Data Retrieval Committee Annual Report

TRANSFERS OF BOTH *IN VIVO* DERIVED AND *IN VITRO* PRODUCED EMBRYOS IN CATTLE STILL ON THE RISE AND CONTRASTED TRENDS IN OTHER SPECIES IN 2005.

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Summary

The committee met in early 2006 at the IETS Annual Conference venue at Orlando (Fla, USA). The results from the survey of the previous year were discussed and emphasis was addressed on the effort that is still to be made to cover more efficiently the activity in some countries, resulting in some underestimation of the numbers published. This unfortunately still holds true for the data of 2005 here reported.

In cattle, the embryo transfer industry has again broken records in numbers of *in vivo*-derived embryos transferred (612,178 transfers) as well as for *in vitro*-produced embryos (265,991 transfers). For the former, North America takes into account 45% of the total number and for the *in vitro*-produced embryos, South America (mainly Brazil) and Asia (the People Republic of China and Korea mainly) take into account respectively 48.6 and 47.9% of the total number.

In the other species, sheep and goats and to a much lesser extent the Cervids see some activity in all parts of the world; approximately 25,000 sheep embryos have been transferred in 2005, as well as more than 7,000 goat embryos and a few hundred Cervid embryos. Horse embryos are also transferred with approximately a number of 14,000. Finally, even if still essentially in an experimental approach, swine embryos are being transferred, particularly in Korea and Vietnam, and some are in commercial operations.

The year 2005 has again been a very good year to the embryo transfer industry and so to the benefits to the farmers.

Introduction

The present article reports, for the 15th year in a row, the activity of the embryo transfer industry worldwide referring to cattle and also to other domestic animal species. This report is provided as a benefit of membership to IETS members and as a public service to the rest of the world. As usual, the committee met at the IETS conference venue, this year in Orlando (Fla, USA). The report of this meeting can be found on the IETS Homepage. In brief, there were 14 members attending from all the regions of the world and they expressed their appreciation for the work being done by all the many members of the Committee. So, now for more than 15 years, IETS has been able to communicate to the world the dynamic activity of the embryo transfer industry. The major point discussed once more was the necessity to find some IETS members or other persons able to collect data from those countries where no report is dispatched. It is a little sad to see that no progress is being made these last years. Data from the People Republic of China are now being sent to the committee, thanks to those who contribute and this is significant progress from previous years. However, we still have difficulties in retrieving data from some West Asian countries and from the Middle East. Furthermore, there are still a few countries in which only a minority of practitioners respond to the national collector, particularly in Oceania. Again little progress has been made and all suggestions to improve the collection of such data will be appreciated, particularly if they are efficacious…

1. A further significant increase in the numbers of *in vivo*-collected and transferred embryos in cattle.

Again this year, the total numbers of collections and of transferred embryos have increased, which brings the total of number of embryos transferred to more than 600,000, a more than 10 % increase. Details are given in Table 1; it shows than more than 130,000 donor cows were flushed from which close to 800,000 transferable embryos were obtained. Yet as indicated above, these figures are definitely an underestimated. It is difficult to evaluate the magnitude of this underestimation at this stage, if it is in the range of ~20%, a realistic figure it seems, that would mean that almost one million of bovine transferable embryos are collected during 2005 (an estimate only). Finally, there have been 612,178 transfers recorded, obviously a large figure. It is of notice that a majority of those embryos are transferred fresh (53%) but there are significant differences between regions, South America and to a lesser extent Africa are the only continents where the numbers of fresh embryos are much higher than those of frozen. In the other continents, the trend is reversed.

Percentage-wise from the various areas, it can be seen that North America has increased its numbers and accounts for 45.2% of the total number of embryos transferred, now close to 50%! South America and Asia account, respectively, for 20.5 and 18.9% of the total. South America has slightly increased its numbers whereas Asia has slightly decreased. Europe has also shown a slight decrease and covers less than 14% of the total of transferred embryos. The European figures now include those from Israel, a new country included in the European network. Africa remains stable and the data from Oceania, as discussed is only partial, it is difficult to draw any conclusions from the numbers of this area of the world.

Some detailed features have been given in the regional reports and are interesting to share. From Africa, the regional collector, thanks to him, has been able to gather data from Kenya with more than 1,000 transferable embryos collected in this country. Most of those transfers in Africa are from beef breed donors, only 10% approximately derive from dairy females.

From the North American region, data from Mexico seem to have been more complete this year than the previous period. Here too, the beef breeds are collected in a vast majority. The Canadian report is very complete as usual, thanks to all. Here the dairy breeds take into account 75% of the total numbers of collected embryos (n =90,468). Close to 90% of transfers of frozen embryos are direct transfers and there have been 643 frozen and 1,296 fresh sexed embryo transferred. A total of 325 split embryos have been also transferred. A considerable number of embryos are currently in storage (more than 66,000) and the Canadians have imported 175 embryos and exported 15,622 embryos. The Canadians practitioners have been also involved in many transfer operations abroad, in Europe, North America and in the People Republic of China. Data from the USA were almost complete this year thanks to the efforts of many and the numbers are on the rise. The two thirds of collections were from beef donors, which seem to indicate a significant increase of the embryo transfer industry in such herds. From the total number of 230,000 approximately embryos transferred, a little less than 50% were transferred as fresh. A total of 9,216 embryos were reported as exported, mainly from dairy breeds (61%). In Asia, as expected, most of embryos transferred are taking place in Japan and the People's Republic of China but there is also some interesting activity in Korea, Thailand and Vietnam. In Japan, most of the transfers are from the beef breed (close to 80%) as opposed to China where embryos transferred are almost all from dairy breeds. Three countries from South America have reported their results this year: Argentina, Brazil and Uruguay. In those three countries, embryo transfers are almost entirely performed in beef breeds. The vast majority of those embryos are transferred as fresh in Brazil whereas 60% are transferred frozen in Argentina and ~30% in Uruguay. Details from Europe are given below. From the last region, namely Oceania, it is difficult to make any comments due to the scarcity of teams having reported, except that, to no surprise, this industry is essentially addressed to the dairy herds.

From Europe, the AETE (the European Association of Embryo Transfer) has been able to collect data from 24 countries with Israel being the new member of this network. Table 2 reports the numbers and variations compared to last year. The total has decreased as indicated above and the majority of such embryos are frozen (57%). France remains the country with the highest and stable activity. The Netherlands has slightly reduced its activity whereas Germany has increased its numbers as Italy, Denmark, Switzerland and Spain.

Data from the top five countries outside North America and Europe are reported in Table 3. Brazil remains at the top with a further increase as compared to last year (+5%). Japan and the People Republic of China have close numbers but China slightly decreases its numbers reported whereas Japan remains stable. It is of notice that if 70% of the embryos are transferred as frozen in Japan, only 45% of them are frozen in the People Republic of China. The activity in Argentina has remained fairly stable. Finally, South Africa remains in the five top with a significant increase of close to 10% as compared to the previous year, the numbers of fresh and frozen being close one to the other. Some dozens of embryo transfers in buffaloes have been reported distinctly from bovine, this occurred in Argentina, Taiwan and Thailand.

2. The number of *in vitro*-produced embryos in cattle is also in the rise, in 2005.

After the most significant jump last year, this 2005 report still shows some increase in the total numbers of *in vitro*-produced embryos transferred worldwide (+ 11%) with more than 265,000 of such embryos, again breaking the record of last year. However, the situation is quite contrasted according to regions. South America and in particular Brazil covers close to 50% of the total activity. Asia with particularly Korea and the People Republic of China, together takes into account 47 % of the total. Those two regions therefore perform more than 96 % of the total. Europe, Oceania and North America are far behind. More than two thirds of those embryos are transferred as fresh but again with some distinct patterns according to countries. In Brazil, they are almost all transferred fresh and also in Korea (93%) as opposed to China where more than 50,000 *in vitro*-produced embryos have been reported transferred frozen, including imported ones. In Europe and New Zealand, the ratio between fresh and frozen is close to 50/50 whereas in North America, most of them are transferred fresh. The Canadians reported the transfer of 105 cloned embryos. The comparison between numbers of embryos collected and transferred is also of some interest as there are two countries where the collection is important in numbers, namely Japan and Canada but where the numbers transferred are much less, most of them for the latter being exported.

3. Contrasted results from embryo transfer in other species.

Again this year, the data are incomplete; however there is here some interesting information worthwhile to share. In sheep, the total number of transferable embryos collected (Table 5) has diminished as compared to last year but it is of notice that some activity has been reported in all continents including China. Oceania (Australia and New Zealand) remains the highest contributor with more than 20,000 of such embryos collected and reported, Africa and more precisely the Republic of South Africa has also been actively involved with close to 10,000 embryos transferred. South America, North America and Europe in this decreasing order, also contribute to some extent to this industry in sheep. On the whole, more than 25,000 embryos have been transferred with a percentage of 54% fresh, and several thousands have been exported particularly from New Zealand.

In goats, the numbers are obviously less than in sheep (Table 5) with again some contribution from all the regions of the world, but nevertheless increasing. The most active areas are South Africa and Asia. The proportion of fresh and frozen embryos is close to the ratio of 50/50. It is of interest to note that Korea is involved in some programs of *in vitro* production of goat embryos and clones to the extent of the production of 410 of such embryos and 304 being transferred. The activity in Cervids although low, is still in the field with some collections and transfers (mainly as fresh) in Canada and Oceania, essentially New Zealand.

The equine data retrieval is still a matter that could be improved. We had here to accept some estimate due to the wide gap between the recorded data and the reality, as agreed in the committee. The total number of flushes and embryos are less than those of last year but this results from the lack of data from Argentina. What can be noted here is that embryo transfer is still very active in horses with several tens of thousands of embryos transferred to single recipients. To no surprise, the majority of this activity comes from North and South America and it is rewarding to see here figures from new countries in the committee, such as Columbia and Uruguay. Europe and to a lesser extent the Republic of South Africa are also involved in these transfers. Finally, it is to be noted that freezing equine embryos if yet a challenge is feasible and now performed in clinics.

Collecting data in swine is also quite a task and a warm thanks is to be given to those who responded to the committee. Countries in Asia like Korea or Vietnam do a lot of work in this species and those two are involved in large programs of in vitro produced embryos. As a result more than 100,000 collections have been reported out of which ~66,000 embryos have been recovered and assessed as transferable. Close to 30,000 embryos have been transferred. Obviously, many of those were performed in an experimental basis but not all and in any event it proves that there is also an embryo industry at stakes in this species.

In conclusion, as often stated, the embryo transfer industry is "well and alive". In fact it continues to increase its activity, breaking records in cattle for the numbers of both *in vivo*- derived and *in vitro*-produced embryos. It is world wide distributed and to their benefits, the farmers can now approach almost any genetics present in the world, by the means of embryo transfer in farm animal species provided of course that some fundamental rules in the procedures used such as those recommended by IETS (see the IETS Manual) are fulfilled.

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Table 1. Overall Activity of *In Vivo*-Derived Bovine Embryos in 2005.

		TRANSFER-RABLE	NUMBER OF TRANSFERRED EMBRYOS		
CONTINENT	**FLUSHES**	**EMBRYOS**	**FRESH**	**FROZEN**	**TOTAL**
AFRICA	**1,893**	**12,612**	**3,453**	**3,223**	**6,676 (1.1%)**
N. AMERICA	**65,520**	**392,232**	**130,523**	**146,223**	**276,746 (45.2%)**
S. AMERICA	**26,052**	**150,434**	**110,817**	**14,433**	**125,250 (20.5%)**
ASIA	**19,811**	**135,633**	**49,814**	**65,745**	**115,559 (18.9%)**
EUROPE (*)	**16,995**	**96,581**	**36,500**	**48,787(**)**	**85,287 (13.9%)**
OCEANIA (***)	**590**	**2,480**	**1,300**	**1,360**	**2,660 (0.4%)**
TOTAL	**130,861**	**789,972**	**332,407**	**279,771**	**612,178**

(*) Those European data are derived from the statistics of AETE, 2006.
(**) One country did not split the figures between fresh and frozen (Total 2,211). By convention, they were all included in the frozen column so as to take them into account in the gross total.
(***) Due to lack of responses from many ET teams from this continent, this line is highly underestimated.

Table 2. The Top Twelve European Countries Ranked According to Numbers of *In Vivo*-Derived Embryos Transferred in 2005 (AETE, 2006).

COUNTRIES	NUMBER OF FLUSHES	NUMBER OF EMBRYOS TRANSFERRED	
FRANCE	5,988	28,467	≅
NETHERLANDS	2,720	13,753	↘
GERMANY	2,712	13,731	↗
ITALY	1,120	6,330	↗
CZECH Republic	1,151	5,499	↘
DENMARK	688	4,210	↗
FINLAND	478	2,389	≅
UNITED KINGDOM (*)		2,211	↘
SWITZERLAND	319	2,204	↗
BELGIUM	451	2,119	↘
SPAIN	559	1,583	↗
SWEDEN	292	1,238	≅

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

↗↘≅ evolution as compared to the previous year

Table 3. The Top Five Countries Outside Europe and North America in 2005.

COUNTRIES	NO. FLUSHES	NUMBER OF EMBRYOS TRANSFERRED FRESH	FROZEN	TOTAL	
BRAZIL	20,370	102,717	5,000	107,217	↗
JAPAN	9,240	17,559	40,253	57,812	≅
P R CHINA	9,931	31,625	24,945	56,570	↘
ARGENTINA	3,703	5,285	8,339	13,624	≅
SOUTH AFRICA	1,716	3,409	3,149	6,558	↗

Table 4. The Number of Bovine I*n Vitro*-Produced Embryos Transferred in 2005.

	TRANSFERABLE EMBRYOS COLLECTED	TRANSFERRED EMBRYOS FRESH	FROZEN	TOTAL
AFRICA	**383**		**8**	**8**
ASIA	**136,553**	**49,099**	**78,396**	**127,495**
N.AMERICA	**29,243**	**1,451**	**18**	**1,469**
S.AMERICA	**143,916**	**129,340**	**68**	**129,408**
EUROPE	**18,545**	**2,689**	**3,127**	**5,816**
OCEANIA	**2,007**	**898**	**897**	**1,795**
TOTAL	**330,647**	**183,477**	**82,514**	**26**

Table 5. Small Ruminants ET Activity in 2005.

SPECIES	TRANSFERABLE EMBRYOS	TRANSFERRED EMBRYOS FRESH	FROZEN
SHEEP	**34,458**	**13,745**	**11,408**
GOAT (*)	**5,135**	**3,439**	**3,897**
CERVIDS	**482**	**321**	**9**

(*) the number of transferred embryos exceeds that of collected due to international movements which have not always been recorded consistently.

Table 6 Equine ET Activities in 2005.

COUNTRIES	FLUSHES	TRANSFERABLE EMBRYOS	EMBRYOS TRANFERRED FRESH	FROZEN
ARGENTINA	**ND**			
BRAZIL	**9,300**	**5,700**	**5,700**	
CANADA	**67**	**53**	**53**	
COLUMBIA	**2,800**	**1,600**	**1,600**	
EUROPE	**ND**	**509**	**711**	
SOUTH AFRICA	**77**	**79**	**59**	
URUGUAY	**5**	**2**	**2**	
USA*(*)*	**12,000**	**6,000**	**5,500**	**500**
TOTAL	**24,249**	**13,943**	**13,625**	**500**

(*) This is an estimate because only 1278 individual collections have been recorded

Table 7 Swine ET Activity in 2005.

COUNTRIES	FLUSHES	TRANSFERABLE EMBRYOS	TRANSFERRED EMBRYOS FRESH	TRANSFERRED EMBRYOS FROZEN	RECIPIENT FEMALES
CANADA	224	3,422	6,057		
KOREA (1)	17,653	19,333	19,333		
EUROPE (2)		271	192		
(3)	277	4,686	357	2,280	24 for fresh and 109 for frozen embryos
VIETNAM	85,200	35,200	1,800		12
USA	ND	3,427			
TOTAL	103,354	66,339	27,739	2,280	-

(1) *In vitro* produced and clones
(2) From AETE statistics
(3) In addition to the AETE data.

Classifieds

Upcoming Events-Continuing Education Opportunities

American Society for Reproductive Immunology, 27th Annual Meeting, Westin Harbor Hotel, Toronto, May 14-16, 2007. Plenary sessions on immunology of Infertility, endometriosis, viral and bacterial sexually transmitted infections, HIV, reproductive cancers, innate immunity in genital tract, new approaches to prevention of sexually transmitted infections, NK cells, pregnancy immunology, pre-eclampsia, fetal programming, male reproductive tract immunology, translational research.

The abstract deadline will be Feb 1, 2007. There will be poster sessions and oral presentations during the plenary sessions. Accepted abstracts will be published in the American Journal of Reproductive Immunology.

For more information, visit the ASRI Website at http://www.theasri.org or contact the local meeting organizer: Charu Kaushic, McMaster University, Department of Pathology and Molecular Medicine, MDCL 4014, 1200 Main Street West, Hamilton, Ontario, Canada Tel: 905-525-9140; e-mail: kaushic@mcmaster.ca