

**THE IETS STATISTICS OF EMBRYO TRANSFERS IN
LIVESTOCK IN THE WORLD FOR THE YEAR 1999:
A NEW RECORD FOR BOVINE IN VIVO-DERIVED
EMBRYOS TRANSFERRED**

A report of the IETS Data Retrieval Committee

By Professor Michel THIBIER, Chairman

SUMMARY

The Committee has, for the 9th consecutive year, compiled statistics of embryos collected and transferred worldwide. Geographically, all regions have participated in the survey; however, there are still some places where it has been impos-sible to retrieve such data (particularly in Asia). The statistics, therefore, are partially underestimated. By contrast, in other areas, the system has proven to be more efficient than before, particularly in North and South America. This has re-sulted in the present report, which gives a somewhat more satisfactory picture of the current situation of the ET industry. For the second year, it has also been possible to collect data for several species other than cattle. In cattle, the number of *in vivo*-derived embryos collected and transferred has once again increased with more than half a million embryos trans-ferred in 1999 (520,712), a **new record**. The number of bovine *in vitro*-produced embryos has remained stable this year as compared with the previous year (approximately 30,000 embryos transferred). However, there are still teams that have not yet reported their data. More than 10,000 embryos in each of the ovine and caprine species and close to 2,000 cervid embryos were reported transferred in 1999. Some 500 embryos of the equine species and a few thousand in the porcine and rabbit species have also been transferred in 1999.

It is concluded that the ET industry continues to be very active, and, in many species, it encompasses a larger segment of the livestock population overall, which is to the farmer s benefit.

INTRODUCTION

Following the yearly committee meeting, which was held in Maastricht (The Netherlands) in January 2000, each member of this committee has strongly contributed to this data retrieval, searching data from all species wherever possible. Using charts that were approved by the Committee, the goal was to gather sound data from most countries where ET takes place. There are still some improvements to be made. This has been particularly true in Asian countries, where it has been difficult to identify someone to collect such data, and in Oceania, where the ET teams and veterinarians have not yet responded to the questionnaires in a fully satisfactory manner. It should be reminded once more that all of these data are totally anonymous and there is no possibility for anyone to take any particular advantage of such information. In addition, following the Committee recommendation, the charts have been maintained identically for the two previous years to facilitate the compilation of data by any given ET team. Details and methods of the Committee have been reported at length in last year's report (Thibier, IETS Newsletter, 1999, 17, 4, 25-31).

The aim of this article is to report from the data received by the Committee on the numbers and distribution of embryos collected and transferred worldwide.

1. ANOTHER INCREASE IN THE NUMBER OF BOVINE *IN VIVO*-DERIVED EMBRYOS TRANSFERRED

The embryo transfer industry has **set a new record** for the second consecutive year. More than **520,000 embryos were transferred** in to recipient cows or heifers, marking the first time in history this volume has been achieved. As shown in Table 1, these embryos were collected from close to 120,000 donors, resulting in 715,000 transferable embryos, yielding an average of six transferable embryos per donor collected. This is quite a high figure for field reports. The time is quickly approaching when one million embryos will have been collected worldwide, adding yet another dimension to the industry. Close to two-thirds of the latter have been transferred, and, similar to last year's numbers, almost 50% were transferred as fresh embryos, and 50% were

transferred as frozen embryos. In terms of geographic distribution, the major trend this year was the very significant increase in the share of transfers in South America, which now contributes to almost 20% of the total transfers. Africa (mainly, but not exclusively, the Republic of South Africa) has seen the numbers of embryos transferred climb by close to 50% compared with the previous year. By contrast, the numbers in Asia are a little higher (+5%) even though there are reports missing from countries such as India, Pakistan, and others. North America and Europe maintain their activity: the numbers in North America are almost identical to those last year, and, in Europe, there is a slight increase (9,000 more embryos transferred) of approximately +8%. This could be partially explained, however, by the much better data retrieval in the United Kingdom compared with last year, thanks to the British collector and the British teams.

Table 1. Overall Activity of *In Vivo*-Derived Bovine Embryos in 1999

CONTINENTS	FLUSHES	TRANSFERRABLE EMBRYOS	NUMBER OF TRANSFERRED EMBRYOS		
			FRESH	FROZEN	TOTAL (%)
AFRICA	1,765	10,005	3,766	1,949	5,715(1.1)
N. AMERICA	51,224	299,180	98,391	99,495	197,886(38.0)
S. AMERICA	12,719	92,400	58,423	34,929	93,352(18.0)
ASIA	11,519	74,811	11,684	38,487	50,171(9.6)
EUROPE (*)	26,429	145,305	54,286	75,494	129,780(24.9)
OCEANIA(**)	15,508	92,655	29,182	14,626	43,808(8.4)
TOTAL	119,164	714,356	255,732	264,980	520,712(100.0)

(*) Those European data are derived from the statistics of AETE , 2000.

(**) Because of the low number of teams that responded in Australia, in accordance with the AETA, we have extrapolated the data from those few teams to all of the member teams of that association to aid in the understanding of the 1999 results.

A view of the European trend is given in Table 2. Most countries have increasing numbers, in particular Germany and the United Kingdom. France and Germany each transfer more than 20,000 embryos. It can also be noted

that there are now two central European countries in this top twelve table, namely the Czech Republic and Hungary.

Table 2. The Top Twelve European Countries Ranked According to Numbers of *In Vivo*-Derived Embryos Transferred in 1999 (AETE, 2000)

COUNTRIES	NUMBER OF FLUSHES	NUMBER OF EMBRYO TRANSFERRED
FRANCE	7,331	35,841 ↗
GERMANY	4,247	23,113 ↗
NETHERLANDS	3,750	18,100 ↘
UNITED KINGDOM(*)	3,558	16,255 ↗
BELGIUM	2,585	9,483 ↗
ITALY	1,159	5,971 ≅
IRELAND	n.d.	2,458 ↘
CZECH Republic	934	4,894 ↗
DENMARK	707	3,529 ↗
HUNGARY	592	2,874 ↗
SPAIN	472	1,612 ≅
SWITZERLAND	353	2,670 ≅

↗evolution as compared with the previous year

In North America, 143,057 and 48,615 embryos, respectively, have been transferred in the USA and Canada. The US reported 18,370 bovine *in vivo*-derived embryos exported in 1999, half of them from dairy and half from beef breeds. Canada indicates that there have been 9,005 bovine *in vivo*-derived embryos exported and 640 imported. There are also close to 50,000 embryos in storage. The data for countries, other than North American and Europe, that have the four highest numbers of transfers are reported in Table 3. Brazil and Japan, respectively, have transferred more than 70,000 and 45,000 embryos in 1999. Argentina and South Africa have transferred 14,000 and more than 5,500 embryos, respectively. The People's Republic of China followed with approximately 4,500 embryos transferred.

Table 3. The Top Four Countries Outside Europe and North America in 1999 (*)

COUNTRIES	NO. FLUSHES	NUMBER OF EMBRYOS TRANSFERRED		
		FRESH	FROZEN	TOTAL
BRAZIL	9,416	50,632	23,588	74,220
JAPAN	10,473	8,987	36,259	45,246
ARGENTINA	3,237	7,438	7,381	14,846
SOUTH AFRICA	1,761	3,756	1,888	5,644

(*) Because of the insufficient accuracy of the data originating from Australia and New Zealand, those countries could not be included in the present table.

2. STEADY-STATE NUMBER OF BOVINE *IN VITRO*-PRODUCED EMBRYOS

There has been some commercial activity surrounding *in vitro*-produced embryos for some time. However, because there were only a few teams reporting for a while, it was difficult to retrieve those data without the possibility of identifying those teams. Times have changed, and now more than 50 teams around the world do proceed with some *in vitro* production of embryos. The statistics reported here are not quite complete because some teams have not yet provided their data. But, however underestimated this statistic may be, it is clear that the order of magnitude of such embryos transferred is now approximately 30,000. As shown in Table 4, a considerable number of oocytes were collected (the number 166,000 is again underestimated). Japan leads all countries in this area with around 8,000 *in vitro*-produced embryos transferred in 1999 of which approximately 60% have been transferred after the deep freezing-thawing procedure. Europe, particularly Italy and The Netherlands, are also actively involved in this *in vitro* production and transfer of embryos. Several hundred nuclear-transferred embryos have reportedly been transferred by the Korean teams for experimental purposes.

Table 4. The Number of Bovine *In Vitro*-Produced Embryos Transferred in 1999

COUNTRIES	TRANSFERABLE EMBRYOS COLLECTED	NUMBER OF EMBRYOS TRANSFERRED		
		FRESH	FROZEN	TOTAL
AFRICA	421	31	17	48
ASIA	136,751	4,089	6,114	10,203
N.AMERICA	1,384(*)	2,182	117	2,299
S.AMERICA	92(*)	27	42	69
EUROPE	24,146	6,074	7,314	13,388
OCEANIA	n.d	895(*)	50	945
TOTAL	166,794	13,298	13,654	26,952

(*) Only one country from this region has reported that figure.

3. EMBRYO TRANSFERS IN THE OTHER SPECIES

Small ruminants have also been involved in the development of this industry for many years. However, the numbers (Table 5) are not quite as high as for cattle, and there is an obvious regional trend for each of those species. In the ovine, more than 12,000 embryos were transferred in 1999, mainly, and to no surprise, in Australia and South Africa. It is noticeable that the number of transferable embryos appears to be quite higher than the number of embryos actually transferred (one log difference), resulting in active embryo banking. These embryos are transferred fresh or frozen-thawed at roughly the same proportion. For caprine embryos, more than 11,000 embryos were transferred, but almost all were transferred as fresh embryos. However, there is some freezing and storage with some thousands banked. The USA also has quite an active practice with several thousands of caprine embryos transferred, almost all as fresh. For both sheep and goat, South Africa reports an active export activity at a level of several thousand embryos moved internationally. More than a thousand cervid embryos have also been transferred and even moved internationally. This activity seems to be particularly developed in Canada and New Zealand. Several teams around the world work experimentally on *in vitro* production of embryos in small

ruminants. Canada reports some activity in both deer and elk.

Table 5. Small Ruminant's ET Activity in 1999

CONTINENTS	FLUSHES	TRANSFER- ABLE EMBRYOS	NUMBER OF EMBRYOS TRANSFERRED			
			FRESH	FROZEN	STORAGE	EXPORT
SHEEP						
ARGENTINA	30	270	180			
AUSTRALIA	6,000	36,000	5,517	4,664	261	
CANADA	280	1,647	174	979	757	
CHINA (PRC)		6,744	1,000			
EUROPE		6,744	6,330			
MEXICO	31	170	170	50		
NEW ZEALAND (*)	28	136	136		130	
SOUTH AFRICA	3,076	14,748	228	257	1,803	12,484
USA	69	414	414			
TOTAL	9,514	60,129	7,819	5,950	2,951	12,484
GOAT						
AUSTRALIA	n.d					
CANADA	310	n.d	376			
CHINA (PRC)			1,000			
EUROPE		303	175			
KOREA	224	769	132			
MEXICO ⁷⁵	23	117	117	75		
NEW ZEALAND	620	6,454	1,500		330	
SOUTH AFRICA	624	3,874	72		849	3,048
TAIWAN	9	82	53		29	
THAILAND	64		30			
USA	706	8,404	8,284	45		
TOTAL	2,580	20,003	11,740	120	1,208	3,048
CERVIDS						
NEW ZEALAND	200	1,035	550	328	62	44
CANADA	280	695	174	674	96	
TOTAL	480	1,730	724	1,002	168	44

(*) Much underestimated (from the collector s comment).

Several hundred equine embryos were collected from various regions across the world (Table 6). Most of them are immediately transferred as fresh, and it is remarkable that, in contrast to other species and for obvious reasons, those embryos are almost all transferred with little embryo banking.

The swine industry is moving in to embryo transfer technology, and, although all data could not be collected, it is shown in Table 7 that several thousand embryos have been transferred, particularly from the USA. Although Taiwan has seen its activity somewhat diminished in comparison with the previous year, activity in Korea has significantly increased. Similarly, Canada has been very active in this area.

Finally, rabbits, as farm animals, are also subject to some embryo collection and transfer. Ninety-five rabbit embryos have been collected in Taiwan, and 44 were transferred after freezing-thawing. Similarly, Europe has reported, mainly from France, that 3,200 rabbit embryos were collected and transferred.

Numbers of embryos from exotic species have not yet been assembled; however, the South African report indicates that some trials are on-going on African buffaloes.

Table 6. Equine ET Activity in 1999

CONTINENTS	FLUSHES	TRANSFER -ABLE EMBRYOS	NUMBER OF EMBRYOS TRANSFERRED	
			FRESH	FROZEN STORAGE EXPORT
ARGENTINA	27	16	16	
CANADA	124	93	46	25
EUROPE	n.d	222	194	
MEXICO	12	14	14	
SOUTH AFRICA	29	21	21	
USA	252	159	159	
TOTAL	444	525	450	25

Table 7. Swine ET Activity in 1999

CONTINENTS	FLUSHES	TRANSFER -ABLE EMBRYOS	NUMBER OF EMBRYOS TRANSFERRED		
			FRESH	FROZEN	STORAGE EXPORT
CANADA	102	1,990	1,918		
EUROPE		3,995	534		
KOREA	119	2,006	77		160
TAIWAN	20	80			80
TOTAL	241	8,071	2,529		240

In conclusion, in terms of the efficiency of the present Committee to retrieve the relevant data, it can be assessed that data collection and retrieval are satisfactory, even though some improvements are still to be made. Some members were suggesting the addition of some breed distributions and even some pregnancy rates. It is thought that, at this stage, it is still premature. The overall quality of data sets from individual teams, in terms of details, has never allowed us to reasonably try to compute breed distribution. Even the split between beef and dairy cattle has been dropped as recently as a few years ago because of the lack of information from many teams. Similarly, the time to collect the mean pregnancy rates has not yet come because, in some areas, some practitioners are still somewhat reluctant to send to the collector their data, just in terms of numbers.

In terms of how dynamic is the ET industry in 1999, again, and for several consecutive years, the ET industry has been more active than in previous years. This industry not only shows its capacity to maintain a high level of the so-called classical techniques, such as the bovine *in vivo*-derived embryo collection and transfer, but also proves its ability for the innovative and effective use of newer techniques, such as *in vitro*-produced embryos and expands embryo transfer to a larger number of species, which could also benefit from this technology. There is every reason to believe that this will continue to develop with newer technologies, including that of sexed semen, for example, able to generate pre-determined gender embryos. This also demonstrates that there is an active demand from the farmers who seem to be

satisfied with all of the inherent advantages of these technologies to their livestock in terms of genetics, health security, etc.

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