Group Research. A constituting committee was formed with Braend as chairman and Bouw, Moustgaard, Rendel and Schmid as members. The organizer of the next meeting, Matoušek, Prague, was added as ex-officio member (Braend 1962).

**The American connection**

Modern cattle blood typing in Europe was started by people trained in the Madison laboratory and at the start using reference reagents from that laboratory. During their stay in USA, Braend, Neimann-Serensen and Rendel had the opportunity to participate in the 2nd North American Bovine Blood Typing Conference held in July 1952 at Ohio State University, Columbus, in which three US laboratories and one from Canada took part together with representatives from several breed associations (Columbus 1952). The 'highlight' of that meeting was a description by Clyde Stormont of the complex B system in cattle and its usefulness in parentage tests and breed studies. Through the Columbus meeting the three European participants got to know practically all those involved in cattle blood grouping in North America. Contacts were thereafter maintained through correspondence, particularly with Drs Irwin, Stone and Stormont.

In the mid-1950s the dairy husbandry branch of USDA, Beltsville took the initiative to arrange a cattle blood typing and standardization trial for the North American laboratories. The laboratories in Copenhagen, Oslo, Uppsala and Wageningen were invited to participate in the programme from the second trial. The USDA programme differed from the European comparison tests by including blind repeats to check the repeatability within laboratories in the same and succeeding trials. The repeatability was found to be very high in most laboratories and that aspect of the programme was therefore abandoned after some time (Kiddy & Hooven 1961). By 1962 no less than four US and 11 non-US laboratories had participated at least once (Kiddy 1962). The USDA tests were very useful in bringing together information and results from USA and Europe. 'New factors' had been reported in many laboratories and it now became possible to decide whether European and US new factors were really new or repeats of the same factors. The naming of new factors and the correction of erroneously designated antigens also became possible.

In 1956 Dr Irwin was invited to give a keynote paper (Irwin 1956) at an international animal production conference in Madrid, Spain which gave a boost to the European interest in immunogenetics. When the European animal blood group meetings developed into scientific conferences they started to attract visitors also from the USA. For instance, Stone participated in the Wageningen meeting (1957) and several Americans, among them Drs Stormont and W E Briles (Fig. 12), took part in the Ljubljana Conference (1962). Stormont has since attended most of the ESABR, ISABR and ISAG meetings. In 1959 Rendel visited — on behalf of FAO — most North American animal blood grouping laboratories to discuss international cooperation (see 'Contacts with international organizations', p. 7).

Another European scientist, Schmid of Munich visited Madison, Davis and several other laboratories in 1959–60. At intervals starting in 1961, Stormont invited European colleagues to work in his laboratory. Braend of Norway was the first one in a series of Europeans who spent research periods in the Stormont laboratory.

Another undertaking which strengthened international collaboration and the exchange of information was the establishment of the *Immunogenetics Letter* in 1958. Its publication was sponsored by the Animal Husbandry Research Division of USDA and its first editor was Dr Scheinberg, a graduate from the Madison laboratory. The objective of the newsletter was 'to provide a medium for presentation of ideas, techniques and research reports of a preliminary nature in the field of immunogenetics'. For some years it was quite popular.

It may be concluded, that during the whole period that the European laboratories started to organize themselves into a European society, there were very close and intimate links to colleagues in North America.

**Contacts with international organizations**

*European Association of Animal production (EAAP)*

After World War II, EAAP developed into an important forum for exchange of ideas and information on matters related to applied animal science. The chairman of EAAP's study commission on animal genetics in the mid-1950s, Professor Johansson, Uppsala wanted to see the new field of animal immunogenetics included in the commission and a special group on immunogenetics with Neimann-Serensen as coordinator was formed in 1956 or 1957. As already mentioned the connection to EAAP was again discussed at the Edinburgh meeting. The animal genetics study commission was mainly directed towards quantitative genetics and applied animal breeding. The interest for EAAP among most of the animal immunogeneticists was therefore moderate. However, in at least two of the
annual EAAP meetings in the reporting period, sessions were arranged on animal blood groups and biochemical genetics, viz. in Stockholm (1960) and Lisbon (1964). These meetings were used to report on matters of particular interest to applied animal breeding.

The Food and Agriculture Organization of United Nations (FAO)

In 1958 the Danish governmental delegation to FAO made a proposal that 'the cooperation of animal blood group work, practical as well as theoretical, be developed within FAO'. It was pointed out that 'this new field can serve as an aid for animal genetics and practical animal breeding'. In countries where artificial insemination is in use, blood group investigations seem in fact indispensable... a possible scheme of cooperation within FAO should consider the following points:

1. Exchange of reagents and blood samples.
2. Holding of blood grouping meetings and seminars.
3. Promoting agreements on uniformity of standard reagents and their storing in a central laboratory.
4. Encouraging blood grouping research as an aid to breeding control studies on twins and on genetic relationships between breeds of animals.

In two additional points the importance of possible linkage between blood groups and production and the need for mutual information between laboratories were stressed (FAO 1958). The proposal was treated positively by FAO. As a follow-up Rendel was asked to undertake an exploratory visit to North America to discuss international cooperation with laboratories there. The idea of closer international cooperation was fully supported by the Americans. It was understood that matters related to reagent standardization, nomenclature and exchange of information would be central topics in the cooperation. For instance the Wisconsin laboratory indicated that they would be glad to send out some of their reagents to facilitate the selection of standard reagents but would not want to have any of their own sera selected as standards. The California laboratory would be willing to prepare some standard reagents. It was pointed out that the newly established Immunogenetics Letter could play an important role in the exchange of information. In the report to FAO (Rendel 1960) it was stated that 'the formation of an international association of research workers in animal blood groups seems desirable'. To begin with it should be an informal body to provide a means for exchange of information and materials among research workers. The recommendation of rules for the selection, storage and use of standard blood typing reagents should constitute one of its major functions.

When these ideas were presented in Rome the secretary general of EAAP was present. He argued that EAAP should be the appropriate organization to represent the blood group workers. We had a somewhat heated dialogue on the issue.

The FAO maintained an interest in animal blood group research and instituted a 'panel of experts' which met in the Hague 1963. Of its 20 members, 13 could participate in the meeting. Dr Stormont was elected panel chairman; Braend drew up lines for the future work of the panel and referred among others to the European Society for Animal Blood Group Research (ESABR). This was probably the first time this name was used internationally. Braend and Bouw described the ESABR cooperative programmes and stated that these activities could easily be extended to work on a worldwide basis. For instance no less than 28 reference cattle blood typing reagents were now available. Requirements for establishing new laboratories, the use of biochemical polymorphism, nomenclature and the possibilities for comparative breed studies using available immunogenetic and biochemical markers were discussed (FAO 1963). Three subcommittees were appointed, one for the publication of guidelines for those interested in establishing new laboratories and two on nomenclature (immunogenetics and biochemical polymorphism). Even though the panel never met again, the meeting in the Hague was very useful in that a truly international group of specialists was brought together which was in position to penetrate and analyse a number of questions which were subsequently taken up by ESABR. In this way ESABR in spite of its 'European' ramification became from the very beginning an international organization open to worldwide participation.

The foundation of ESABR at the 9th European Animal Blood Group Conference, Prague 1964

At the 8th European Animal Blood Group Conference, Ljubljana 1962, agreement was reached on the formation of a European Society for Animal Blood Group Research (ESABR). A constituting committee was formed with Braend as chairman and Bouw, Moustgaard, Rendel and Schmid as members and Matoušek. Prague, the organizer of the next Conference, as ex-officio member. Work on developing the constitution and by-laws was initiated already during the Ljubljana meeting and general agreement on the main lines was initiated during that meeting. The first draft was spelt out in detail.
Fig. 13. Ljubljana Conference 1962: J G Hall (UK) (right), and O Bohm (Yugoslavia) (left).

by Hall, Edinburgh (English mother tongue) (Fig. 13) in cooperation with the committee.

In connection with the FAO panel meeting at the Hague in 1963 the ESABR constituting committee met to discuss the constitution and the forthcoming Prague conference. The meeting was attended by Drs Braend, Bouw, Moustgaard, Rendel and Schmid. It was decided that the constitution and the by-laws needed an additional revision by the committee before the conference. It was felt that it would be desirable to have two kinds of fees, one for ordinary members and one for the institutes that participated in the reference and comparison tests. It was proposed that the former be set at UK£1 per year and the latter at UK£15. Matoušek was complimented for the preliminary plans for the Conference and for having secured funds for publishing the Conference proceedings. It was agreed that the agenda should comprise both invited (symposia) papers on special subjects and short papers by individual members. The host country should appoint the main speaker at the opening session. Each morning session should have two symposia papers and the afternoons should be open for papers by members and for the business meeting (ESABR 1963). This general set-up has been followed at most subsequent ESABR-ISAG Conferences.

When the animal blood group workers met in Prague for the 9th Conference all was prepared for the formal foundation of the European Society for Animal Blood Group Research. Dr Matoušek was responsible for the programme and arrangements.

Fig. 14. J Bouw (Secretary) and M Braend (President): preparation of the presidential speech at Prague 1964.

No less than 118 scientists from 24 different countries participated. At the business meeting the proposed constitution and by-laws were accepted. It was stated that the society should cover 'genetically determined characters of animal tissues and fluids'. (The full text of the constitution is given in Appendix 1.) Mikael Braend, Norway was elected President and Jacob Bouw (Fig. 14), The Netherlands, became Secretary. Members of the Committee (Board) included Oskar Böhm (Fig. 13), Yugoslavia, Josef Matoušek, Czechoslovakia, Johannes Moustgaard, Denmark and Jan Rendel, Sweden.

Matters regarding comparison tests and selection of reference reagents in cattle were dealt with in the usual way. Seven new reference sera were selected giving a total of 35. It was decided to arrange in the future comparison tests also in pig blood groups. The first one was carried out by the Danish laboratory (ESABR 1965).

Concluding remarks

On the whole one may say that the first nine blood group conferences accurately reflect the developments in the field of animal blood groups in Europe. First the interest was focused on cattle and antigenic characters. Thereafter interest was shown also in other species and in other types of polymorphisms, particularly serum proteins. The practical applications were from the very beginning given much attention. Gradually more fundamental questions were taken up.

The work of the Society members proved that immunogenetics and biochemical genetics are essential parts of animal genetics. This branch of genetics had so far been limited mainly to studies based on statistical analyses of population data. The interest for scientific and laboratory approaches in animal genetics and breeding grew rapidly during the period that the Society was established, often due to papers published by individual Society members.

The Society started as a small group of friends which rapidly grew larger. The subject of animal blood groups was in the 1950s considered a rather odd part of animal science among animal breeders, veterinarians and biologists: we needed each other. From 1958 when Matoušek joined the group the participation from Eastern Europe became large and scientifically very active. For the Europeans, whether we came from the West or East it was very important to have this group of friends that made it possible to exchange samples and ideas through the iron curtain.

The names of the elected committee members before the Society was officially established are given in Appendix 2.