Data Retrieval Committee Annual Report

MORE THAN HALF A MILLION BOVINE EMBRYOS TRANSFERRRED IN 2002

A report from the IETS Data Retrieval Committee-

By Professor Michel THIBIER – Chairperson.

SUMMARY

The Committee met once again in early 2003 at the IETS venue at Auckland (New Zealand). It discussed the report of the previous year and the means to make its network even more efficient. The results presented here show some progress in having more countries providing data from the embryo transfer teams. However, there is still some underestimation of the true numbers as all the teams in all countries that have an ET industry have not contributed to the IETS network.

The main feature of the Committee's report this year is that the number of bovine embryos transferred and recorded (**538,312 embryos**) has rebounded and is up close to the figures reported in 2000 and 2001. This is an increase of 20% as compared to last year. Similarly, the number of *in vitro* produced bovine embryos has increased due to a high activity in this area in two countries: Brazil and the People Republic of China. In total, **83,329 *in vitro***-produced bovine embryos were transferred and recorded in 2002.The small ruminant industry is also actively invested in embryo transfer technology with more than **130,000 sheep embryos** transferred in 2002. Similarly, there has been activity with goat and cervid embryos with 16,238 and 769, respectively, successfully collected and transferred. Equally, the horse embryo transfer industry is developing, particularly in South America and in the USA. There were **10,959 equine embryos** transferred in 2002. Although more difficult to collect, the data in the swine industry show that this technology is also of interest in this species at least in the context of research and development. Close to 200 transfers were recorded this year. The IETS Data Retrieval Committee will meet again at the next IETS conference in Portland (USA) in January 2004. It must continue to improve its network and all the practitioners should help in achieving this goal. Thanks to all of them.

INTRODUCTION: THE GREAT ADVANTAGE OF MAKING THE WORLD ET ACTIVITY KNOWN REQUIRES SOME PROGRESS IN RETRIEVING MORE ACCURATE AND COMPLETE DATA.

For the 12th year in a row, the IETS Data Retrieval Committee has been able to collect information on numbers of embryos flushed, handled and transferred in most of the species of farm animals. Although, after more than 10 years, this Committee still has some work ahead. It last met at the 2003 venue of the IETS Conference in Auckland (New Zealand), where 14 members from the various regions of the world attended. The Committee made some comments on the last year's report, which had just been published in the IETS Newsletter and also debated the best ways to provide more extensive data with greater accuracy. There are in fact two radically different problems. The first deals with those countries where there is a known ET industry (sales of equipment, etc.) but provides no data. The first step is to try to identify one of our colleagues who is able to be the national collector according to the IETS Data Retrieval Committee scheme (see previous reports in the IETS Newsletter). This requires that the collector be recognized, by his colleagues, as having no interest in getting "privileged" information as the basis of our system is relies on anonymity. The second step is to get the information and forward it to the Chairman of this Committee. Even partial information is important as it is always better to get some information rather than to get none. The current forms of this Committee, revised in 2001, are now operational and take into account the percentage of teams identified that have responded.

The second challenge of this Committee is to deal in a better manner with the information collected in those countries where data are provided. Accuracy is one factor and it is recommended that every collector follows exactly the forms of this IETS Committee (the number of flushed cows, as well as the number of embryos flushed, the numbers of transfers of fresh and frozen embryos). This format has now been repeated for more than ten years so that all practitioners know what they need to contribute with no extra work. In addition to the accuracy factor, the completeness of the data is also one point that was discussed by this Committee. In some countries, there are only a small percentage of people that respond. In one country this year, all practitioners sent their data not to a national collector but to the Chairman of this Committee directly. This has some advantages particularly when there is reluctance to let fellow nationals know about the particular activity. Experience this year has been rather positive although some improvement should be made to identify national teams who have not responded so we may reiterate the need for this data.

One question that should be re-discussed at our next meeting in Portland (Oregon, USA) is what should be done with the information of the percentage of responses given by the collector for the data he/she is providing to the Chairman. So far the decision was made that only figures from responders were taken into account with no calculation to include the non-responders. One of the reasons is that it is hard to evaluate the numbers of the non-responding population and that they are usually small teams that have little contact with the rest of the industry including the IETS.

In other words, when one country collector declares in his chart that he received data from 80% of the teams, that does not necessarily mean at all that he obtained only 80% of the total number of embryos, in fact it may well be that 98% of the total has been received. However, it is true that the numbers recorded and reported here are underestimated. It does give however, an accurate enough estimate for the world to know the scope and development of embryo transfer and associated technologies. This is the most important factor and rewarding part for this Committee. Indeed the academic world as well as the Intergovernmental International Organizations are fond of this information and are anxious to get the IETS report to stimulate reflection and support strategy. Remember the words of a recent IETS President: **"so little for the practitioners, so much to the world".**

The Committee also debated the effort that is being made for the other species. The network inside these species is not so efficient. Members of IETS that contribute to this retrieval network can only make improvement in data retrieval for these species. Finally, following the discussions we had in our Committee meeting, it was nice to see that we managed to retrieve data from countries that had provided little information in recent years. Thanks to the collectors in those countries.

1. MORE THAN HALF A MILLION TRANSFERS IN VIVO-PRODUCED BOVINE EMBRYOS.

This year, **538,312 *in vivo*-derived bovine embryos** have been transferred and recorded by the IETS Network. This is a significant increase compared to last year (+ 20% approximately) and again in the magnitude of records at the turn of the present century. This number results from various factors. The first is the fact that countries that had not responded last year are again included in this report. The results from the P R of China and India almost doubled the numbers in Asia as compared to last year. Further, Colombia, Croatia, Moldavia, Kenya, Namibia, Sudan, Zambia and Zimbabwe provided results this year. The increased numbers also results from a more extensive report from Australia. An increase in activity has been observed as well and this seems to be particularly the case in Brazil. Conversely, the activity has decreased in Europe (-8%) and in North America (-14%).

Worldwide data is shown in Table 1, a little more than 100,000 embryo collections have been recorded, which lead to more than 600,000 transferable embryos. This represents a considerable number of embryos that have been flushed. Not all of the embryos were transferred and on the whole more than 100,000 embryos were stored. The world distribution of activity according to continents is also reported in Table 1. One may see that North America has the largest number with more than a third of the total. Following are South America (22%),

Asia and Europe (in the order of 17%), Oceania (6%) and Africa (~3%). Roughly speaking, the number of transferable embryos per female flushed seems to have increased a little compared to that ratio observed the previous years with a mean of 6.2 vs. 5.9 the two last years. This is somewhat encouraging, technically speaking.

Table 1. Overall Activity of *In Vivo*-Derived Bovine Embryos in 2002.

			NUMBER OF TRANSFERRED EMBRYOS		
CONTINENTS	**FLUSHES**	**TRANSFERABLE EMBRYOS**	**FRESH**	**FROZEN**	**TOTAL**
AFRICA	**1,968**	**12,641**	**5,557**	**8,785**	**14,342 (2.7%)**
N. AMERICA	**42,238**	**265,175**	**89,472**	**99,652**	**189,124 (34.7%)**
S. AMERICA	**14,189**	**90,572**	**73,952**	**45,166**	**119,118 (22.2%)**
ASIA	**17,557**	**120,951**	**39,375**	**53,037**	**92,412 (17.2%)**
EUROPE(*)	**18,294**	**102,996**	**41,753**	**48,618**	**90,371 (16.8%)**
OCEANIA	**7,419**	**37352**	**17,631**	**15,314**	**32,945 (6.4%)**
TOTAL	**101,665**	**629,687**	**267,740 (48%)**	**270,572(52%)**	**538,312**

(*) Those European data are derived from the statistics of AETE, 2003.

One can also notice that the ratio of fresh and frozen embryos remains close to 50% with a slight advantage to the frozen embryos (52%). Another figure interesting to report is that although some countries are still reluctant to report the numbers of embryos exported, it appears that almost 30,000 *in vivo*-derived bovine embryos were exported worldwide including all continents. Good management in terms of disease control is certainly one of the key factors to allow such international movements.

Several features from North America are interesting to report. Mexico deals essentially in beef breeds with more than 90% of the cows flushed from such breeds. Mexico also contributes several hundred beef embryos to international exchanges. In the USA, it was reported that 30 certified members of AETA did not report their activity (28%) which might be one reason for the slight decrease in the numbers. Close to 30,000 cows (58% of beef breeds) were reported to have been flushed in 2002 and 63% of embryos were transferred as frozen. The USA has exported 7,005 and imported 2,314 bovine embryos. Canada as usual provided an exhaustive report for which they should be commended. The overall activity has remained almost identical to that of the previous year. Globally, three quarters (78%) of the 14,427 flushed females were of dairy breeds. This is in contrast to what was observed in the USA. A mean of 6.6 (vs. 6.4 last year) transferable embryos per donor was reported, slightly higher than the world average. The percentages of fresh and frozen embryos were each 50%. Ninety-nine percent of the frozen embryos were directly transferred. The Canadian practitioners also sex many embryos: 2,433 sexed fresh and 1,329 sexed frozen embryos were reported transferred. More than 300 embryos were split and 3 pregnancies were reported from cloned embryos. Canada reports having exported 13,664 embryos (very similar to that of the previous year) and imported 14,135 embryos mainly from the USA.

In Europe a large set of data is available (25 countries have provided their data not including Russia). From Table 2, it can be seen that France, the Netherlands and Germany remain the major countries in terms of numbers of cows flushed or embryos transferred. It is of interest to note that Spain and Sweden have returned to the top twelve European countries in ET activity. Half of the top fourteen countries (Table 2) have shown an increase in their activity with more than 15,000 embryos transferred in the Netherlands. France has had stable activity as compared to the previous year (32,710 embryos transferred) and accounts for a little more than a third of the total number of embryos transferred in Europe. By contrast, Germany and Italy, for example, have experienced a decrease in their activity by approximately 10 % with a greater decrease in Belgium and Ireland.

Table 2. The Top Fourteen European Countries Ranked According to Numbers of *In Vivo*-Derived Embryos Transferred In 2002 (AETE,2003).

COUNTRIES	NUMBER OF FLUSHES	NUMBER OF EMBRYOS TRANSFERRED
FRANCE	6,797	32,710 ≅
NETHERLANDS	2,971	15,374 ↗
GERMANY	2,567	10,141 ↘
CZECH Republic	1,321	6,808 ↗
ITALY	1,078	6,504 ↘
BELGIUM	1,016	4,140 ↘
DENMARK	850	4,501 ↗
UNITED KINGDOM	n.d	3,638(*) ↗
FINLAND	441	2,090 ↗
SPAIN	372	1,340 ↗
SWEDEN	308	1,096 ↗
IRELAND	258	1,116 ↘
SWITZERLAND	215	1,655 ↘
SLOVAKIA	206	1,138 ↘

(*)This is the only data available for this country this year.

↗↘ evolution as compared to the previous year.

The data for the top six countries outside Europe and North America are shown in Table 3. Brazil had an intense activity in 2002 with more than 110,000 embryos transferred, mainly from the beef breeds (87%). Japan (~53,000 embryos transferred) had a stable number of transfers with a majority of embryos from beef breeds (84%). The number of embryos reported transferred in the People Republic of China, such as it was possible to determine, was a little more than 37,000 embryos. The percentage of fresh embryos transferred was higher than that of frozen embryos (60%). Australia has managed this year, to retrieve data from a higher percentage of the embryo transfer teams. The Australian collector deserves our thanks. This results in a dramatic increase of the embryos transferred (close to 30,000 vs. 11,000 last year). The percentages of frozen and fresh embryos are almost identical at around 50%. South Africa has resumed its activity quite significantly once the ban on Foot and Mouth Disease was lifted. The total number of transferred embryos has almost tripled in 2002 as compared to that of 2001. Argentina has slightly decreased its activity this year with less than 10,000 embryos transferred. Most of the embryos from Argentina were from the beef breeds (87%) and most were transferred frozen (66%). Finally, India reports some activity in buffaloes, although partial, those data indicate that 124 transferable embryos were flushed and 78 were transferred as fresh and 19 as frozen. In addition, 265 buffalo embryos are in frozen storage.

Table 3. The Top Six Countries Outside Europe and North America in 2002.

		NUMBER OF EMBRYOS TRANSFERRED		
COUNTRIES	NO. FLUSHES	FRESH	FROZEN	TOTAL
BRAZIL	12 369	71 076	39 300	110 376 ↗
JAPAN	9 903	15 811	37 122	52 933 ≅
P R CHINA	7 235	22 575	15 048	37 623
AUSTRALIA	5 645	15 788	14 046	29 834 ↗
ARGENTINA	1 694	2 768	5 522	8 290 ↘
SOUTHAFRICA	1 689	5 221	8 536	13 757 ↗

↗↘ evolution as compared to the previous year.

2. A SIGNIFICANT INCREASE IN THE NUMBER OF *IN VITRO*- PRODUCED BOVINE EMBRYOS TRANSFERRED.

Again, this year, the data on *in vitro*-produced embryos have been collected as extensively as possible. The total number (**83,329**) of transferable embryos produced and transferred has increased quite significantly (Table 4). In addition, another 58,000 *in vitro*-produced embryos were imported into the P R of China but it is unknown at this stage if they have been transferred. This figure of more than 80,000 *in vitro*-produced bovine embryos is more than twice the number of last year. This is mainly due to the report from Brazil, which takes into account close to 50% of the total. It is noticeable that most of those IVP embryos have been transferred as fresh embryos. Asia has the second highest number of transfers, which is also higher than the previous year. This results from an intense activity, in addition to that in the P R China, in Japan, South Korea, Taiwan and also in Vietnam. Close to 40% of such embryos are being transferred frozen. Europe transfers *in vitro*-produced embryos but the number recorded is about half of that of Asia. However, the European numbers represent an increase compared to last year. Interestingly, in this part of the world, the origin of such embryos has been investigated and 70% of those embryos result from Ovum Pick-Up (OPU). The remaining embryos come from abattoir-collected ovaries. The number of OPU donors was 602 resulting into 5,163 OPU sessions and 7,737 transferable embryos (1.5 embryo per session). A clear underestimation of IVP embryos can be noted from North America with the data from the USA and from Oceania missing. There was almost no report on IVP from Australia or New Zealand. Africa has still a small activity in this area consistent with that of last year.

Table 4. The Number of Bovine *In Vitro*-Produced Embryos Transferred in 2002.

	TRANSFERABLE EMBRYOS COLLECTED	TRANSFERRED EMBRYOS FRESH	FROZEN	TOTAL
AFRICA	**450**	**4**	**97**	**101 ≅**
ASIA(*)	**77,199**	**13,859**	**8,968**	**22,827 ↗**
N. AMERICA(**)	**20,378**	**464**	**30**	**494 ↘**
S. AMERICA	**51,063**	**46,630**	**2,040**	**48,670 ↗**
EUROPE	**11,084**	**5,952**	**5,191**	**11,143 ↗**
OCEANIA (**)	**521**	**42**	**52**	**94 ↘**
TOTAL	**160,695**	**66,951**	**16,378**	**83,329 ↗**

(*) Several batches of imported IVF embryos into the P R China have been reported to the number of 58 000 but it is unknown at this stage if such embryos have been transferred.

(**) only one country from this region has reported those figures

↗↘ evolution as compared to the previous year.

It is hence reasonable to assume that approximately 15% of the total bovine embryos transferred are from IVP. Regarding the ratio of fresh to frozen embryos, here again there is some contrast between areas or countries in which most embryos are transferred as fresh (Brazil) as opposed to others countries, such as Italy, where more than 95% of the embryos transferred were previously frozen.

3. EMBRYO TRANSFERS IN THE OTHER SPECIES: SOME PROGRESS STILL NEEDS TO BE MADE TO RETRIEVE THE DATA.

For small ruminants, the feedback from the collectors has increased thanks to the Australian collector in particularly. Many countries have now reported from Europe and also from Canada, USA, South Africa and

neighboring countries, New Zealand, Australia, Korea, China, India and Taiwan. As shown in Table 5, more than 100,000 transferable embryos have been collected and **135,886** have been transferred. The difference results from embryos that have been exported from countries that did not provide their data. The Australian embryo transfer teams comprise more than 50% of this world activity. The number of close to 20,000 exported embryos recorded reflects the high international movement of such embryos worldwide. In addition, there is quite a considerable storage of such embryos (>20,000).

Table 5. Small Ruminants E T Activity in 2002.

		NUMBER OF TRANSFERRED EMBRYOS			
SPECIES	TRANSFERABLE EMBRYOS	FRESH	FROZEN	STORAGE	EXPORT
SHEEP	100,496	83,453	52,433	21,457	19,214
GOAT	17,921	7,004	9,234	7,843	6,784
CERVIDS	1,032	179	590	269	-

Embryo transfer is also popular in the goat population although to a lesser extent than in sheep but in accordance with the respective importance, reflected by the numbers, of these two species. More than 20,000 embryos have been collected with approximately 18,000 of transferable quality of which over **16,000** were transferred (Table 5). Many countries also contribute to these operations including Europe, Oceania, North America, Brazil, Taiwan and Vietnam. Interestingly, the ratio of fresh/frozen embryos is close to 50% (43%), which illustrates the fact that goat embryos are indeed transferred on the spot (or close to it) for many of them. Close to 8,000 embryos are in storage and 6,784 of such embryos have been moved internationally. Some small ruminant embryos have been split in Canada and 13 pregnancies were obtained from 18 transfers. The pregnancy rates in small ruminants (non-split) were 66.9% from fresh embryos and 56.9% from frozen embryos.

Finally, the cervids are also subject to embryo transfer. Two countries report regularly on to those species, namely Canada and New Zealand. More than a thousand transferable embryos were collected and close to 800 of them were transferred, most of them being previously frozen (Table 5). Canada also reports some IVF-produced embryos (n = 16) that were transferred fresh and resulted in 8 pregnancies (out of 16).

Retrieval of data in equines seemed to improve with 8 continents or countries having now reported. As shown in Table 6, almost 20,000 flushes have been performed in 2002, out of which 10,762 transferable embryos have been collected. For obvious reasons, almost all collected embryos were immediately transferred as fresh, however it is of note that more than 200 embryos were frozen and transferred. The Canadians report a pregnancy rate of 67.7% from their 62 transfers with fresh embryos and 45.5% from their frozen embryos (n=11 transfers). Quite expectedly, the USA, Argentina and Brazil are the countries with the most embryo transfer activity in this species. Other countries such as South Africa, Australia, New Zealand, Austria, Finland, Hungary and Italy do participate in such programs.

Table 6 - Equine E T Activity in 2002.

	TRANSFERABLE		NUMBER OF EMBRYOS TRANSFERRED			
CONTINENTS	**FLUSHES**	**EMBRYOS**	**FRESH**	**FROZEN**	**STORAGE**	**EXPORT**
ARGENTINA(*)	**5 000**	**2 500**	**2 500**			
BRAZIL	**4 600**	**3 020**	**3 000**	**20**	**20**	
CANADA	**119**	**75**	**62**	**11**	**11**	
EUROPE	**115**	**74**	**71**	**3**		
SOUTHAFRICA	**59**	**48**	**47**			
USA (*)	**10 000**	**5 000**	**5 000**	**200**	**150**	
Australia	**40**	**30**	**30**			
New Zealand	**20**	**15**	**15**			
TOTAL	**19 953**	**10 762**	**10 725**	**234**	**181**	

(*) Estimation given by Dr E Squires.

For the third year in a row, this Committee has decided to continue to try to collect some information about the embryo transfer in the swine industry. This is not easy as a lot of commercial companies have been very secretive. Again all these data are anonymous and when put together, they allow one to understand where the industry is headed in terms of numbers of transfers. Thanks to some of our colleagues who agreed to send their data either to the national collector or most often to the Chairperson of this Committee. We have been able to put some data together to reflect the activity in this industry (Table 7). There is still some misunderstanding regarding the criteria that this Committee has selected and hence it is difficult to put all the information in a given table. The attempt illustrated in Table 7, shows that several hundreds of flushes have been performed in swine, certainly mainly for experimental purposes. This activity has resulted in more than 5,000 embryos assessed as transferable from close to 200 sows. The Canadian report indicates that out of 43 recipients that had embryos transferred, 39 became pregnant (91% pregnancy rate). One collector indicated also that success in such transfers were good….. This certainly shows that there is some research and development taking place in this species and hence it seems interesting to continue to collect embryo transfer data for swine.

Table 7 - Swine E T Activity in 2002.

		TRANSFERABLE	NUMBER OF
CONTINENTS	**FLUSHES**	**EMBRYOS**	**RECIPIENT FEMALES**
CANADA	**129**	**2,405**	**43**
KOREA	**30**	**505**	**12**
EUROPE(*)	**NA**	**995**	**41**
(**)	**105**	**1,103**	**44**
USA	**NA**	**NA**	**80**
TOTAL	**264**	**5,008**	**176**

(*) from AETE statistics

(**) in addition to the AETE data.

In **conclusion**, the year 2002 has shown to be quite successful in retrieving data from both *in vivo*-derived and *in vitro*-derived bovine embryos as well as from other species. There is definitely still a lot of progress to be made in 1) identifying national collectors in some countries where ET takes place but where no reports were provided and 2) in some countries where more accurate and extensive data needs to be reported to the collector. However, ET activity shown here is quite dynamic, with large numbers of *in vivo*-derived bovine embryos being transferred not only nationally but also internationally. The *in vitro* production of embryos particularly in the bovine shows a contrasting trend. In some countries, the industry activity is high, in others, it seems that it is declining, the reasons for which are not well known at this stage. The reasons could be technical or economical or both? Thanks to the collectors in the Southern Hemisphere, where we had a lot of data provided on small ruminants which show in such species, embryo transfer is an interesting and adapted tool. This is well illustrated by the large numbers of embryos being transferred and moved both nationally and internationally. It is also quite difficult to trace back the numbers of ET's in equine and swine, although the results in the former are encouraging. The equine industry has obviously realized the benefits from this technology when one looks at the numbers reported here. In swine, there is still some need for research and development but it seems that the technology is improving and could be assessed as a useful tool for various purposes.

The IETS Data Retrieval Committee thinks that this report is one of the major achievements of the IETS and the whole embryo transfer industry. It certainly shows this year that this industry is active, dynamic and benefiting the producer.

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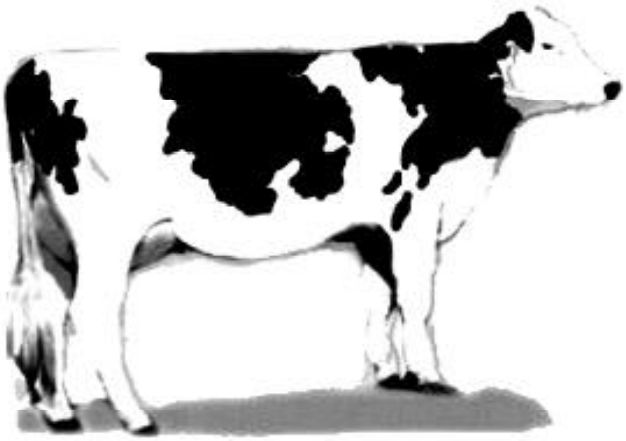
()^{n}

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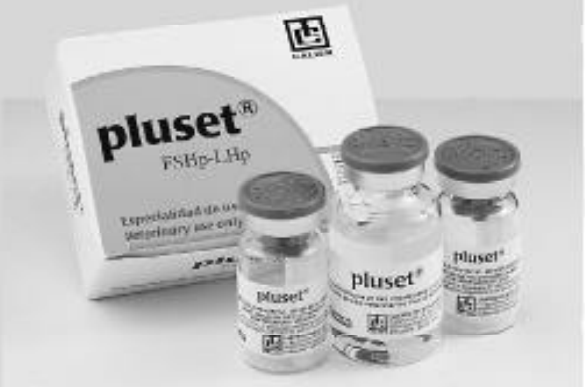

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