

The 1997 Embryo Transfer Statistics from Around the World

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A Data Retrieval Committee Report

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Summary

For the 7th consecutive year, the IETS Data Retrieval Committee has completed its world survey of the ET industry. It held its annual meeting in Boston, January 1998. At this meeting, new tables for collecting embryo data from additional species as well as *in vitro* produced embryos were agreed upon. These tables were distributed, at that time, to the local or regional ET statistics collectors. The results of the network for collecting this data are reported here. The total number of *in vivo* derived embryos from cattle has slightly decreased (by 13.6%) mainly due to fewer embryos transferred in Asia, North, and South America. By contrast other continents, such as Europe, have increased their number of embryo transfers. In total, 36 0,656 *in vivo* derived embryos have been transferred worldwide. In contrast to this slight reduction, there was a dramatic increase in the number of *in vitro* produced (IVP) embryos that were eventually transferred. This is the key event of the year! *In vitro* produced embryos have reached the market and in some countries are used on a routine basis by the farmers. Over 30,000 IVP cattle embryos have been transferred. Therefore adding up the *in vivo* and the *in vitro* data, < B>391,225 total embryos have been **transferred** worldwide. Like last years' data, embryo transfers from other species have been reported. The species include ovine, caprine, equine, swine and cervids. The IETS Data Retrieval Committee was happy to see that this network was continuing to serve its members. This was illustrated by numerous queries for statistics from Universities and International governing bodies. It was also encouraging to see that new countries, such as Paraguay, have been included in the network. The Chairman once again thanks very much all those, from close to 50 countries throughout the world, that helped collect this data.

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Introduction

The IETS Data Retrieval Committee has worked very efficiently this past year to collect the ET statistics from many countries. The IETS wants to thank its members who dedicated some of their time to that effort.

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Objectives and Methods of the Committee

The Committee held its meeting at the IETS yearly conference in Boston, in January 1998, and discussed, at large, its objectives and the most appropriate methods to achieve those goals. It was clearly established that the present system, through local or regional collectors of data from all teams involved in ET in a given area (see Thibier, 1992, IETS Newsletter, 10 (4): 11), is the best one. This is provided that the collectors convince their citizens and colleagues of the benefits the whole ET industry can receive from those world reports. Further, practitioners must be willing to release the statistics from their yearly operation. It is rewarding to see that this is most often the case, but there are places where these requests for information are still met with some reluctance. It has been re-conveyed that this data is kept strictly confidential by the local or regional collector, as had always been observed. Continued thanks to the professionalism of the collectors who never use this privileged information for their own benefit. The system works fine even though some improvements can be made by getting still more countries in the system. Particularly important are the countries of the former USSR and India where we have had difficulty the past two years reaching a national based set of data. It is undoubtedly a more difficult job in some areas of the world than in others. However, all IETS members should be able to help in this regard. Members can either identify, where relevant, somebody who has the authority and confidence of its country people or publicize and communicate the need for a good indication of our world ET industry activity. On the other hand, the Committee is happy to see new countries joining this network, such as Paraguay, and others returning, such as Mexico. Other points of improvement discussed in Boston refer to additional species that we want to cover and also on the renovated format of the forms for putting the figures together. These forms will be sent to the local or regional collectors, filled out and sent back to the Chair of the Committee for final computerization. On those forms, it was decided to stop requesting the breed distribution and just embryos from cattle. Even though simplified, this

year's experience has shown that most often breeds were not reported and therefore makes the use of that data impossible.

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Major entry of in vitro produced embryos in routine field operations in cattle.

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In cattle, we are now collecting data from both *in vivo* derived and *in vitro* produced embryos. The major observation one can make from this year's data is that *in vitro* produced embryos have their place in the routine field operations in some countries.

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Bovine *in vivo* derived embryo transfers

The *in vivo* derived embryo data presented in Table 1, show a slight reduction (10-14%) in the total number of embryo collections as well as in the total number of embryos transferred. There were a little more than 350,000 embryos reported to have been transferred this year. This reduction originates from several parts of the world, North America, South America, and Asia. This is however, in contrast with what was observed in Europe. In Europe, there was again a significant increase in the numbers of transfers (> 10%) compared with the previous year. These slight changes do result in some re-distribution by region from that reported last year. This year (1997), one can see that more than two-thirds of the embryos transferred are from Europe (35.5%) and North America (34.6%). Asia and South America transferred approximately 14 and 10% of the total respectively, which is a little less than the previous year. Oceania reported more than 14,000 embryo transfers, thanks to a more efficient data collection network this year, while Africa remained stable. It is also interesting to observe in terms of fresh vs. frozen embryos that were transferred, 53% of the total were frozen. The percentage seen in Europe is exactly reversed in North America. It was claimed in previous years, that the embryos from dairy breeds are transferred as fresh more often than those from the beef breeds. This is because more beef embryos are carried over in time and perhaps in space than dairy embryos. The dairy breeders want to take advantage of the higher genetics from those embryos right away. By contrast the beef breeders more often try to position themselves in a domestic or international markets and

to do this, need to have those embryos banked. It is not known at this stage whether this still holds true here and if this would explain the opposite trend of the European and North American distribution of fresh vs. frozen embryos. We failed in trying to obtain the breed distribution of embryos transferred in a consistent manner worldwide, and therefore, we cannot comment on this hypothesis at this stage. In South America and even more in Asia, most embryos are transferred as frozen, while the majority of embryos in Africa and Oceania are transferred as fresh. It is also worthwhile to note from the bulk data, the number of transferable embryos per flush is over 5.5 (5.54 exactly) which shows quite a high efficiency in superovulation. This figure has slightly increased as compared to the previous year (5.4). Although this report is not technical, it is interesting that some comments given by the collectors show that direct transfer of frozen embryos in the bovine has increased dramatically. The pregnancy rates with these embryos are ~58% in North America and close to this figure in some countries of Europe. It is also of interest to note that frozen direct transfer is overtaking the classical "so-called" glycerol technique. Close to 60% of embryos transferred used the direct transfer procedure both in North America and Europe. As always it is difficult to get an accurate idea of the international movements of embryos. The US however, reports that approximately 11,000 embryos were exported. Canada exported 8,531 *in vivo*-derived bovine embryos and imported 350. The People's Republic of China imported more than 1,000 bovine embryos mainly from Canada.

Table 1. Overall Bovine Embryo Collection and Transfer Activity in 1997.

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÷	÷	Transferable	Number of Embryos Transferred			÷	÷	÷
Continents	Flushes	Embryos	Fresh	Frozen	Total	Percentage		
Africa	3,031	17,452	5,238	3,528	8,766	2.4%		
N. America	27,681	178,818	65,570	59,383	124,953	34.6%		
S. America	5,380	24,425	18,542	16,712	35,254	9.8%		
Asia	14,435	72,466	11,416	38,308	49,724	13.8%		
Europe *	28,706	150,428	59,997	67,525	127,522	35.4%		
Oceania	3,074	12,669	7,610	6,827	14,437	4.0%		

Total	82,307	456,258	168,373	192,283	360,656	÷
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* The European data is derived from the statistics of AETE, ÷ 1998. Due to some typing errors in those proceedings, some data has been corrected and the data of Finland and Turkey, not available from the AETE, has been added.

From North America, the US reports a total of 76,028 transferred embryos of which 56.2% were transferred as fresh embryos. Those figures are estimated to cover about 80% of the total US ET activity. From Canada, 60 operations responded totaling 10,947 flushes, 65,653 transferable embryos, and 44,845 embryos transferred, 47.9% of these were transferred as fresh embryos. Additionally, the Canadian report indicates that 71% of the donors flushed were of dairy breeds. Mexico has flushed 390 females and more than 4,000 *in vivo* derived embryos have been transferred.

As far as Europe is concerned, Table 2 reports the numbers and trends from the various

countries, most of them are increasing in number or are stable and those with some decline have

only a marginal decrease. One can see that 4 countries do transfer almost 20,000 embryos or

more: France (with over 30,000), the Netherlands, the United Kingdom, and Germany.

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Table 2. The Top Twelve European Countries Ranked According to Numbers of Bovine Embryos Transferred in 1997 (AETE, 1998*).

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Country	Number of Flushes **	Number of Embryos Transferred ***
France	6,814	31,297 ◻
Netherlands	5,530	23,607 ≅
United Kingdom	5,192	21,444 ◻
Germany	3,837	19,620 ≅

Belgium	1,821	6,741 [□]
Italy	1,122	9,563 [□]
Ireland	883	5,610 [⌀]
Czech Republic	790	4,159 [≡]
Denmark	613	3,176 [⌀]
Spain	508	1,527 [⌀]
Switzerland	397	2,358 [□]
Sweden	382	1,884 [□]

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ú @ Ó Evolution as compared to the previous year.

* Some of the countries have sent corrections since the AETE meeting due to typing errors in the proceedings. They have been corrected accordingly.

** This corresponds to the number of collections of *in vivo* derived embryos.

*** This corresponds to the total number of embryos transferred including those *in vitro* produced, when relevant, as to better illustrate the appropriate embryo transfer activity.

The five top countries outside North America and Europe and their relevant numbers are listed in Table 3. Japan and Brazil remain the two countries with the highest numbers in this group. However, their number of embryos transferred decreased by 30 and 50% respectively, compared to last year. Some of this reduction might come from a couple of ET teams who have not responded to the request, but it also indicates a slight slow down of the industry in those countries. By contrast, Argentina seems to have a very active ET industry as close to 2,000 donors were flushed with close to 10,000 transferable embryos collected. The vast majority of the embryos collected there were from the various beef breeds with only 23.5% of the embryos from dairy breeds. Approximately 20% of the frozen embryos transferred in Argentina were imported.

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Table 3. The Top Five Countries Outside Europe and North America (1997 data).

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Country	No. Flushes	Number of Embryos Transferred		Total
		Fresh	Frozen	
Japan	13,231	8,433	31,946	40,379
Brazil	3,319	13,724	10,361	24,085
Argentina	1,855	4,142	5,135	9,277
South Africa	3,011	5,213	3,407	8,620
New Zealand	1,567	3,930	3,830	7,760

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In Vitro Produced (IVP) Bovine Embryos Transferred

This is the second year we have published statistical data for *in vitro* produced bovine embryos. As eluded too earlier, one can see (Table 4) a dramatic increase in the number of such in vitro produced embryos in cattle. More than 30,000 of such embryos have been transferred (30,569 exactly). However, only New Zealand, Europe, Asia, particularly but not only Japan, have clearly distinguished between *in vivo* and *in vitro* derived embryos. There are some IVP embryos that are produced and transferred elsewhere in the world, but as yet they are not clearly identified. Nevertheless, there is a lot to learn in terms of relevant strategies for use of this *in vitro* produced germplasm in cattle. The number of transferable embryos is close to 30,000 in Asia as reported from Japan, Korea, and Taiwan. This high number is related essentially to mass production reported in Korea. This however, covers both experimental and commercial data, and it has not been possible to divide the proportions associated with commercial operations. In New Zealand, more than 1,000 transferable embryos have been produced following 1,057 trans vagino-rectal collections with two thirds being (semi) commercial. In Europe, over 10,000 transferable *in vitro* produced embryos have been reported from 10 countries: Belgium, Czech Rep., France, Hungary, Ireland, Italy, Netherlands, Portugal, Spain, and United Kingdom. Most of them, and particularly Italy and the Netherlands, have organized themselves very efficiently to sell IVF-produced embryo services to

the farmers. This allows them to participate in the improvement of the genetic level of the cattle herds, mainly but not exclusively dairies. One can also see from the numbers transferred, there are more frozen embryos transferred than fresh embryos transferred. This holds true in Europe, Japan, and Korea, indicating that whatever the pregnancy rates reported from deep frozen IVF produced embryos, such embryos can be transferred on a commercial basis. It is of note that two countries in Europe are exception to this, Ireland and the Netherlands which both have the majority of their IVF produced embryos transferred as fresh (approximately 1,300 and 1,800 respectively).

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Table 4. The Number of Transfers of Bovine *In Vitro* Produced Embryos in 1997 (AETE, 1998).

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÷	Transferable	Number of Embryos Transferred		
÷	Embryos Collected	÷	÷	÷
Country		Fresh	Frozen	Total
Asia	28,622 *	3,151	7,409	10,560
Europe	11,674	7,166	11,142	18,308
Oceania **	1,336	1,701	÷	1,701
Total	÷	12,018	18,551	30,569

* This is the sum of both experimental and commercial embryos.

** The country involved here is New Zealand.

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Embryo Transfers in Other Species

As far as the other species are concerned, we have improved our system of collection so we do get more species information reported. We have received reports on horses with some embryos being collected and transferred, for example Mexico reports 29 collections, 8 transferable embryos, and 2 pregnancies. Iran reports some 29 transfers of fresh embryos from the Thoroughbred and Turkoman

breeds although it was not clear whether this was done last year or over the last few years. Other countries quote some pregnancies underway in this species resulting from ET, but there are no figures given. Clearly this is one point where the Committee and all IETS members could try to make an effort in helping to collect this data. For other ruminants, some countries have a good indication of what has been done, particularly where there is some international movement allowing the collector to clearly identify the operators. Table 5 collates the information and shows that the number of flushes and transferable embryos collected have not changed much in sheep as compared to last year. The number of embryos transferred however, has decreased slightly due to a lower number in fresh embryos. By contrast, goat embryos have generated a great deal of activity during 1997. Close to 10,000 goat embryos have been transferred mainly in the Southern Hemisphere. France and Mexico have each reported that ~300 goat embryos have been transferred. Finally, cervids are once again identified as a genus, which use ET technology. Both Australia and New Zealand report having transferred cervid embryos either fresh or frozen (approximately 500 combined). We have for the first time this year, thanks to our colleagues from Canada, a report on embryo transfer in swine, Elk and Bison. From 5 sows collected, 105 embryos were assessed as transferable. In Elk and Bison, 241 flushes were performed giving 1,088 transferable embryos out of which 893 were frozen. From those, 295 were transferred fresh (pregnancy rate 48% according to Mapletoft) and 419 frozen-thawed embryos were transferred with a pregnancy rate of 45% reported. There are almost 700 embryos from these species banked at this time in Canada. Some embryos were reported transferred in other species, for example, South American camelids, not only in zoos. We hope to get more of that data together next year.

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Table 5. Small Ruminant ET Activity in 1997.

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÷	÷	Transferable	Number of Embryos Transferred			÷	÷	÷
Continents	Flushes	Embryos	Fresh	Frozen	Storage	Export		
<i>SHEEP</i>	÷	÷	÷	÷	÷	÷		
South Africa	128	345	121	168	25	143		

Mexico	25	150	120	20	10	÷
Canada	51	403	83	161	310	30
Australia	79	328	380	199	÷	143
Total	283	1,226	704	548	345	316
GOAT	÷	÷	÷	÷	÷	÷
South Africa	64	301	105	269	300	269
Mexico	35	175	130	120	15	÷
Australia	613	6,475	7,776	1,007	÷	894
Argentina	÷	÷	÷	142	÷	÷
New Zealand	200	850	÷	÷	÷	÷
Total	912	7,801	8,011	1,608	315	÷
CERVIDS	÷	÷	÷	÷	÷	÷
New Zealand	88	495	395	÷	÷	÷
Australia	2	÷	24	51	÷	÷
Total	90	495	419	51	÷	÷

Conclusion

In conclusion, the ET industry in 1997, has had a very busy year with close to 400,000 bovine embryos transferred. *In vivo* derived embryos are still in the majority, approximately 360,000, but close to 30,000 *in vitro* produced embryos were also transferred. This last figure is the key event of this past year in our ET industry. We have shown the world that this technology can be used routinely to benefit farmers. Further, it can be used not only to transfer fresh but also deep frozen-thawed embryos as illustrated in this article. As far as the IETS Data Retrieval Committee is concerned, we still have to improve our collecting network to encompass more countries, more teams in the countries, and probably more species to have an even more accurate set of data. The Committee will meet again at the next IETS Annual Meeting in Quebec City, and all members are welcome to make suggestions to improve our data collection even further.

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