Dear Colleagues,

Roll up, Roll up for the magical mystery tour to Japan!

Now it’s time to remind you that the 2007 Annual Conference in Kyoto is just around the corner so be sure that you have made your travel plans, registration and hotel room arrangements, because in the beginning of January many Japanese travel around not only Japan but also the world and it will be difficult to book tickets and rooms.

I am pleased to report that we have 416 accepted abstracts (34 more than that of 2006 Orlando!) from 34 countries (Top five countries; Japan: 113, Korea: 67, USA: 51, Spain: 27 and Brazil: 21) in the 2007 Annual Conference in Kyoto. Although there was a competition to host IETS 2007 between Korea and Japan, so many Korean people are kind enough to send many abstracts to 2007 IETS Kyoto. Many thanks for Korean friends! And surprisingly form Brazil, the opposite side of the earth from Japan, and from Spain, far west European country from Japan, we have many abstracts. However, in spite of short distant fight to Japan, we do not have so many abstracts from Asia (China: 7, Thailand: 6, India: 4, Taiwan: 3, Vietnam: 3) mainly because of the travel and accommodation costs. To enhance internationalization of IETS we have to think about the way to have many delegates from countries with little funding support to attend the international meetings. Anyway, with the large number of abstracts and venue of Kyoto this year, we are expecting a large number of delegates.

As you have seen in the September Newsletter and on the website, the scientific program that Carol Keefer and Fulvio Gandolfi as well as the social program that Hiroshi Imai and the Local Organizing Committee have put together, are very exciting.

Besides the extraordinary scientific program, we have two very deserving candidates for the Pioneer and Distinguished service awards. Please take the opportunity to thank David Stringfellow, the recipient of the 2007 IETS Distinguish Service Award, for his dedication and important contributions to the Import/Export Committee from the beginning and participation in the drafting of the first sanitary protocols with the OIE. And he has also been co-editor of the IETS Manual. Congratulations also to Akira Iritani, the recipient of the 2006 Pioneer Award. His pioneering works on in vitro fertilization in domestic animals, the transgenic pig and cloning
have provided major advances that led the way forward enabling many of the technologies that we currently use on a daily basis.

Finally, I would like to thank the members for giving me the opportunity to serve IETS as a member of the Board of Governors and as President. It has been a really challenging experience, specially to organize the teleconference was something to me because it was very difficult for me, as a non-English speaker, to understand discussions among many people without seeing faces, summarize the discussions and draw conclusions. I would like to thank all the IETS Board of Governors (past and present) and FASS, for their help, counsel and especially friendship during these years. Without their help I was not able to complete my duties. Now I will be hooked them off during the Annual Conference in Kyoto, and play some songs for you to dance. We will have a new President, Naida Loskutoff, newly elected Governors (Rebecca Krisher and Ann van Soom) and Vice-President (Richard Fayer-Hosken). And we will have the chance to thank the out-going Board Members, Janneke van Wagendonk, and David Faber for all their work during the past three years. They have being outstanding dedicated people that have given a lot of themselves on behalf of all of us to make the IETS what it is today. Also leaving the Board as Immediate Past President is Matthew Wheeler. Matt has worked energetically hard on behalf of the IETS. He has been trying to improve the financial situation of our society from many aspects, and the Society, now in the future, is in better condition because of his efforts and has built a path to follow. We all owe him a debt of gratitude. I will miss his insight and tenacity during the next year, but I know he will continue to serve the IETS as needed in many years to come. Thanks Matt!

From my experience as the Board of Governors and President, serving on the Board of Governors is a fascinating experience, and I urge you members to submit your names next year as candidates for members of the Board of Governors and/or Vice-President. Please do not leave it to the Board to make all the nominations if you or some one you know is interested in serving your Society. In Japan when the Shin-Tou festival is held, in the most of case many people carry a “Mikoshi”, a sacred palanquin in English. Mikoshi is so heavy that many people are needed to carry and march along to festival shouts throughout the town. Although caring Mikoshi on the shoulder is so painful, once experienced this caring Mikoshi, people can get spiritual get together feeling and enlightenment.

I sincerely look forward to seeing each and every one of you in Kyoto, my birth place.

Best Wishes,

Takashi (TAKU) Nagai
President, IETS
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December 2006
Recent Advances in Cloning of Agricultural Animals in China

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Abstract

Cloning research was initiated as early as 1960s in China. The creative studies on fish cloning were conducted in 1960s and 1970s, but most results were published in Chinese journals. In late 1980s and early 1990s, embryonic cell cloning was successful performed in several species of livestock. After the birth of Dolly, Chinese scientists switched their studies to somatic cell cloning and have successfully cloned bovine, goat, pig, and buffalo using somatic cell nuclear transfer. In addition, cloning-related basic research and transgenic somatic cell nuclear transfer studies are also being widely performed.

Key words: nuclear transfer, cloning, China, livestock

Early cloning research and fish cloning in China

Cloning research was initiated as early as 1960s in China. Tung et al. (1963) for the first time reported nuclear transfer in fish. They obtained the inter-species cloned fish by nuclear transfer between two-subfamilies of gold fish, Carassius euratus and Rhodeus sinensis (Tung et al., 1973). Hybrid fish were obtained from the combination of nucleus and cytoplasm from two genera of fresh-water teleosts using the technique of nuclear transplantation (i.e. the combination of the nucleus of crucian (Carassius auratus) and the cytoplasm of carp (Cyprinus carpio). Morphological characteristics of these hybrid fish that have been examined so far indicate that some features such as barbs, pharyngeal teeth, the number of scales along the lateral line, and the number of vertebrae are similar to those of crucian. Some of the hybrid fish grow to normal adult fish (Yan et al., 1984). Further studies investigated the nuclear transplantation in different orders of teleosts. The nucleus of a blastula cell from Tilapia (Oreochromis nilotica, family Cichlidae, order Perciformes) was transplanted into an enucleated egg of Loach (Paramisgurnus dabryanus, family Cobitidae, order Cypriniformes). From among 3,747 nucleo-cytoplasmic hybrid (NCH) eggs two NCH larval fish (0.05%) were obtained; one died on the 6th day and the other died on the 12th day after the operation. Morphological examinations showed that both NCH larval fish had developed normally with an opened mouth except they could not take food after complete utilization of their egg yolk on the 5th day of development. This is the first report indicating that inter-order NCH larval fish can be obtained in spite of their evolutionary divergence (Yan et al., 1991)
Recently, production of seven cross-genus cloned fish by transferring nuclei from transgenic common carp into enucleated eggs of goldfish was reported. Nuclear genomes of the cloned fish were exclusively derived from the nuclear donor species, common carp, whereas the mitochondrial DNA from the donor carp gradually disappeared during the development of nuclear transfer (NT) embryos. The somite development process and somite number of nuclear transplants were consistent with the recipient species, goldfish, rather than the nuclear donor species, common carp. This resulted in a long-lasting effect on the vertebral numbers of the cloned fish, which belonged to the range of goldfish. These demonstrate that fish egg cytoplasm not only can support the development driven by transplanted nuclei from a distantly related species at the genus scale but also can modulate development of the nuclear transplants. It seems that the recombination of nucleus and egg cytoplasm from different species of fish is more feasible than that of other vertebrates, perhaps because fish were the first vertebrates to evolve (Sun et al., 2005).

After 1980s, Chinese scientists have done much work on embryonic nuclear transfer in domestic animals, and produced embryonic cell cloned goat, cattle rabbit, and pig species in early the 1990s (Li et al., 2000). After the birth of the somatic cell cloned sheep “Dolly”, Chinese scientists quickly switched their studies to somatic cell cloning of domestic species.

**Cattle cloning**

The National Natural Science Foundation of China began to support a project of somatic cell nuclear transfer of domestic animals in 1998. Cooperated with Japanese scientists, Dong et al. (2002) reported the birth of somatic cell cloned cattle by using point-hit enucleation and transfer of frozen bovine fetus epidermal cells. Cooperating with Shandong Zhongda Animal Embryo Engineering Center, the scientists in the Institute of Zoology, Chinese Academy of Sciences successfully cloned 14 calves by using somatic cells as donors, of which 13 were from a highly productive Holstein cow and the remaining one from a stock bull in early 2002. All the procedures including adult fibroblast cell culture, nuclear transfer, embryo culture and embryo transfer were conducted inside China. A total of 5 cloned calves are still alive and have been proved to be of normal fertility. Microsatellite DNA analysis showed that the genetic DNA of all cloned calves is consistent with that of donors, but has no relationship with that of the foster mother (Chen et al., 2003). The same group also produced another 15 live cloned cows and bulls in subsequent years (unpublished data). Another group used six types of bovine somatic cell lines, including a granulosa cell line of Chinese Red-Breed Yellow Cattle, a granulosa cell line of Holstein cow, two skin fibroblast cell lines of two adult Holstein cows respectively, a skin fibroblast cell line and an oviduct epithelial cell line of a Holstein fetus, for nuclear transfer. The blastocyst rates for SCNT embryos ranged from 29.4% to 41.5% and the birth rates ranged from 10.3% to 27.3% (Gong et al., 2004). Oocytes from F1 hybrid cattle, as well as their parental lines, were recovered by ovum pick up (OPU) and used as recipient cytoplasm for somatic cell nuclear transfer (SCNT). It was shown that at Day 8, the blastocyst rate from the cleaved embryos (51% versus 37% and 27%), the total number of cells per blastocyst (135+/−4.1 versus 116+/−3.6 and 101+/−4.2), and the percentage of Grade-A (excellent quality) blastocysts (54% versus 42% and 29%) in the hybrid group were all higher than that of Holstein and Yellow cattle groups. Thus the use of F1 hybrid oocytes as recipient cytoplasm significantly improved in vitro development of cloned bovine embryos relative to oocytes derived from the parental lines (Yang et al., 2005).
Further study was designed to determine if oocytes vitrified by the open pulled straw (OPS) method could subsequently be used to produce somatic cell cloned cattle. Twenty-four blastocysts derived from vitrified-thawed oocytes were transferred to six Luxi yellow cattle recipients. Two recipients (33%) were diagnosed pregnant; one delivered a cloned calf after 263 d. Thus, bovine oocytes vitrified by the OPS method and subsequently thawed supported development (to term) of somatic cell cloned embryos (Hou et al., 2005).

Chinese scientists are also devoted to producing transgenic cows by nuclear transfer (Gong et al., 2004). For production of transgenic NT cows as human proUK bioreactor, an expression plasmid for human prourokinase was constructed by inserting a bovine beta-casein promoter, a green fluorescent protein (GFP) marker gene, and human prourokinase target gene into a pcDNA3 plasmid. For production of transgenic NT cows of human thrombopoietin (hTPO) gene, an expression vector was constructed by combining the promoter of bovine beta-casein gene, cDNA of hTPO and neomycin resistance gene (pBT-L neo). Bovine ear skin fibroblast cells were transfected with the expression vector (pBT-L neo) using Lipofectamine. Cumulus cells and ear skin cell were used as donor cells and transfected with expression plasmid using the Fugene 6 as a carrier. The development rate of non-transgenic NT embryos was significantly higher, compared to transgenic NT embryos. Blastocysts were proved to be transgenic. Transgenic cloned cows were also produced, but most of the transgenic cloning data have not yet been published.

Goat cloning

In 1999, the scientists from the Institute of Developmental Biology of Chinese Academy of Sciences and Yangzhou University for the first time obtained cloned goats by using fetus somatic cells as donors (Wang et al., 2000). The same group produced another 3 live cloned goats by injection of cumulus cells into enucleated oocytes or by fusing cumulus cells with enucleated oocytes (Zou et al., 2001). At the same time, a live cloned goat was also produced by using adult somatic cells as donors in Northwest Agricultural University. The former group also reported that neo-resistant gene, can be introduced into goat fetal fibroblast cells, and that the resulting transgenic cells are capable of being cloned to produce 100% transgenic animals (Zou et al., 2002). The same group successfully obtained transgenic goats that express rhEPO in the breast cells. Furthermore, the scientists collected ear fibroblasts and follicular granulosa cells from the transgenic goats and used for cloning after in vitro passage of these cells. Two transgenic cloned goats carrying the rhEPO gene were produced (Cheng et al., 2002).

Recently, cloned goat offspring was also obtained by using abattoir-derived oocytes receiving nuclei from granular cells and long-term cultured fetal fibroblast cells (Lan et al., 2006). In addition, four live Asian yellow goats (C. hircus) were produced by telophase enucleation combined with whole cell intra-cytoplasmic injection (Jiang et al., 2006).

Further, it is suggested G0/G1 -->MII and G0/G1-->S nuclear transfer might be effective ways for improving the developmental competence of the reconstituted embryos, and that G2/M-->MII nuclear transfer by electrical fusion (even in Ca²⁺-free fusion medium) induces abnormal chromosome ploidy (Zhang et al., 2004).

Embryo Transfer Newsletter
Pig cloning

Nuclear transferred embryos were reconstructed by using pig fetal fibroblasts as donors and in vitro matured oocytes as recipients. The blastocyst rate was about 10%. Transgenic embryos expressing green fluorescent protein by somatic cell nuclear transfer were also reported (Zhang et al., 2006). Blastocyst rate of 5.88% were observed when cells cryopreserved at -196 degrees C were used as donors (Zhang et al., 2006). Live somatic cell transfer offspring was produced in 2005 (unpublished data). Several groups are attempting to produce transgenic cloned pigs (Zhang et al., 2006).

Buffalo cloning

A cloned somatic cell cloned buffalo was produced in 2004, but it died soon after birth. In 2005, the same group in Guangxi University produced a live somatic cell cloned buffalo, but the result has not been published yet.

Interspecies cloning

Interspecies nuclear transfer is an invaluable tool for studying nucleus-cytoplasm interactions; and at the same time, it provides a possible alternative to clone endangered or rare animals whose oocytes are difficult to obtain. Somatic cell nuclei of giant pandas can dedifferentiate in enucleated rabbit ooplasm, and about 10% of the reconstructed eggs can develop to blastocysts (Chen et al., 1999). Panda-rabbit cloned embryos can implant in the uterus of a third species, the domestic cat (Chen et al., 2002). The cat-rabbit embryos possess equal developmental capacity as cat-cat embryos and the timing of the first three cleavages for the cat-rabbit embryos is recipient-specific, while the time to form blastocysts is donor nucleus-specific (Wen et al., 2003). Even chicken genome can coordinate with rabbit oocyte cytoplasm in early embryo development till blastocysts stage (Liu et al., 2004). Recently, cloned blastocysts of endangered species takin (Budorcas taxicolor) by inter-species nuclear transfer and comparison of the blastocyst development with yak (Bos grunniens) and bovine were also reported (Li et al., 2006). However, there is still no interspecies nuclear transfer offspring produced in China.

Basic research related to somatic cell cloning

1. Mitochondrial inheritance

   In order to determinate the source of mitochondrial DNA of cloned calves, breed-specific PCR primers was designed by aligning the known D-loop sequences of Bos taurus and analyzed the displacement loop sequences of live cloned calves by breed-specific primers PCR. The results demonstrated that mtDNAs originating from donor and recipient co-exist in cloned calves (Han et al., 2004). In most interspecies cloned embryos, the mitochondria from donor and recipient also co-exist.

2. Centrosome inheritance

   Centrosomes, the main microtubule-organizing centers (MTOCs) in most animal cells, are important for many cellular activities such as assembly of the mitotic spindle, establishment of cell polarity, and cell movement. In nuclear transfer (NT), MTOCs that are located at the poles of the meiotic spindle are removed from the recipient oocyte, while the centrosome of the donor cell is introduced. It is found that the donor cell centrosome, defined as pericentriolar material surrounding a pair of centrioles, is degraded in the 1-cell
reconstituted embryos after activation; however, the components of donor cell centrosomes contribute to the formation of the transient spindle and normal functional mitotic spindle (Zhong et al., 2005).

Abnormalities in either distribution and/or number of centrosomes were evident in approximately 50% of reconstructed embryos following SCNT. The defects in centrosome remodeling could lead to chromosome instability and developmental failures associated with embryo production by SCNT (Dai et al., 2006).

3. Gene expression and epigenetics

Aberrant gene expression occurred in most tissues of cloned bovines that died soon after birth. For each specific gene, aberrant expression resulting from nuclear transfer was tissue-specific. The aberrant transcription patterns detected in dead clones may contribute to the defects of organs reported in neonatal death of clones (Li et al., 2005). To study the DNA methylation events in normal and cloned rabbit embryos, the methylation status of a satellite sequence and the promoter region of a single-copy gene were studied using bisulfite-sequencing technology. It is indicated that unique sequences and satellite sequences have aberrant methylation patterns in cloned embryos (Chen et al., 2004). Cloned bovines have a much higher abortion rate than those derived in vivo. It is demonstrated for the first time that aborted cloned fetuses exhibited under methylated status of individual sequence, suggest that aberrant DNA methylation may contribute to the developmental failure of cloned bovine fetuses (Chen et al., 2005).

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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.

By Professor Michel THIBIER – Chairperson.

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 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.

Acknowledgments: It is the privilege of the Chairman to gratefully acknowledge the most valuable help of all who participated to this worldwide network of the IETS ET data retrieval and more particularly all of the AETE, S. Merton and all the European collectors and also, M. Alvarenga, G. Bo, A. Cover, Dong Soo Son, D. Ducro-Steverink, J. Gavel, J. A. Gomez, M. A. Hidalgo, A. Iritani, S. Kmaid, R. Mapletoft, F. Martinat-Botté, T. Nagai, B. X. Nguyen, D. Osborn, A. Pugh, J. Ramon, R. Remillard, M. de la Rey, J. L. Rigo Rodrigues, N. Sanderson, T.-F. Shiao, E. Squires, B. Stroud, J. C. Van Niekerk, J. H. Viana, V. Yiengvisavakul. I would also like to acknowledge M. B. Wheeler for his assistance in reviewing colloquially this manuscript.

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

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

(*) 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 \textit{In Vivo}-Derived Embryos Transferred in 2005 (AETE, 2006).

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

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

\(\uparrow\downarrow\equiv\) evolution as compared to the previous year

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

<table>
<thead>
<tr>
<th>COUNTRIES</th>
<th>NO. FLUSHES</th>
<th>NUMBER OF EMBRYOS TRANSFERRED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FRESH</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>20,370</td>
<td>102,717</td>
</tr>
<tr>
<td>JAPAN</td>
<td>9,240</td>
<td>17,559</td>
</tr>
<tr>
<td>P R CHINA</td>
<td>9,931</td>
<td>31,625</td>
</tr>
<tr>
<td>ARGENTINA</td>
<td>3,703</td>
<td>5,285</td>
</tr>
<tr>
<td>SOUTH AFRICA</td>
<td>1,716</td>
<td>3,409</td>
</tr>
</tbody>
</table>
Table 4. The Number of Bovine In Vitro-Produced Embryos Transferred in 2005.

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

Table 5. Small Ruminants ET Activity in 2005.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>TRANSFERABLE EMBRYOS</th>
<th>TRANSFERRED EMBRYOS</th>
<th>TRANSFERRED EMBRYOS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FRESH</td>
<td>FROZEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEEP</td>
<td>34,458</td>
<td>13,745</td>
<td>11,408</td>
<td></td>
</tr>
<tr>
<td>GOAT (*)</td>
<td>5,135</td>
<td>3,439</td>
<td>3,897</td>
<td></td>
</tr>
<tr>
<td>CERVIDS</td>
<td>482</td>
<td>321</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

(*) 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.

<table>
<thead>
<tr>
<th>COUNTRIES</th>
<th>FLUSHES</th>
<th>TRANSFERABLE EMBRYOS</th>
<th>EMBRYOS TRANSFERRED</th>
<th>TRANSFERRED EMBRYOS</th>
<th>FROZEN</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARGENTINA</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRAZIL</td>
<td>9,300</td>
<td>5,700</td>
<td>5,700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CANADA</td>
<td>67</td>
<td>53</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLUMBIA</td>
<td>2,800</td>
<td>1,600</td>
<td>1,600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EUROPE</td>
<td>ND</td>
<td>509</td>
<td>711</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOUTH AFRICA</td>
<td>77</td>
<td>79</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>URUGUAY</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA(*)</td>
<td>12,000</td>
<td>6,000</td>
<td>5,500</td>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>24,249</td>
<td>13,943</td>
<td>13,625</td>
<td>500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Economy Transfer Newsletter

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Table 7  Swine ET Activity in 2005.

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

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

Classifieds

Upcoming Events-Continuing Education Opportunities


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
Call for abstracts to “2007 Tsukuba Meeting for Animal Biotechnology”

Dear IETS members,

After 2007 IETS Kyoto meeting, we will organize the following workshop;

2007 Tsukuba Meeting for Animal Biotechnology (2007 TMAB):
The Production of High-Quality Livestock Products With Somatic Cell Nuclear Transfer Technology
from January 12 afternoon to 13 evening, 2007, in Tsukuba, Ibaraki Japan.

We call abstracts for poster presentations. Deadline of the submission will be 30 November, 2006. One or 2 page-abstract with the title and authors names, address and e-mail must be sent to (2007tmab@nias.affrc.go.jp) in Word format.

On January 11, the IETS Local organizing committee will organize excursion in Kyoto area. If you will depart Kyoto on January 12 by JR-Shinkansen at 8:46, you will arrive at Tsukuba by Tsukuba Express (TX) at 12:15 on the same day. After the meeting, you can have a flight from Narita Airport to your home! Because Tsukuba locates very close to New-Tokyo International Airport (Narita Airport) (1.5 h by an airport bus).

We will have two exciting days in Tsukuba! Thank you very much for your attention.

Sincerely,

Takashi Nagai: National Institute of Livestock and Grassland Science (NILGS)
Kazuhiro Kikuchi: National Institute of Agrobiological Sciences (NIAS)

E-mail: mab2007@nias.affrc.go.jp

2007 Tsukuba Meeting for Animal Biotechnology (2007 TMAB):
The Production of High-Quality Livestock Products With Somatic Cell Nuclear Transfer Technology
From January 12 afternoon to 13 evening, 2007, in Tsukuba, Ibaraki Japan

January 12, 2007
13:30-13:35 Welcome to Tsukuba
   Kazuhiro Kikuchi, National Institute of Agrobiological Sciences, Japan
13:35-13:40 Opening remarks
   Masaki Shibata (The Director General), National Institute of Livestock and Grassland Science, Japan

Keynote Presentation
13:40-13:50 Progress in cloning: A retrospective from the pages of Theriogenology
   John P. Kastelic (Co-Editor-in-Chief, Theriogenology), Agriculture and Agri-Food Canaad Lethbridge Research Centre, Canada

Session 1: Oocyte and embryo quality for development
13:50-14:15 Messenger RNA in oocyte and embryo in relation to embryo quality
   Christine Wrenzycki, University of Veterinary Medicine Hannover, Germany
14:15-14:40 Initial differentiation and primordial germ cell formation in the bovine and porcine embryo
   Poul Maddox-Hyttel, Royal Veterinary and Agricultural University, Denmark
14:40-15:05 Acquisition of oocyte developmental competence in juvenile donors
   Christopher Grupen, University of Sydney, Australia
15:05-15:35 Break

Session 2: Relationship between embryos and reproductive tracts
15:35-16:00 Oviductal function: what are we still missing in vitro?
   Heriberto Rodriguez-Martinez, Swedish University of Agricultural Sciences, Sweden
16:00-16:25 Interactive effects of bovine somatotropin, pregnancy status and supplemental fish oil on endocrine responses and gene expression of the bovine uterus at day 17 after ovulation
   W. W. Thatcher, T. R. Bilby and C.R. Staples, University of Florida, FL, USA

Program continued...
Classifieds

16:25-16:50 Epigenetic modification during preimplantation embryos: possible role of microRNAs
   Nam-Hyung Kim, Chungbuk National University, South Korea

18:00 Banquet

January 13, 2007
Session 3: Biotechnology in farm animals
9:00-9:25 Farm Animal Biotechnology in China
   (Bou Shorgan, Inner Mongolia University, Inner Mongolia, P.R. China)

9:25-9:50 Clone cattle and transgenic pig research in Korea
   (Chang Won-Kyong, National Livestock Research Institute, Korea)

9:50-10:15 Developmental capacity of horse oocytes following ICSI, nuclear transfer and in vitro culture
   (Cesare Galli, Laboratorio di Tecnologie della Riproduzione, Italy)

10:15-10:45 Break

Session 4: New approaches for the cloning and stem cell technology
10:45-11:10 Handmade cloning in pigs
   (Gábor Vajta, Danish Institute of Agricultural Sciences, Denmark)

11:10-11:35 The minipig as a biomedical model in stem cell research
   (Jan Motlík, Institute of Animal Physiology and Genetics, Czech Republic)

11:35-12:00 Application of robotic and microfluidic technologies to stem cell culture and analysis
   (Matthew B. Wheeler, University of Illinois, IL, USA)

12:00-13:30 Lunch

Session 5: Differentiation and methylation in cloned embryos
13:30-13:55 The influence of donor cell differentiation on nuclear cloning efficiency
   (David Wells, AgResearch, New Zealand)

13:55-14:20 DNA hypomethylation in aborted bovine clones
   (Qing-Yuan Sun, Institute of Zoology, Chinese Academy of Sciences, PR China)

Session 6: Reprogramming in cloned embryos
14:20-14:45 Oocyte kinases and their effects on oocyte behaviour and nuclear reprogramming in SCNT embryos
   (Keith H. S. Campbell, University of Nottingham, UK)

14:45-15:10 Nuclear transfer cell reprogramming with adult somatic cells at different differentiation lineages
   (Jerry Yang, University of Connecticut, CT, USA)

15:10-15:40 Break

Session 7: New system in producing of transgenic animals
15:40-16:05 Generation of transgenic chickens using retrovirus vector system
   (Teoan Kim, Catholic University of Daegu, Rep. Korea)

16:05-16:30 Highly efficient somatic cloning of multi-transgenic pigs
   (Heiner Niemann, Bjoern Petersen, Andrea Lucas-Hahn, Erika Lemme, Nadine Hornen, Wilfried Kues and
   Joe Carmwath, Institut fur Tierzucht, Germany)

16:30-16:45 Summary of the symposium
   (Takashi (TAKU) Nagai, National Institute of Livestock and Grassland Science, Japan)

16:45-16:50 Closing remarks
   (Teruo Ishige (The Director General), National Institute of Agrobiological Sciences, Japan)

Workshop for Authors Publishing Scientific Papers in English
by Dr. John P. Kastelic, Co-Editor-in-Chief, Theriogenology
and Rose M. Kastelic, BA (French), January 12, 9:15-12:00, January 13, 17:00-18:30

December 2006
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Letter of Invitation from the LOC

To: IETS Members

From: Akira Iritani and Hiroshi Imai, LOC member IETS 2007

On behalf of the Local Organizing Committee, we are pleased to formally invite you to the 33rd Annual Conference of the International Embryo Transfer Society at Kyoto, Japan, in the year 2007. Kyoto city was the formal capital of Japan for more than 1200 years and is gifted with abundant cultural and historical treasures. The city has a very convenient subway system so that it gives a ready access to the meeting venue, downtown, hotels and the major sightseeing locations. We are looking forward to our meeting at the scientific program and the special program in the New Year 2007.

Please check sometime at the IETS web site at www.iets.org/2007 for updates.

Sincerely yours,

IETS 2007 Local Organizing Committee

REGISTRATION INFORMATION NOW AVAILABLE ON THE 2007 IETS MEETING WEBSITE

Additional Program and Meeting information will be posted on the website (www.iets.org/2007) as it becomes available.
Schedule of Events & Program
Event times and locations are subject to change; events may be added.

Thursday, January 4, 2007
9:00–17:00 IETS Board of Governors Meeting

Friday, January 5, 2007
9:00–17:00 IETS Board of Governors Meeting
8:00–16:00 Health And Safety Advisory Committee (HASAC)—Research Subcommittee
17:00–20:00 Health And Safety Advisory Committee (HASAC)—Regulatory Subcommittee
16:00–19:00 Registration with pick up of pre-registrations only

Saturday, January 6, 2007
7:00–18:00 Registration
8:00–17:00 Pre-conference Workshop: Successful Publishing in an English Language Journal
8:00–17:00 Pre-conference Satellite Symposium I: Innovative Techniques in Human and Animal Embryology
8:15–17:05 Pre-conference Satellite Symposium II: Assisted Reproductive Technologies and Food Safety in Farm Animals
13:00–17:00 IETS Foundation Board of Trustees Meeting
16:30–18:30 W-1171 Research Group
18:00–20:00 Health And Safety Advisory Committee (HASAC)—Forms & Certificates Subcommittee
13:00–18:00 Poster Setup
13:00–18:00 Commercial Exhibit Setup
18:30–21:00 Opening Reception

Sunday, January 7, 2007
7:30–8:30 Past President’s Breakfast
7:30–8:30 Student Competition Breakfast with the Foundation Education Committee
7:00–18:00 Registration
8:00–9:30 Health And Safety Advisory Committee (HASAC)—Food Safety Subcommittee
8:00–17:00 Commercial Exhibits
8:00–12:00 Pre-conference Workshop: Successful Publishing in an English Language Journal
8:00–17:00 A/V Library/Speaker Preparation
8:30–10:00 IETS Foundation Education Committee
9:30–10:00 Opening and Welcome
10:00–12:00 Session I: Oocyte Quality

Evaluation of oocyte quality: Morphological, cellular and molecular predictors.
Qing-Yuan Sun, State Key Laboratory of Reproductive Biology, Institute of Zoology, Chinese Academy of Sciences, Beijing, China

Mounting evidence that oocyte quality profoundly affects fertilization and subsequent embryo development spurs the continued search for reliable predictors of oocyte developmental competence. We will provide an overall summary and analysis of potential criteria that can be used to evaluate oocyte quality. These criteria are purposively classified as morphological, cellular or molecular predictors. Traditional methods for evaluation of oocyte quality are based on morphological classification of the follicle, cumulus–oocyte complex, polar body (PB) or meiotic spindle. Although the use of morphological characteristics as predictors of oocyte quality is controversial, such a grading system can provide valuable information for preselecting oocytes with higher developmental competence and may therefore maximize embryo developmental outcomes. When compared with morphological parameters, cellular and molecular predictors of oocyte quality are proposed to be more precise and objective. Several intrinsic markers for oocyte quality may be used as indicators for oocyte competence. On the other hand, several extrinsic markers such as apoptosis of follicular cells, concentrations of growth factors in
follicular fluid (FF) or serum and gene expression profiles of cumulus cells also have been reported to be tightly correlated with oocyte competence and embryo quality.

**Oocyte quality and strategies to improve oocyte cryopreservation in domestic animals.**

Sergio Ledda, Department of Animal Biology University of Sassari, Italy

Despite significant progress in cryopreservation of mammalian oocytes and embryos, many of the molecular and biochemical events that underlie this technology are poorly understood. In recent years, researchers have focused on obtaining viable oocytes that are developmentally competent. Even in the most favorable conditions, experimental approaches have obtained only limited success as compared with fresh oocytes used in routine in vitro embryo production. Chilling injuries and toxic effects of the cryoprotectants are the major adverse consequences following cryopreparative procedures. Different strategies have been developed to improve cryopreservation results. These strategies have included reducing container volumes, increasing the thermal gradient, changing the cell surface/volume ratio, enhancing cryotolerance by supplementation with various additives, or modifying the lipid–lipid composition of the oocyte membrane. To develop new strategies for reducing the various forms of stress associated with oocyte cryopreservation, it is fundamental to gain a better understanding of the major changes responsible for poor post-thaw survival. With this knowledge, we hope that oocyte cryostorage will become a fully reliable reproductive technique in the near future.

12:00–13:30  Lunch Break

12:30–14:00  Poster Session I

14:00–16:00  **Session II: Early Embryo Development**

**Maternally derived transcripts: Identification and characterization during oocyte maturation and early cleavage.**

Nam-Hyung Kim, National Research Laboratory of Molecular Embryology, Chungbuk National University, Cheongju, Chungbuk, Korea

Identification and characterization of differentially regulated genes in oocytes and early embryos are required to understand the mechanisms involved in maturation, fertilization, cleavage and early embryonic development. Improved RT-PCR-based differential display, real-time RT-PCR, cDNA microarray and in silico mining have been applied to identify maternal effect genes in mammalian oocytes. Moreover, conventional gene knockout and RNA interference techniques have been used to characterize the specific functions of maternally derived genes. The regulatory mechanisms of the activities of maternally derived genes in mammals are currently under investigation. These findings may subsequently be applied to animal biotechnology procedures, such as improvement of culture systems for in vitro maturation, in vitro embryo production, cloning by nuclear transfer and IVF in the clinic. The present talk focuses on the identification and functions of maternally derived transcripts during oocyte maturation, fertilization and early cleavage.

**Temporal and spatial control of gene expression in early embryos of domestic species.**

Tiziana A.L. Brevini, Istituto Anatomia Animal Domestic, Milano, Italy

A gradual transition from oocyte-derived mRNA and proteins to full embryonic transcription characterizes early embryonic development. Messenger RNAs and proteins of maternal origin accumulate in the oocyte throughout its growth in the ovary. This presentation will describe some of the mechanisms activated upon fertilization in early embryos of domestic species that control the appropriate use of such material and prepare for the synthesis of new ones. Data will be presented on the control of gene expression by the 3' untranslated regions and their interaction with specialized sequences at the 5' cap end. The process of RNA sorting and localization, initially demonstrated in different cell types and in oocytes of lower species, will also be discussed, particularly in relation to its possible role in regulating pig early development. Finally, specific genes involved in the activation of cattle embryonic transcription will be described. This brief overview will provide some suggestions on how these different mechanisms may be integrated and how they cooperate to ensure the correct initiation of embryonic development.
16:00–16:30
Break

16:30–18:00
IETS Foundation: Student Competition Presentations

**Xenografting of Adult Mammalian Testis Tissue.**
(Abstract #1)

**Global Peptide Sequencing and Quantification of Proteins in Porcine Parthenotes by Proteomics.**

**Histone H4 Acetylation at Lysine 12 and Cdc2a Expression are Decreased in Aged Mouse Germinal Vesicle Stage Oocytes.**
I. Manosalva, C. Goday, and P. Esponda. (Abstract #3)

**Myostatin Gene Knockdown Through Lentiviral Mediated Delivery of ShRNA for In Vitro Production of Transgenic Bovine Embryos.**
M. P. Milazzotto, W. B. Feitosa, B. E. Strauss, M. Bajgelman, C. M. Mendes, M. E. O. A. Assumpção, and J. A. Visintin. (Abstract #4)

**Nucleolar Development Requires Transcriptional Activity During Porcine Embryonic Genome Activation.**

**Timing of Deadenylation of Gdf-9 and Cyclin 3 Utr Constructs in Bovine Oocytes.**
D. J. Walker, C. J. Wilusz, and G. E. Seidel, Jr. (Abstract #6)

18:00–19:30 Bioniche Think Tank

**Monday, January 8, 2007**

7:30–15:30 Registration

8:00–18:00 Commercial Exhibits

8:00–17:00 A/V Library/Speaker Preparation

8:00–10:30 **Session III: Long-Term Consequences on Development**

Embryo culture and long-term consequences.
Jeremy G. Thompson, The University of Adelaide, School of Paediatrics and Reproductive Health, Adelaide, Australia

There is now clear evidence that conditions used during mammalian embryo culture can cause variation in the phenotype of the resulting fetus and offspring, especially in relation to growth characteristics and possibly other characteristics, such as mental development. This appears to be an adaptive response to the environment encountered. The well characterised adaptive responses by the developing fetus to environmental perturbations which lead to fetal programming can now be extended to the concept of “embryonic programming.” This presentation will examine some of the phenotypic changes that occur following embryo culture under different environments, especially the work in our own laboratory which targets specific environmental perturbations during embryo culture. None of these cause reduced early development to the blastocyst stage in vitro, but following transfer there are consequences for both pregnancy establishment and subsequent development. In particular, we will examine the link between embryo physiology and the induction of cellular stress by these specific environmental stressors. We will also examine mechanisms of how this may occur, primarily by investigating the interaction between energy production mechanisms of the early embryo and subsequent development.

Long-term effects of nutritional programming of the embryo and fetus: Mechanisms and critical windows.
Michael E. Symonds, Academic Division of Child Health School of Human Development, Queen’s Medical Centre, Nottingham, United Kingdom

The maternal nutritional and metabolic environment is critical in determining not only reproduction but also long-term health and viability. One key nutrient that may modulate these types of effects is the supply of glucose from the mother to the fetus. The maintenance of a balance and appropriate supply of glucose from the mother to the fetus may be pivotal in ensuring optimal embryonic, placental and fetal growth. An increase or decrease in maternal plasma glucose, either alone or in conjunction with other
macro- or micronutrients, may result in offspring with an increased risk of a range of adult diseases. Large animals, such as sheep, provide a valid model for maternal–fetal nutritional studies owing to the similarities to humans in fetal development, number and maturity at birth and outcomes following nutritional manipulation. In this review, the effects of maternal nutritional manipulation in large animals at defined stages of gestation coinciding with embryo development, maximal placental or fetal growth will be discussed.

10:30–11:00 Coffee Break/Exhibition
10:30–13:30 Tea Ceremony
11:00–12:30 Poster Session II
11:00–12:30 IETS Data Retrieval Committee Meeting
12:30–13:30 Lunch Break
13:30–15:30 **Session IV: Implantation and Gestation**

*Pregnancy recognition and conceptus implantation in domestic ruminants: Roles of progesterone, interferons and endogenous retroviruses.*
Thomas E. Spencer, Texas A&M University, College Station, Texas, USA

New information on pregnancy recognition and conceptus development and implantation in sheep with respect to regulation by progesterone, interferons and endogenous retroviruses will be discussed. After formation of the corpus luteum, progesterone acts on the endometrium and stimulates blastocyst growth and elongation to a filamentous conceptus (embryo/fetus and associated extraembryonic membranes). The envelope of endogenous viruses related to Jaagsiekte sheep retroviruses (enJSRVs) appears to intrinsically regulate trophoblast cell proliferation and differentiation into giant binucleate cells. The mononuclear trophectoderm cells of elongating sheep conceptuses secrete interferon tau (IFNT), which acts on the endometrium to prevent development of the luteolytic mechanism. Progesterone downregulation of its receptors (PGR) in luminal and glandular epithelia correlates temporally with induction of secreted galectin 15 (LGALS15) and secreted phosphoprotein one (SPP1), which are proposed to regulate trophoblast proliferation and adhesion. IFNT acts on the endometrial lumenal epithelium to induce WNT7A and to stimulate LGALS15, cathepsin L (CTSL), and cystatin C (CST3), which are candidate regulators of conceptus development and implantation. The number of potential contributors to maternal recognition and establishment of pregnancy continues to grow and highlights our limited appreciation of the complexity of the key molecules and signal transduction pathways that intersect during these key developmental processes.

*Gene expression and maintenance of pregnancy in the bovine: Roles of trophoblastic binucleate cell-specific molecules.*
Kazuyoshi Hashizume, Department of Veterinary Medicine, Iwate University, Morioka, Iwate, Japan

Various molecules participate in implantation and maintaining endometrial function during gestation. Advances in molecular biological technologies, such as microarrays, contribute to clarifying the intricate dialogue between the fetus and dam, because microarrays enable changes in the expression levels of thousands of genes to be monitored simultaneously. Cell-to-cell interaction plays a pivotal role in the regulation of placentogenesis and the exchange of stage-specific developmental signals between the fetal and maternal units. These interactions are paramount for programmed fetal growth, maternal adaptation to pregnancy and coordination of parturition. However, little is known about the precise regulation of placentation and maintenance of gestation in cattle. In the ruminant, the binucleate cell plays a central role in forming the structures and secretions at the fetomaternal interface that are crucial in establishing and maintaining pregnancy. We summarized differences in the abundance of specific RNA transcripts in the bovine cotyledon and caruncle using global gene expression profiling, and further investigated the relationship of mRNA abundance for select pregnancy-specific genes of interest (identified from microarray studies) across pregnancy that were exclusively localized to the binucleate cell, such as placental lactogen, prolactin-related proteins and pregnancy-associated glycoproteins. Our results suggest that a well-orchestrated transcriptional command from the binucleate cells is pivotal to the establishment and progression of pregnancy in cattle.

15:30–16:00 Coffee Break/Exhibition
16:00–16:30  IETS-Pioneer Award Presentation
16:30–17:30  IETS Annual Business Meeting
17:30–19:30  Health And Safety Advisory Committee (HASAC)—Open Meeting

**Tuesday, January 9, 2007**

7:30–8:30  Organizational Meeting of the IETS Foundation
8:00–15:00  Registration
8:00–13:30  Commercial Exhibits
8:00–17:00  A/V Library/Speaker Preparation
8:30–10:30  **Session V: Sperm Evaluation and Physiology**

*State of the art in farm animal sperm evaluation.*
Heriberto Rodriguez-Martinez, Faculty of Veterinary Medicine SUAS, Uppsala, Sweden

Our ability to screen the structural and functional integrity of the spermatozoon in vitro has increased dramatically over the past decades, but not our capacity to estimate the fertility of a semen sample, or of the sire from which it has been collected, especially in selected farm animal breeders. Estimation of fertility is constrained by several factors, e.g., type of cell, analysis strength, sperm deposition strategies, recordings of fertility, and so on, including the fact that the ejaculate is composed of a diverse sperm population. Such cell heterogeneity is not only reflected in differences in the persistence of attributes needed for fertilization, such as motility, but also in the relative ability of spermatozoa to remain fertile over time, and to endure exogenous selection steps and stimuli, all of which account for innate variations in fertilizing ability among doses, ejaculates and sires. Determination of the concentrations and conditions required to maintain a sperm population with competence for fertilization would allow for a better estimation of fertility. The value of these analyses is hereby discussed.

*Interactions of sperm with the female reproductive tract: Inspiration for assisted reproduction.*
Susan Suarez, Cornell University, Ithaca, New York, USA

Interactions of sperm with the female tract prepare them for fertilization in ways that are different from methods used to prepare sperm for AI, IVF and ICSI. After natural mating, bull sperm are rapidly removed from seminal plasma when they enter the cervical mucus, in contrast to the slower dilution of seminal plasma that sperm experience in vitro in preparation for AI, IVF and ICSI. Sperm passage through the uterotubal junction involves interactions of sperm surface proteins with the junction, which could modify the sperm, oviduct or both. In the oviduct, binding of sperm to the epithelium stabilizes them for storage and enables them to live longer than they do in vitro. As the time of ovulation approaches, unidentified factors in the oviduct initiate capacitation and hyperactivation in the sperm. Although capacitation and hyperactivation can be induced in vitro, the inducers used may be less efficient or effective than those in vivo, thereby accounting for the need to use thousands of sperm to achieve fertilization of an oocyte in vitro. Finally, evidence indicates that chemotactic factors guide sperm to the oocyte in vivo, whereas successful fertilization in vitro may depend on random collisions of sperm with the oocyte.

10:30–11:00  Coffee Break/Exhibition
11:00–11:30  IETS-Distinguished Service Award
11:30–12:15  IETS-Foundation Student Competition Awards, CANDES & HASAC Updates
12:15–13:30  Lunch Break
12:00–13:30  5th IETS Annual Running Competition
Practitioner's Forum: The Use of Embryo Transfer for Improvement of Fertility in Dairy Cows
Moderator: Prof. O. Dochi
In recent years, the fertility of dairy cows has gradually decreased everywhere around the world. The cause of the low fertility may vary considerably across countries. In this Practitioner’s Forum, we will focus on and discuss on the use of embryo transfer for overcoming the low fertility in dairy cows.

Relationship between endometrial epidermal growth factor (EGF) and fertility after embryo transfer in repeat-breeder cows
Dr. S. Katagiri (Graduate School of Veterinary Medicine, Hokkaido University, Japan)

Improved pregnancy after embryo transfer of frozen–thawed embryos in repeat-breeder Holstein cows
Mr. K. Takahashi, DVM (Genetics Hokkaido Assoc., Japan)

Improvement of fertility after embryo transfer in dairy cows under heat-stress conditions
Dr. Vascocelos, JLM (Faculdade de Medicina Veterinaria e Zootecnia, UNESP, Botucatu, SP, Brazil)

15:00–15:30 Coffee Break/Exhibition
13:30–15:00 Commercial Exhibit & Poster Teardown
15:30–16:30 Session VI: Keynote Address
Stem cells and lineage development in the mammalian blastocyst.
Janet Rossant, The Hospital for Sick Children, Toronto, Ontario, Canada
The mammalian blastocyst is the source of the most pluripotent stem cells known—embryonic stem (ES) cells. However, ES cells are not totipotent: In mouse chimeras they do not contribute to extraembryonic cell types of the trophectoderm and primitive endoderm lineages. Understanding the genetic pathways that control pluripotency versus extraembryonic lineage restriction is key to understanding not only normal embryonic development but also how to reprogram adult cells to pluripotency. The trophectoderm and primitive endoderm lineages also provide the first signals that drive patterned differentiation of the pluripotent epiblast cells of the embryo. My laboratory has produced permanent mouse cell lines from both the trophectoderm (TE) and the primitive endoderm (PrE), termed trophoblast stem (TS) and eXtraembryonic ENdoderm (XEN) cells. We have used these cells to explore the genetic and molecular hierarchy of lineage restriction and identify the key factors that distinguish the ES cell versus the TS or XEN cell fate. The major molecular pathways of lineage commitment defined in mouse embryos and stem cells are probably conserved across mammalian species, but more comparative studies of lineage development in embryos of nonrodent mammals will likely yield interesting differences in terms of timing and details.

16:30–17:00 Closing Ceremony
17:00–18:00 Organizational Meeting of the IETS Board of Governors
18:00–21:30 Banquet & Dance Party

Wednesday, January 10, 2007
8:00–18:00 Post-conference Sattellite Symposium: Quality Control of Embryos for Embryo Transfer and Related Advanced Technologies in Cattle

Thursday, January 11, 2007
9:00–17:00 Post-conference Tour: Excursion to see the world-famous Japanese Black cattle (Wagyu) and to taste their marbled beef with Sukiyaki
Pre-conference Satellite Symposium I
Innovative Techniques in Human and Animal Embryology
January 6, 2007
Organizers: Jeremy Thompson (Adelaide, Australia)
Gábor Vajta (Tjele, Denmark)

Timetable
8:00    Introduction
8:05    Keynote Lecture by Stanley Leibo
8:30    Section I—Maturation and Culture
        • Oocyte maturation: Emerging concepts and technologies to improve developmental potential. Robert Gilchrist
        • Alternatives to culture in the petridish. Jeremy Thompson
        • Quantification of embryo quality by respirometry. Henrik Callesen, Ana Lopes
        • Metabolic profiling of human embryos in culture: Improving selection for transfer. Daniel Brison
10:10   Coffee Break
10:30   Section II—Stem Cells
        • Derivation of human embryonic stem cell lines. Teija Peura
        • Maintaining epigenetic and genetic integrity of human ES cells. Maisam Mitalipova
        • Embryonic stem cells and animal models of early human development and adult disease. Kevin Sinclair
        • Isolation and characterization of pluripotent cell lines from pig embryos of different origins. Fulvio Gandolfi
12:10   Lunch
13:00   Section III—Cryopreservation
        • Analysis of oocyte physiology to improve cryopreservation procedures. David Gardner
        • Highly efficient vitrification for cryopreservation of human oocytes and embryos: The Cryotop method. Masashige Kuwayama
        • Toward verification of vitrification parameters—What is really important for oocyte cryopreservation. Amir Arav
14:20   Coffee Break
14:40   Section IV—Embryo Manipulation
        • Oocyte-induced enucleation reveals spindle-associated regulators of cytoplast developmental competence. Eric Overstrom
        • Comparative approach to nuclear transfer with the zona free method in cattle, horse, pigs and sheep. Cesare Galli
        • Artificial gametes: When and how? Zsolt Peter Nagy
        • The porcine epidermal stem cells as a biomedical model for wound healing and normal/malignant epithelial cell propagation. Jan Motlik
16:20   General Discussion and Conclusion
**Pre-conference Satellite Symposium II**

**Assisted Reproductive Technologies and Food Safety in Farm Animals**

January 6, 2007

Organizers: Dr. H. Kochhar, Dr. M. Thibier, and Dr. H. Imai

8:45 Opening address—Dr. Michel Thibier, France

**Section I: Newer Assisted Reproductive Technologies**

**Section Chair: Dr. H. Imai**

9:00 Animal clones and methodology of cloning—Dr. Keith Campbell, UK

9:30 Transgenic animal production and animal biotechnology—Dr. Jim Robl, USA

**Section II: Newer Assisted Reproductive Technologies and Impacts on Food Safety**

**Section Chair: Dr. H.P.S. Kochhar**

10:00 Assessing the quality of products from cloned cattle: an integrated approach — Dr. Yvan Heyman, France

10:30 Health Break

11:00 How healthy are animal clones and their progeny? Five years of field experience — Dr. Martin Panarace, Argentina

11:30 Genomic stability and physiological assessments of live offspring sired by a bull clone, Starbuck II — Dr. W. Alan King, Canada

12:00 Fourteen weeks feeding test of meat and milk derived from cloned cattle in the rat — Dr. Seiya Takahashi, Japan

12:30 Lunch

14:00 Meat composition of offspring derived from cloned boars—Dr. Irina Polejeava, USA

14:30 Compositional analysis of products derived from clones and cloned transgenic cattle — Dr. Goetz Laible, New Zealand

15:00 Health Break

**Section III: Regulatory Considerations in Animal Biotechnology**

**Section Chair: Dr. M. Thibier**

15:30 Regulatory considerations in transgenic livestocks from the aspect of Cartagena Protocol in Japan—Dr. Kazuhioko Yamanouchi, Japan

16:00 Current status for regulating biotechnology-derived animals in Canada—Animal health and food safety considerations—Dr. Harpreet Kochhar, Canada

16:30 The US Food and Drug Administration (FDA) and animal cloning: Risk and regulatory approach—Dr. Larisa Rudenko and Dr. John Matheson, USA.

17:00 Concluding remarks—Dr. Takashi Nagai, Japan

17:05 Adjournment.

**Features of the program**

Genetically modified livestock in agriculture are already an experimental reality and can rapidly become a commercial reality. The challenge is to see whether the existing science based safety-assessment model will work and whether the current marketing practices will be up to this challenge. The acid test of industry practices will be their capacity to build consumer confidence. On the other hand, scientists engaged in the development of transgenic livestock intended to supply food must recognize that regulators and the general public consider the transgenic technology as a considerable shift from the traditional animal breeding practices. Livestock breeding is and will continue to be a balancing act of multiple trait selection, and it is naïve to believe that transgenes will become so important as to monopolize the selection process. Food safety and regulatory requirements for transgenic livestock are not yet definitive, but clearly have the potential to affect important areas such as trade certifications, animal identification, product identity and traceability. Hence, this symposium will be an effort to flush out the issues pertaining to the science, food safety data from experiments in animal cloning and transgenesis, regulatory initiatives in this direction and the public perception of this technology. The program will have three components:

1. **Newer Assisted Reproductive Technologies—Cloning, Transgenesis, etc.:** The presenters will provide an overview of the technologies and show how we are at a stage at which there is a potential to market the food and products derived from these animals.

2. **Food Safety Components:** The presenters in this subtheme will provide valuable data in terms of safety of food derived from animal clones or transgenics as well as the parameters and strategies used to generate the data.

3. **Regulatory Considerations:** A tough decision to approve or not to approve the food based on the scientific information guides the regulations (which at present time are unclear for the biotechnology-derived animals). The presenters will look at the specific approaches of assessment by different countries and the public perception of the food derived from such animals.
Post-conference Satellite Symposium
Quality Control of Embryos for Embryo Transfer and Related
Advanced Technologies in Cattle

January 10, 2007, Room D

08:00 Opening address: Local Organizing Committee Chair, Dr. A. Iritani
08:15 Introduction: Dr. Y. Izaike

Session I: Oocyte collection following superstimulation and ovum pick-up (OPU)
08:30 Superovulation in the Cow: Effects of Gonadotrophins and Follicular Wave Status
Dr. R.J. Mapleton (Canada)
09:00 The efficiency of embryo production by OPU
Dr. K. Imai (Japan)
09:30 Application of ultrasound guided follicular aspiration (OPU) in prepubertal and adult cattle.
Dr. H. Niemann (Germany)
10:00 Coffee Break

Session II: Quality control of oocytes and embryos for in vitro production systems
10:30 The role of growth factor signaling on oocyte quality and maturation
Dr. K. P. McNatty (New Zealand)
11:00 Embryo quality in bovine embryos: Influence of oocyte origin and culture environment on gene expression
and developmental competence of IVF embryos
Dr. P. Lonergan (Ireland)
11:30 Non-invasive quality assessment of IVP embryos
Dr. H. Abe (Japan)
Lunch Break

Session III: Embryo cryopreservation and commercial application of frozen embryos
13:30 Cryopreservation of manipulated embryos
Dr. S. P. Leibo (USA)
14:00 Essential methods of freezing embryos for application in animal reproduction management
Dr. O. Dochi (Japan)
14:30 Vitrification and direct transfer of bovine embryos
Dr. G. Seidel (USA)
15:00 Mass production of cattle from IVM, IVF and cryopreservation of in vitro-produced embryos in Japan
Dr. Hamano (Japan)
15:30 Coffee Break

Session IV: Early embryonic-loss and maintenance of early pregnancy with manipulated embryos
16:00 What drives the formation of trophectoderm during early embryonic development?
Dr. R. M. Roberts (USA)
16:30 Interaction between fetal and maternal environments during early pregnancy in domestic species
Dr. T. Ezashi (Japan)
17:00 Failure of uterine-conceptus interactions in cattle
Dr. T. R. Hansen (USA)
17:30 Improving pregnancy maintenance in dairy cows
Dr. W. W. Thatcher (USA)
18:00 Adjournment

December 2006
30
Many manuscripts are delayed or rejected because of poor experimental design, analysis and presentation of data, and writing. This workshop is an overview of how to plan and conduct research, analyze and present your data, write a paper and interact with editors and reviewers. In addition to presentations of principles and common errors, there will be exercises and interactive discussions.

This workshop is primarily designed for those for whom English is a second language. Therefore, English syntax, grammar and punctuation will be reviewed. However, this workshop will also be valuable for those for whom English is their native language, especially students and young scientists.

This is a Pre-conference Workshop (in association with the 2007 IETS Conference). The workshop will be held in the Kyoto International Conference Hall (IETS Conference location) in Kyoto, Japan, on Saturday, 6 January (8:00 to 17:00) and Sunday, 7 January (8:00 to 12:00).

Class size is limited to the first 20 participants. Registration fees are payable to IETS via the registration form. The reduced early registration fee (US$200 for IETS members listed in current membership directory; US$300 for nonmembers) must be received before 15 November 2006. The on-site registration fee is US$250 for IETS members and US$350 for nonmembers (if space is available). Student registration is US$150 prepaid, or US$200 at the door. The registration fee does not include meals.

Information about the workshop: therio@shaw.ca or 403-317-2236

Registration and fees: iets@assochq.org or 217-398-4697