Program Book

46th Annual Conference of the International Embryo Technology Society

From Stem Cells to Neonates—The Embryo at the Center of All

New York Hilton Midtown
New York, New York
January 16–19, 2020

Scientific Program Co-Chairs:
Anna C. Denicol and Peter J. Hansen
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2019 IETS Board of Governors

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The choice of midtown Manhattan as the site of the 46th annual conference of the International Embryo Technology Society was a bold one. Few scientific societies of the size and scope of IETS would have the audacity to meet in the heart of the USA’s most emblematic and important city—to locate ourselves within walking distance of such iconic locations as Times Square, Radio City Music Hall, the Museum of Modern Art, and Central Park. And, we are gathering there together in the height of winter!

The theme of this year’s meeting was chosen to be equally bold. The phrase “From stem cells to neonates—The embryo at the center of all” reflects, of course, the research goals and clinical activities of many of us in IETS. It also highlights the fundamental importance of the embryo for formation of eukaryotic organisms by sexual reproduction. Harvey famously wrote *ex ovo omnia* but he could also have written *omnia ex embryone* (assuming Google Translator is faithful to Harvey’s Latin). Furthermore, the theme focuses our attention on the increasing importance of the embryo as a research model for deciphering fundamental mechanisms of developmental biology and reproduction and acknowledges that the embryo is now at the center of many emerging and mature biotechnologies.

The choice of speakers is designed to illustrate important aspects of the centrality of the embryo for biology and biotechnology. Session I is focused on one of the building blocks of the embryo—the oocyte. Session II features presentations regarding how the embryo can be used to generate pluripotent stem cells *in vitro* and be used as a tool for gene editing. Sessions III, IV, and V are focused on embryo transfer including new concepts related to embryo production (session III), possible alterations in developmental programming associated with embryo transfer (session IV), and presentation of research focused on enhancing success of embryo transfer programs (session V).

The keynote presentation, by Theresa Woodruff of Northwestern University, is being saved for the last day to entice you all to stay. Her presentation, titled “Engineering reproduction: Creating physical environments for oocyte success” is sure to provoke excitement and contemplation about new possibilities for assisted reproduction.

The CANDES–Morulas Preconference Symposium, DABE Forum, and Practitioners Forum are important aspects of the meeting. As seen from the title of the CANDES–Morulas symposium, the embryo is also at the center of all for companion animals and non-domestic species. The DABE Forum is focused on the ethics of gene editing of embryos. The Practitioners Forum promises to be a lively and interesting session focused on the nuts and bolts of embryo transfer.

Finally, we have tried to maximize the number of oral presentations selected from the submitted abstracts. Some represent abstracts for award competitions, and some were selected from a larger group of abstracts that we felt merited special attention. The short oral presentations, as well as the posters, are often where the cutting edge of science and clinical practice resides.

Peter J. Hansen and Anna C. Denicol, Co-chairs

**Acknowledgments**

The program co-chairs are grateful for all the support and hard work from our colleagues and friends. We thank all the speakers for getting their manuscripts in on time (mostly) and all those who submitted abstracts of work to be presented in poster and oral sessions. We are very grateful to the reviewers of the invited papers and abstracts for their timely reviews and for the section chairs who handled the review process for abstracts; the names are listed elsewhere in the program. The January issue of *Reproduction, Fertility and Development* provides an excellent medium for communication of the science presented at the annual conference—thanks are extended to Graeme Martin (editor), Jenny Foster (publisher), and Ellen Dutton (our point person for interactions with the journal). The program booklet was put together by the FASS editorial staff, and they deserve a big thanks for getting everything done well and on time.
The CANDES–Morulas Preconference Symposium was organized by Dragos Scarlet and Gabriela Mastromonaco, the DABE Forum by Marcia A. M. M. Ferraz, and the Practitioners Forum by Larry F. Lanzon and Anna C. Denicol. Thanks very much for organizing these very important components of the annual conference.

Fun parts of every IETS meeting are the student competitions. We thank Dr. Bianca Gasparrini for organizing the IETS Foundation Student Competition (Bianca—we still need a soccer tournament, maybe in Monfalcone!) and Nisar Ahmad Wani for taking responsibility for the Farin Trainee Awards. The IETS Foundation has made the promotion of graduate education a key priority, and we thank Jennifer Barfield, chair of the Foundation, and Foundation members Hilde Aardema, Lucky Nedambale, Joao Viana, Satoko Matoba, and F. X. Grand for their continued support of student activities at the annual conference. The Morulas enrich the society in so many ways—we thank them for, among other things, co-organization of the preconference symposium, selection of co-chairs of sessions, and planning the Morulas and Mentors Luncheon. This year, the president of the Morulas was Pouya Dini and the governors were Beatriz Rodriguez Alonso and Rolando Pasquariello. We thank session chairs and co-chairs for their efforts to make for stimulating scientific sessions.

We sincerely thank IETS President Pascale Chavatte-Palmer and the Board of Governors for giving us the opportunity to develop the program, supporting us during the process, providing useful input, and organizing all the other aspects of the meeting in such a wonderful way.

We appreciate the leadership and the volunteer spirit of all those working to make the meeting a success. On a personal note, Debi Seymour of FASS has made what was always going to be a worthwhile endeavor (organizing the program) into a very enjoyable experience. Debi always knew the answer when we were unsure how to proceed, kept us to task gently but insistently, and made the process fun. Thanks Debi!!
2020 Recipient of the IETS Pioneer Award

Eric Palmer

The Pioneer Award is bestowed by the International Embryo Technology Society (IETS) to recognize individuals who have made seminal contributions to the development of embryo-based technologies.

Award Presentation: Sunday, January 19, at 14:15

Previous Recipients

- B. Bavister (2019)
- M.-A. Sirard (2018)
- H. Niemann (2017)
- C. E. Pope (2016)
- K. H. S. Campbell (2015)
- W. W. Thatcher (2014)
- J. Hahn (2013)
- O. J. Ginther (2012)
- I. Wilmut (2011)
- S. P. Leibo (2009)
- D. Kraemer (2006)
- S. Willadsen (2005)
- B. Brackett (2004)
- P. J. Dziuk (2001)
- R. M. Moor (1999)
- S. Wintenberger-Torres (1997)
- C. R. Austin (1995)
- N. W. Moore (1994)

- R. L. Brinster (1992)
- J. D. Biggers (1990)
- C. Thibault (1989)
- E. J. C. Polge (1987)
- T. M. Sugie (1986)
- L. E. A. Rowson (1985)
- M. C. Chang (1983)
- R. O. Berry (1982)
Map of the Venue
New York Hilton Midtown
1335 6th Ave., New York, New York 10019

Meeting Space (Second Floor)
Map of the Venue
New York Hilton Midtown
1335 6th Ave., New York, New York 10019

Meeting Space (Fourth Floor)
General Information

Meeting Room Directory
Main conference sessions Sutton North, Center, and South; DABE Forum, Beekman
Exhibits Rhinelander Gallery
Poster displays Rhinelander Gallery

Please see the Scientific Program for additional room assignments.

Registration Desk Hours
The registration desk is located on the second floor, East Promenade.

Pick-up of preregistration packets
Wednesday, January 15 16:00–19:00

On-site registration hours
Thursday, January 16 07:00–18:00
Friday, January 17 07:00–18:00
Saturday, January 18 07:30–16:00
Sunday, January 19 08:00–15:00

Exhibit Information
Rhinelander Gallery

Setup
Thursday, January 16 13:00–18:00

Exhibits open
Friday, January 17 09:00–19:00
18:00–19:00 (Reception)
Saturday, January 18 08:00–17:00
Sunday, January 19 08:30–13:00

Teardown
Sunday, January 19 13:00–15:00

This year, all registrants of the 46th IETS Annual Conference will find a game board in their registration bags. Take time to meet the exhibitors and get your game boards filled. All completed game boards will be eligible for a drawing of four prizes to be drawn on Sunday, January 19, right before the Keynote Lecture.

Details on the exhibitors can be found in the Exhibit Directory on page 52.
Badges
As a security requirement, we request that all participants wear their conference name badges to all sessions and social functions.

Certificates of Attendance and Presentation
A Certificate of Attendance will be included in your badge packet.

Currency
The dollar is the legal tender in the United States. Should you need to exchange your local currency, you will be able to make exchanges at the larger airports: New York, Miami, Los Angeles, Atlanta, Dallas, or Houston.

Passport and Visa Information
As with all IETS meetings, we expect attendees from all over the world. Please contact your embassy for visa/passport requirements for entering into the United States to attend conferences.

Climate
In January, daytime high temperatures tend to be mostly in the lower 40s °F (4–6°C), and overnight lows tend to average in the mid to upper 20s °F (2–3°C). A few of the warmer afternoons will see temperatures reaching or exceeding the lower 50s °F (11–12°C).

Winter in New York City requires at least one warm winter jacket or coat, as well as a warm hat and gloves. If sightseeing, a waterproof jacket will keep you warm in case of rain, sleet, or snow. New York tends to be windy in January. Layering your clothing will leave you feeling warm outdoors, with the option to remove layers when indoors. Wear comfortable, warm shoes or boots when sightseeing. Manhattan is a walking city, and you want to keep your feet warm and dry.

Registration Fees
All registration fees will be paid in US dollars or credit card purchases.

Messages
Any messages received for conference delegates will be posted on the message board located near the registration desk.

Fun Run
The Fun Run is still in effect; we have just had a run, pardon the pun, of bad luck. There was not any close space for the run this year. We would also been required to have a number of permits and security and safety officers for this year’s run at a very steep cost. Next year we will look at space for a run in Peru, and definitely in 2022 in Savannah, Georgia, we will most definitely have the run. It will be next to the river, right behind our hotel!

Refreshments
Morning and afternoon refreshments are included in your registration fee and are provided during the scheduled break times in the exhibit area located in Rhinelander Gallery.

Dining and Entertainment
With hundreds of restaurants in midtown, there is something for everyone and everyone’s pocketbook.

Located in the heart of Midtown, the Hilton Midtown puts you in the forefront of a dining experience that only NYC can offer. Start your day with a breakfast buffet and specialty coffees at Herb N’ Kitchen. Unwind with a few friends and a few drinks at the sophisticated Bridges Bar. Enjoy light fare or a late night snack at the Lobby Lounge.

Services and Amenities
Guests can take advantage of the modern fitness center, complimentary internet in guest rooms, gift shop, tour desk, theater, and transportation desk.
**Program**

**Tuesday, January 14**
09:00–17:00  IETS Board of Governors meeting (Hilton Board Room)

**Wednesday, January 15**
09:00–17:00  IETS Board of Governors meeting (Hilton Board Room)
09:00–13:00  HASAC Research Subcommittee meeting (Morgan)
14:00–18:00  HASAC Regulatory Subcommittee meeting (Morgan)
16:00–19:00  Registration (Rhinelander Gallery)

**Thursday, January 16**
07:00–18:00  Registration (Rhinelander Gallery)
08:00–15:00  W4171 Committee meeting (Harlem)
08:30–17:30  CANDES–Morulas Preconference Symposium (Sutton North, Center, South)
             Companion Animals and Non-Domestic Species: The Embryo at the Center of All
13:00–18:00  Poster setup (Rhinelander Gallery)
13:00–18:00  Exhibitor setup (Rhinelander Gallery)
14:00–18:00  IETS Foundation Board of Trustees meeting (Hilton Board Room)

**Friday, January 17**
07:00–18:00  Registration (Rhinelander Gallery)
07:00–08:00  Poster setup (Rhinelander Gallery)
07:00–08:00  Past Presidents Breakfast (Morgan)
07:00–08:00  Graduate and Undergraduate Student Competition Presenters Breakfast with IETS Foundation
             Education Chair (Madison)
08:00–08:30  Opening and welcome (Sutton North, Center, South)
09:00–19:00  Exhibits (Rhinelander Gallery)

**Session I: In Vitro Oogenesis and Folliculogenesis (Sutton North, Center, South)**
Session co-chairs: Luiz F. Shutz, University of Nevada, Reno, and Miranda Zwiefelhofer, University of Saskatchewan

08:30–09:15  In vitro growth (IVG) of immature bovine follicles and oocytes
             *Evelyn Telfer, University of Edinburgh, Scotland*

09:15–10:00  Prospects for new oocyte-based assisted reproduction in animals and humans
             *David Albertini, Center for Human Reproduction, USA*

10:00–10:30  Refreshment break, poster viewing, and exhibits (Rhinelander Gallery)

**IETS Foundation Student Competition Presentations (Sutton North, Center, South)**
Session chair: Bianca Gasparrini, Università degli Studi di Napoli Federico II

10:30–10:45  Assessing the energy status of porcine embryos by means of Biodynamic Imaging

10:45–11:00  The landscape of accessible chromatin in bovine oocytes and early embryos
             *H. Ming*, J. Sun, R. Pasquariello, J. R. Herrick, Y. Yuan, E. Gutierrez, L. Gatenby, K. R. Bondioli, R.
             L. Krisher, and Z. Jiang (Abstract 2)
11:00–11:15 Dietary caloric normalization or restriction as preconception care strategies: Impact on metabolic health and fertility in high fat-induced obese outbred mice
A. Smits*, W. Marei, M. De Ketelaere, B. Meulders, P. Bols, and J. Leroy (Abstract 3)

11:15–11:30 Sperm, but not seminal plasma, elicit changes in the bovine endometrial transcriptome after natural mating

11:30–11:45 Transport and cholinergic innervation in the bovine oviduct are dysregulated in cystic ovary disease
D. Scully*, D. Campion, F. McCartney, S. Reese, and S. Kölle (Abstract 5)

11:45–12:00 In vitro validation of gene edited phenotypes using CRISPR-dCas9 transcriptional activators
K. M. Polkoff*, N. K. Gupta, and J. A. Piedrahita (Abstract 6)

12:00–13:30 Lunch break
12:00–13:30 IETS Board luncheon with Partner Societies (Morgan)
12:00–13:30 HASAC Manual and Certificates Subcommittee meeting (Madison)
12:00–13:30 Morulas and Mentors Luncheon (Clinton)

Session II: Embryonic Stem Cells and Gene Editing (Sutton North, Center, South)
Session co-chairs: Martha Sofia Ortega, University of Missouri, and Kathryn Polkoff, North Carolina State University

13:30–14:15 Livestock pluripotency is finally captured in vitro
Pablo Ross, University of California–Davis, USA

14:15–15:00 Application of genome editing systems to enhance available pig resources for agriculture and biomedicine
Kiho Lee, Virginia Tech, USA

15:00–15:30 Refreshment break, poster viewing, and exhibits (Rhinelander Gallery)

15:30–16:45 Selected short presentations (Sutton North, Center, South)

Edition of prostaglandin E2 gene receptors EP2 and EP4 by CRISPR/Cas9 technology in equine adipose mesenchymal stem cells

CRISPR Cas9 gene editing of in vivo fertilized bovine embryos via endoscopic oviductal flushing and electroporation of zygotes

YAP/TAZ increased expression encourages outgrowth establishment, 3D colony formation and boosts plasticity of Parthenogenetic stem cells
S. Arcuri*, G. Pennarossa, F. Gandolfi, and T. Brevini (Abstract 212)

Urine samples as a non-invasive source for induced pluripotent cells (iPSCs) generation in the swine model

CRISPR-on, a new tool for activation of endogenous gene expression in bovine embryos

16:45–17:15 Distinguished Service Award (Sutton North, Center, South)
18:00–19:00 Welcome Reception (Rhinelander Gallery)
19:00–21:00 Student Mixer (Beekman)

Saturday, January 18

07:00–08:00 Organizational breakfast meeting of the IETS Foundation (Hilton Board Room)
07:30–16:00 Registration (Rhinelander Gallery)
08:00–17:00 Exhibits (Rhinelander Gallery)

Session III: New Developments in Embryo Transfer Technologies (Sutton North, Center, South)
Session co-chairs: Veronica Negron, University of Puerto Rico, and Paula Chen, University of Missouri

08:00–08:45 Genetics of embryo production in cattle
Filippo Miglior, Ontario Genomics, Canada

08:45–09:30 The role of extracellular vesicles from follicular fluid during oocyte maturation and early embryo development
Juliano da Silveira, University of São Paulo, Brazil

09:30–10:00 Selected short presentations (Sutton North, Center, South)

- microRNAs of extracellular vesicles secreted by embryos as early biomarker of competence
  (Abstract 79)

- Embryonic metabolism orchestrates epigenetic mechanisms: What can we anticipate from the first cleavages?

10:00–12:00 Poster session I (Rhinelander Gallery)
10:00–12:00 Exhibits (Rhinelander Gallery)
12:00–13:30 Lunch break
12:00–13:30 IETS Data Retrieval Committee meeting (Madison)
12:00–13:30 IETS Exhibitors Luncheon with IETS Board of Governors (Morgan)
12:00–13:30 Morulas Career Luncheon (Clinton)

Session IV: Developmental Programming Associated with Assisted Reproduction (Sutton North, Center, South)
Session co-chairs: Maria Belen Rabaglino, Denmark Technical University, and Emilie Derisoud, INRA

13:30–14:15 Consequences of assisted reproductive techniques on the embryonic epigenome in cattle
Rocio Rivera, University of Missouri, USA

14:15–15:00 Consequences of assisted reproductive technologies for function of the offspring in cattle
Luis Siqueira, Embrapa, Brazil

15:00–15:30 Peter Farin Trainee Award Winners Presentations (Sutton North, Center, South)

15:30–16:00 Refreshment break, poster viewing, and exhibits (Rhinelander Gallery)

Concurrent Session
16:00–18:00 Practitioners’ Forum (Grand Ballroom AB)
Co-Chairs: Larry F. Lanzon and Anna C. Denicol

In vivo or in vitro embryo production: when to choose each technology, and why?
1. Introduction and overview of the latest data on the status of MOET and IVP in the US and worldwide
2. Selected abstract presentations from Case Reports and Field Data

Relationship between estrus manifestation and pregnancy rates on recipients used in an IVP embryo transfer program

Pregnancy loss in Holstein lactating recipient cows diagnosed pregnant by PAG test in blood
R. Santos*, M. Oliveira, N. Melgar, R. Chebel, and D. Demtrio (Abstract 9)

3. Panel discussion and Q&A: Critical factors for success of both practices including IVM, IVF and embryo culture, embryo manipulation and cryopreservation, and recipient management.
Panel members: Alvaro Guerra (Ohio State University), Daniela Demetrio (Maddox Dairy, California), William Croushore (White Oak Veterinary Clinic, Pensylvania), Larry Lanzon (Embryo Inc, California), Teresa Mogas (Universidad Autonoma de Barcelona).

Concurrent Session
16:00–18:00 DABE—Narrowing the gaps between embryo gene editing and ethics (Beekman)
Chair: Marcia A. M. M. Ferraz

Introduction

Embryo gene editing: Techniques, uses and future perspectives
Alison L. Van Eenennaam, University of California, USA

Ethical aspects of embryo gene editing for animal production and the development of biomedical models
Jason Scott Roberts, Arizona State University, USA

Panel discussion

18:00–18:30 IETS Business Meeting (Sutton North, Center, South)
18:30–19:30 HASAC open meeting (Sutton North, Center, South)
18:30–19:30 Morulas Forum (Beekman)

Sunday, January 19

07:30–08:30 Organizational Meeting of the IETS Board of Governors (Hilton Board Room)
08:00–15:00 Registration (Rhinelander Gallery)
08:30–13:00 Commercial exhibits (Rhinelander Gallery)

Session V: Enhancing Success of Embryo Transfer Programs (Sutton North, Center, South)
Session co-chairs: Vitor Mercadante, Virginia Tech, and Jacqueline Ervin, New Mexico State University

08:00–08:45 Bovine oocyte maturation: Acquisition of developmental competence
Bernard Roelen, Utrecht University, the Netherlands

08:45–09:30 Factors affecting embryo production in superovulated Bos taurus cattle
Marja Mikkola, Geno SA, Norway

09:30–10:00 Selected short presentations (Sutton North, Center, South)
Pregnancy from a vitrified-warmed alpaca preimplantation embryo

Comparison of slow and rapid freezing in freeze-dry ram spermatozoa
L. Palazzese*, D. A. Anzalone, P. Toschi, and P. Loi (Abstract 40)
10:00–10:30 Richard Fayrer-Hosken, Lifetime Career Award Recipient (Sutton North, Center, South)
10:30–12:30 Poster session II (Rhinelander Gallery)
12:30–14:00 Lunch break
12:30–14:00 2019, 2020, 2021 IETS Program Committee lunch (Morgan)
13:00–16:00 Commercial exhibit and poster takedown (Rhinelander Gallery)
  All posters must be removed by 13:30.
14:15–14:45 Pioneer Award (Sutton North, Center, South)
14:45–14:45 Exhibitor drawing (Sutton North, Center, South)

Session VI: Keynote Lecture (Sutton North, Center, South)
Session chair: Pascale Chavatte-Palmer, INRA
14:45–15:30 Engineering reproduction: Creating physical environments for oocyte success
  Teresa Woodruff, Northwestern University, USA

Awards Presentation and Updates (Sutton North, Center, South)
15:30–16:00 IETS Foundation Early Career Achievement Award Winner
16:00–16:30 IETS Foundation Student Competition Awards; CANDES, DABE, and HASAC updates
16:30–17:00 Closing ceremony (Sutton North, Center, South)
19:00–23:00 Closing party, New York Hilton Midtown (Rhinelander Gallery)

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Come by and visit with us at Booth # 312 to find out more about our products.
The Program Co-Chairs Acknowledge and Thank the Following People

Section Editors

Bianca Gasparrini, Graduate Student Competition
William Holt, Bioethics, Welfare, and Sustainability
Roberto Sartori, Case Reports and Field Data
Paula Rodriguez, Cloning/Nuclear Transfer
Marcia A. M. M. Ferraz, Companion CANDES
Jean-Magloire Feugang, Cryopreservation/Cryobiology
Kun Zhang, Developmental Biology
Alan Ealy, Early Pregnancy
Dawit Tesfaye, Embryo Culture
Irina Polejaeva, Embryo Manipulation
Luciano Bonilla, Embryo Transfer
Miki Sakatani, Epidemiology/Diseases
Katrin Hinrichs, Fertilization/ICSI/Activation
Poul Hyttel, Folliculogenesis/Oogenesis
M. Sofia Ortega Obando, Genetic Engineering
Brett White, Male Physiology
Marcelo Marcondes Seneda, Oestrus Synchronization/Artificial Insemination
Jeremy Block, Oocyte Collection
François-Xavier Grand, Oocyte Maturation
Paula Tribulo, Periconceptional/Fetal Programming
Pablo Ross, Stem Cells
João H. M. Viana, Superovulation
Bianca Gasparrini, Undergraduate Poster Competition

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ACHIEVE MORE TOGETHER

46th Annual Conference
Poster Session Information

Location
Posters are located in the Rhinelander Gallery of the New York Hilton Midtown on the second floor (see map on page 4).

Poster Numbers
Posters are identified by the number corresponding to the abstract number in *Reproduction, Fertility and Development* 2020, 32(1). Numbering of the posters begins at 1 and ends at 231.

Setup
Posters can be put up from 13:00 to 18:00 on Thursday, January 16, and from 07:00 to 08:00 on Friday, January 17. They will remain up until 12:30, Sunday, January 19.

Poster Session I
**Presentations by authors of odd-numbered abstracts** (e.g., 7, 9, 11) in *Reproduction, Fertility and Development* 2020; 32(1) as well as the student competition finalist and undergraduate finalist poster presentations will take place Saturday, January 18, from 10:00 to 12:00. Odd-numbered posters for the poster competition will also be judged on Saturday, January 18, from 10:00 to 12:00.

Poster Session II
**Presentations by authors of even-numbered abstracts** (e.g., 8, 10, 12) in *Reproduction, Fertility and Development* 2020; 32(1) will take place Sunday, January 19, from 10:30 to 12:30. Even-numbered posters for the poster competition will be judged on Sunday, January 19, from 10:30 to 12:30.

Teardown
Poster teardown will take place from 12:30 to 13:00 on Sunday, January 19. **Posters that are not taken down by 13:30 on Sunday will be discarded.**
Poster Session Order by Topic

Poster number = abstract number in *Reproduction, Fertility and Development* 2020; 32(1)

Graduate Student Competition Finalists

1  Assessing the energy status of porcine embryos by means of biodynamic imaging  

2  The landscape of accessible chromatin in bovine oocytes and early embryos  
   H. Ming, J. Sun, R. Pasquariello, J. R. Herrick, Y. Yuan, E. Gutierrez, L. Gatenby, K. R. Bondioli, R.  
   L. Krisher, and Z. Jiang  

3  Dietary caloric normalization or restriction as preconception care strategies: Impact on metabolic  
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   A. Smits, W. Marei, M. De Ketelaere, B. Meulders, P. Bols, and J. Leroy  

4  Sperm, but not seminal plasma, elicit changes in the bovine endometrial transcriptome after natural  
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   Spencer, M. Yeste, P. Lonergan, and B. Fernandez-Fuertes  

5  Transport and cholinergic innervation in the bovine oviduct are dysregulated in cystic ovary disease  
   D. Scully, D. Campion, F. McCartney, S. Reese, and S. Kölle  

6  *In vitro* validation of gene edited phenotypes using CRISPR-dCas9 transcriptional activators  
   K. M. Polkoff, N. K. Gupta, and J. A. Piedrahita  

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7  Pregnancy from a vitrified-warmed alpaca pre-implantation embryo  

8  Relationship between oestrus manifestation and pregnancy rates on recipients used in an *in vitro-*  
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   Lindsey, M. Rubessa, and M. B. Wheeler  

9  Pregnancy loss in Holstein lactating recipient cows diagnosed pregnant by pregnancy-associated  
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   R. Santos, M. Oliveira, N. Melgar, R. Chebel, and D. Demetrio  

10 Pregnancy rates following artificial insemination or embryo transfer in lactating Holstein cows  
    M. Oliveira, R. Santos, R. Chebel, and D. Demetrio  

11  *In vivo*-derived embryo pregnancy rates at Maddox Dairy from 2008 to 2018  
    D. Demetrio, A. Magalhaes, M. Oliveira, R. Santos, and R. Chebel  

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13  *In vitro* and *in vivo* embryo production during foal heat in a mare: A case report  
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15 Combination of RepSox with histone deacetylation inhibitors on *in vitro* development competence of porcine somatic cell nuclear transfer embryos 
*Z.-B. Luo, M.-F. Xuan, Z.-Y. Li, X.-J. Yin, and J.-D. Kang*

16 Improvement of porcine cloned embryo developmental competence via KDM4A overexpression and H3K9me3 methyltransferase inhibitor treatment 
*Y.-T. Zhang, Y. Liu, and Z. Liu*

17 Generation of myostatin gene knockout boars by somatic cell nuclear transfer  
*J.-D. Kang, M.-F. Xuan, Z.-B. Luo, S.-Z. Han, and X.-J. Yin*

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19 Improvement of the developmental competence of bovine somatic cell nuclear transfer embryos using latrunculin A during activation 
*G. Vans Landschoot, V. Savy, L. D. Ratner, V. Alberio, and D. F. Salamone*

20 Aggregation of yak heterospecific somatic cell nuclear transfer embryos improves cloning efficiency 
*M. Yauri Felipe, M. Duque Rodriguez, A. De Stéfano, and D. Salamone*

21 The contrasting role of histone methyltransferases during nuclear reprogramming: SUV39H knockdown improves bovine somatic cell nuclear transfer, while the absence of EHMT2 hampers it 

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22 The zona pellucida is required for normal development of *in vitro*-produced cat embryos 
*D. Veraguas, S. Saez, M. Cordero, C. Aguilera, D. Saez-Ruiz, F. O. Castro, and L. Rodriguez-Alvarez*

23 Sperm quality of Pure Spanish stallions is affected by inbreeding coefficient and age 
*Y. Pirosanto, M. Valera, A. Molina, J. Dorado, and S. Demyda-Peyrás*

24 Asynchronic tetraploid complementation and embryo quality in domestic cat and *Leopardus Geoffroyi* hybrid embryos 
*M. Duque Rodriguez, A. Gambini, C. Gutnisky, L. Ratner, S. Rulli, A. Sestelo, O. Briski, R. Fernandez Martin, P. D. Cetica, and D. Salamone*

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26 Baobab oil supplemented extender preserves post-thaw bull sperm quality parameters 
*Z. Raphalalani, F. Ramukhithi, R. Ndhlala, K. Nephawe, and T. Nedambale*

27 Vitrification at the germinal vesicle stage does not trigger apoptosis in porcine oocytes and early embryos 
28. Short equilibration improves vitrification of *in vitro*-produced bovine embryos using VitTrans device
   *I. Martínez-Rodero, T. García-Martínez, M. López-Béjar, and T. Mogas*

29. Time-lapse analysis of bovine embryos derived after *in vitro* fertilization from vitrified and fresh oocytes
   *D. Angel Velez, H. Atashi, J. Dewulf, K. Smits, and A. Van Soom*

30. Supplementation of *in vitro* culture medium with linoleic acid albumin improves bovine embryo survivability in low-temperature storage at 4°C
   *S. K. Jung, T. Nishisouzu, O. Dochi, and K. Imai*

31. Effect of vitrification on global gene expression dynamics of bovine elongating embryos
   *Z. Jiang, E. Gutierrez, H. Ming, B. Foster, L. Gatenby, C. Mak, C. Pinto, and K. Bondioli*

32. Bovine embryo cryopreservation in a chemically defined medium
   *A. Østergaard, L. Gavin-Plagne, M. Guedes Teixeira, S. Buff, and T. Joly*

33. Assessment of spindle morphology and reactive oxygen species production after vitrification of bovine oocytes following *in vitro* maturation in the presence of glutathione ethyl ester
   *T. García-Martínez, M. Vendrell-Flotats, I. Martínez-Rodero, M. Álvarez-Rodríguez, M. López-Béjar, and T. Mogas*

34. Effect of polysaccharide from *Flammulina velutipes* on the vitrification of bovine oocytes
   *Y. Ihara, K. Tatakura, Y. Wada, H. Kawahara, and K. Yamanaka*

35. Ethanolic extracts of Cerrado plants in cryotolerance of *in vitro*-produced bovine embryos
   *A. A. G. Fidelis, G. O. Fernandes, T. S. Kawamoto, F. R. Melo, and M. A. N. Dode*

36. Extended culture after vitrification-warming helps in spindle recovery of bovine oocytes
   *E. Gutierrez, Z. Jiang, and K. Bondioli*

37. *In vitro* maturation and fertilization in white-tailed deer (*Odocoileus virginianus*) oocytes vitrified with trehalose or sucrose

38. Ram sperm longevity after cryopreservation in extender containing l-carnitine

39. Nanowater enhances cryoprotective effects of glycerol during ram semen freezing
   *J. Szymanowicz, M. Murawski, T. Schwarz, and P. Bartleowski*

40. Comparison of slow and rapid freezing in freeze-dry ram spermatozoa
   *L. Palazzese, D. A. Anzalone, P. Toschi, and P. Loi*

41. Effect of vitrification on DNA integrity of human spermatozoa
   *Y. Toishibekov, B. Shalekenov, Y. Assanova, S. Shalekenov, Y. Kuandykov, D. Toishybek, and V. Isachenko*

42. Vitrification of *in vitro*-produced feline embryos
   *D. Fuller, J. Herrick, J. Graham, and J. Barfield*

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   *E. Jannaman, Y. Xiao, and P. Hansen*
44 Analysis of abnormal chromatin configuration induced by inhibiting MEK at the 1-cell stage
K. Magara, S. Naruto, R. Watanabe, T. Wakayama, and S. Kishigami

45 Expression patterns of PRDM family genes in porcine pre-implantation embryos
K. Farrell, K. Uh, and K. Lee

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K. Uh, N. Wax, K. Farrell, and K. Lee

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49 Expression and actions of the dickkopf-1 receptors KREMEN1 and KREMEN2 in the bovine pre-implantation embryo
T. Fernandes Amaral, Y. Xiao, E. Estrada-Cortes, and P. Hansen

50 Effect of colony-stimulating factor 2 on competence of bovine blastocysts to survive vitrification
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51 Bovine embryos with distinct early morphokinetic pathways present different post-embryonic genome activation transcriptomic patterns and different cryotolerance
A. P. Reis, A. Jampy, A. Teste, B. M. Le Guen, L. Laffont, S. Ruffini, E. Canon, C. Archilla, L. Jouneau, A. Trubuil, and V. Duranthon

52 Blocking of embryonic development by nanoparticles derived from endometrial and oviductal cells isolated with an Amicon filter system
J. Cabezas, D. Rojas, B. Melo-Baez, M. Gutierrez, F. Castro, and L. Rodriguez-Alvarez

53 Transcriptomic profiles of uniform populations of in vivo-produced spherical, ovoid, or tubular porcine embryos during the initiation of elongation
S. Walsh, J. R. Miles, E. C. Wright-Johnson, B. Keel, L. A. Rempel, and A. K. Pannier

54 Choline alters the pattern of DNA methylation and lipid content of pre-implantation bovine embryos
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55 Identification of microRNAs associated with sex determination in bovine amniotic fluid and maternal blood plasma

56 Mammalian pre-implantation embryos at the single cell level: The bovine as a model for early human embryonic development
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57 Primordial germ cell distribution in the horse fetal gonad
D. Scarlet, U. Reichart, G. Podico, R. Ellerbrock, I. Canisso, I. Walter, and C. Aurich

58 Effect of different light sources on the developmental capacity of bovine embryos produced in vitro
A. Gonzalez, F. Dobener, S. Chatterjee, and C. Wrenzycki

59 Genome activation in intracytoplasmic sperm injection-derived horse embryos
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61 Low plasma progestin concentration during the early luteal phase impairs equine conceptus development until placentation
_C. Okada, M. Kaps, S. Handschuh, D. Scarlet, and C. Aurich_

62 Peripheral transcriptome response to embryo mortality in Holstein cows
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63 Inhibition of CXCR4 at the fetal–maternal interface during placentation results in altered production of vascular endothelial growth factor receptors in the placenta on Day 90 of pregnancy
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64 Prediction of pregnancy and early embryo loss through OAS-1 expression, concentrations of pregnancy-associated glycoproteins, and Doppler ultrasonography in beef cattle

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65 Effect of oviductal fluid extracellular vesicle supplementation during _in vitro_ culture on development and quality of bovine embryos
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66 Lipid profiling of bovine blastocysts produced _in vitro_ with and without a stimulator of cyclic guanosine monophosphate synthesis by multiple reaction monitoring profiling

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_Y. Hashiyada, Y. Aikawa, H. Matsuda, and T. Yamanouchi_

68 Anti-Mullerian hormone levels in different bovine species and the relationship with _in vitro_ embryo production

69 Phosphorylation of mechanistic target of rapamycin in porcine blastocyst-stage embryos is dependent on the concentration of glutamine in the medium
_P. Chen, L. Spate, and R. Prather_

70 Trolox during _in vitro_ maturation of bovine oocytes protects developing embryos from palmitic acid-induced lipotoxicity
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71 Comparison of sexed semen ULTRA-4M with conventional semen for the _in vitro_ production of bovine embryos
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73 Cytokine addition does not increase developmental competence of in vitro-produced bovine embryos
C. M. Helland, M. Barcelo-Fimbres, and L. F. Campos-Chillon

74 Analysis of chromosomal abnormality of bovine IVF embryos based on next-generation sequencing
M. Okada, Y. Nagai, S. Matoba, Y. Sakuraba, and S. Sugimura

75 Expression of lipid metabolism-related genes in bovine embryos cultured in vitro with diacylglycerol
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K. Cañón-Beltrán, J. Giraldo-Giraldo, Y. N. Cajas, N. Vásquez, C. L. V. Leal, A. Gutiérrez-Adán, M.
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76 Extracellular vesicles from oviduct and uterus in sequential culture improve the quality of bovine
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77 Nobiletin supplementation affects gene expression profiles of the Akt pathway in bovine embryos in vitro
Y. N. Cajas, K. Cañón-Beltrán, C. L. V. Leal, M. E. González, A. Gutierrez-Adán, and D. Rizos

78 Radio electric asymmetric conveyor treatment during prolonged cold storage of ovaries enhances
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F. Ariu, E. Sanna Passino, A. Piras, V. Melosu, M. Maioli, A. Castagna, V. Fontani, S. Rinaldi, and L.
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79 MicroRNAs of extracellular vesicles secreted by embryos as an early biomarker of competence

80 Evaluation of extracellular vesicles from culture medium of human embryos as a possible method of
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81 Linoleic acid required for reduction of apoptosis through nuclear transcription factor-kappa B during
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82 Stage-specific expression of lineage marker genes and pluripotency marker distribution in porcine
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83 Validation of propidium iodide dye for live-dead staining of bovine blastocysts: Preliminary results
H. Hellmold, D. Teuteberg, J. Tetens, and C. Blaschka

84 Folate-methionine cycle and folate transport in developing buffalo embryos
S. Ansari, S. Jamwal, S. Saini, R. Singh, and D. Malakar

85 Regulation of mammalian target of rapamycin signaling post-fertilisation is essential for efficient
development of bovine pre-implantation embryos
M. El Sheikh, A. Mesalam, A. Mesalam, K. Lee, and I. Kong

86 Effect of in vitro culture conditions on mitochondria functions in mouse embryos
M. Czernik, D. Winiarczyk, S. Sampino, P. Greda, J. A. Modlinski, and P. Loi
Analyzing metabolomic profile of bovine IVF and somatic cell nuclear transfer embryos through Raman spectroscopy

J. Keim, W. Zhang, Y. Liu, H. Rutigliano, A. Zhou, and I. Polejaeva

MicroRNA profile of *in vitro* bovine embryos cultured in the presence of amniotic extracellular vesicles shifts toward *in vivo*-collected blastocysts

A. Lange-Consiglio, B. Lazzari, F. Pizzi, A. Idda, F. Cremonesi, and E. Capra

Embryonic metabolism orchestrates epigenetic mechanisms: What can we anticipate from the first cleavages?


Establishment and characterization of Day 30 equine chorionic girdle and allantochorion cell lines

S. Salman, A. Asghar, C. Magee, Q. Winger, G. Bouma, and J. Bruemmer

In *vivo*- and *in vitro*-produced bovine embryos have different microRNA profiles after *in vitro* individual culture


Using physical parameters of bovine zygotes to predict *in vitro* development success

C. L. Timlin, A. Lynn, L. K. Wooldridge, K. Uh, A. D. Ealy, R. R. White, K. Lee, and V. R. G. Mercadante

**Embryo Manipulation**

Efficient introduction of green fluorescent protein-9R, a protein with cell-penetrating peptides, into oocytes using intracytoplasmic sperm injection

R. Watanabe, H. Okaji, K. Magara, K. Tetsuka, T. Kaitsuka, K. Tomizawa, and S. Kishigami

Efficient generation of myostatin mutation in Korean beef cattle

G. Gim, Y. Jin, S. Yum, H. Park, J. Lee, S. Koo, W. Lee, and J. Goo

Obtaining birds with chimeric gonads using *in vitro* lentiviral transduction of primordial germ cells


Evaluation of CRISPR/Cas9 alternative delivery in parthenogenetic porcine embryos

O. Briski, G. La Motta, D. Salamone, R. Fernandez-Martin, and L. Ratner

Loss of aggregation capacity of bovine *in vitro*–produced embryos and blastocyst-derived trophoblasts from Day 6 of development

V. Alberio, M. Yauri Felipe, and D. Salamone

Effects of maternal age on oxygen consumption of oocytes and *in vitro*–produced equine embryos

G. Catandi, Y. Obeidat, J. Stokes, A. Chicco, T. Chen, and E. Carnevale

**Embryo Transfer**

Short-term storage of equine embryos at 5 or 20°C does not cause lipid peroxidation

G. D. Gastal, D. Scarlet, and C. Aurich

Relationship between corpus luteum blood flow evaluated via color Doppler ultrasound and pregnancy rate in bovine embryo transfer recipients

Treatment with gonadotrophin-releasing hormone on Day 7 or 21 does not reduce pregnancy loss in dairy heifers receiving in vitro–produced embryos

A delay in maternal zygotic transition may lead to early embryonic loss in poor-quality bovine blastocysts
H. Georges, J. Bishop, H. Van Campen, J. Barfield, and T. Hansen

Effects of administration of human chorionic gonadotrophin at Day 5 post-ovulation on development of the original corpus luteum depend on the locational relationship between the original and accessory corpora lutea
K. Hazano, S. Haneda, and M. Matsui

SOFaaci-HEPES or holding media can be used for embryo loading without changes in pregnancies per embryo transfer nor pregnancy loss in an in vitro–produced embryo transfer program
D. Pereira, D. Moreno, R. Sala, L. Carrenho-Sala, M. Fosado, J. Moreno, and A. Garcia-Guerra

Optimization of a five-day fixed-time embryo transfer program in dairy heifers: Use of gonadotrophin-releasing hormone at initiation of the protocol
R. Sala, L. Carrenho-Sala, V. Absalon-Medina, A. Lopez, M. Fosado, J. Moreno, M. Wiltbank, and A. Garcia-Guerra

Comparative growth rates and haematological parameters from calves born by transfer of vitrified in vitro–produced embryos and stepbrother calves born by AI
J. S. Lopes, C. Soriano-Úbeda, L. Sarrias-Gil, E. París-Oller, S. Navarro-Serna, R. Latorre, and P. Coy

Follicular wave synchronization and FSH stimulation prior to ovum pickup for in vitro embryo production
L. Ferré, M. Kjelland, T. Stroud, and P. Ross

Use of seminal plasma as ovulation inductor in alpacas (Vicugna pacos) embryo recipient and its effect on pregnancy rate
W. Huanca, K. Garcia, W. F. Huanca, A. Cordero, and J. Malaga

Effect of ruminal infusion with propylene glycol on the in vitro embryo production of Holstein (Bos taurus) prepubertal heifers and pregnancy rate of the embryo transfer

Absence of transmission of Mycoplasma bovis via naturally contaminated semen during in vitro fertilization
J. Peippo, N. Vähänikkilä, M. Mutikainen, H. Lindeberg, T. Pohjanvirta, H. Simonen, S. Pelkonen, and T. Autio

Fertilizing ability of frozen and freeze-dried semen following intracytoplasmic sperm injection of in vitro–matured sheep oocytes
I. Menéndez-Blanco, F. Ariu, A. Piras, S. Nieddu, M. Paramio, A. Arav, S. Ledda, and L. Bogliolo
The effect of biological extenders on in vitro induction of the acrosome reaction in bovine spermatozoa
L. Gatenby and K. R. Bondioli

Effect of antioxidants on motility and fertility of liquid-stored bovine sperm
Y. Honkawa, T. Fujikawa, N. Miura, and C. Kubota

Omega-3-enriched diet improves fertilization competence of cryopreserved sperm
D. Kalò, D. Reches, A. Komsy-Elbaz, U. Moallem, Y. Zeron, and Z. Roth

In vivo confocal laser endomicroscopy visualisation of fresh and frozen bull spermatozoa in the genital tract of dairy heifers

Effect of different energy sources on motility and calcium ionophore-induced acrosome reaction in equine sperm

Supplementation of IVF medium with nerve growth factor improved bovine embryonic cleavage rates during summer months

Semen quality and fertilization ability of myostatin-knockout boars
M.-F. Xuan, S.-Z. Han, B.-H. Quan, X.-J. Yin, and J.-D. Kang

Short spermatozoa–oocyte co-incubation improves outcomes of IVF in sheep
D. Anzalone, M. Czernik, L. Palazzese, Y. Ressaissi, P. Scapolo, and P. Loi

Use of fixable dyes to analyze equine sperm membrane integrity and acrosome reaction after A23187 treatment
I. Ortiz, M. Felix, H. Resende, C. Love, and K. Hinrichs

Effect of pentoxifylline on motility of good- and poor-quality frozen-thawed equine sperm
M. Felix, I. Ortíz, H. Resende, J. Brom-de-Luna, C. Love, and K. Hinrichs

Proteome of extracellular vesicles from follicular fluid of bovine 3- to 6-mm follicles: Similarity and specifictiy compared with granulosa cells

Nerve growth factor–induced ovulation in llamas: Evidence of hypothalamic refractoriness to nerve growth factor during the declining phase of the luteinising hormone surge
R. Carrasco and G. Adams

Ovarian follicular development and steroid secretion during oestrous cycle of Lohi sheep
M. Younis, M. Irfan-ur-Rehman Khan, A. Murtaza, M. Abbas, M. Z. Tahir, K. Javed, I. Mohsin, and M. Shahzad

Transcriptomic changes in bovine ovarian cortex in response to FSH signaling
J. Candelaria, B. Rabaglino, and A. Denicol

Subcortical maternal complex (SCMC) expression during folliculogenesis is affected by oocyte donor age in sheep
D. Bebbere, A. Abazari-Kia, F. Ariu, L. Bogliolo, and S. Ledda
Chemokine receptor 2 (CCR2) is expressed in growing oocytes, and its deficiency affects follicular activation and long-term female fertility in mice

Study of preantral ovarian follicular population in fetal alpaca (Vicugna pacos) ovaries
D. Dipaz-Berrocal, G. Rojas, C. Mamani, and E. Mellisho

Ovarian dynamics and gonadotropins during selection of the dominant follicle in postpartum lactating versus non-postpartum cycling mares
M. Pastorello, M. O. Gastal, G. K. Piquini, D. B. Godoi, and E. L. Gastal

Increased antral follicle population at 60 days of gestation in Holstein cows with low antral follicle count
R. G. Droher, F. Morotti, A. Guidugli Lindquist, A. Fonseca Zangirolamo, and M. Marcondes Seneda

Genetic Engineering

Genetic variants and haplotype combination in the bovine SH2B2 gene and their associations with molecular breeding for body size traits in Qinchuan cattle (Bos taurus)
S. H. A. Raza and L. Zan

Introduction of F508del human mutation into the CFTR gene of sheep fetal fibroblasts using CRISPR/Cas9 ribonucleoprotein

CRISPR/Cas9 gene editing of in vivo-fertilized bovine embryos via endoscopic oviductal flushing and electroporation of zygotes
D. Miskel, L. Beunink, M. Poirier, V. Havlicek, F. Rings, K. Schellander, U. Besenfelder, and M. Hölker

Generation of NANOS2 knockout goats using CRISPR/Cas9 and somatic cell nuclear transfer techniques
Z. Fan, M. Regouski, Y. Liu, J. Keim, I. Perisse, J. Oatley, and I. Polejaeva

Strategies for transfection of bovine mesenchymal stem cells with pBC1-anti-CD3 vector
F. B. Duarte, S. N. Bào, M. Brigido, J. M. Araújo, E. d. O. Melo, and C. F. Martins

Effects of the homology direct repair enhancer RS-1 on pig embryo culture
C. Gomes Lucas, B. Bauer, P. Chen, L. Spate, K. Wells, and R. Prather

Male Physiology

Recovery of quail spermatogenesis by donor spermatogonia transplantation

Associations of sperm head morphometrics with quality parameters of frozen-thawed ram semen
J. Navaranjan, J. Szymanowicz, M. Murawski, T. Schwarz, and P. M. Bartleowski

Heat stress has a deleterious effect on bull semen quality and subsequent embryo development

The relationship between morphometric characteristics and semen parameters in Bapedi rams
Effect of combined treatment of melatonin and equine chorionic gonadotrophin on fresh semen quality of Beetal bucks during the non-breeding season
M. Abbas, M. Irfan-ur-Rehman Khan, A. Rehman, N. Hameed, I. Mohsin, M. Younis, M. Bilal, and M. Shahzad

Metabolomic analysis of fresh and frozen bovine seminal plasma: A preliminary study
M. A. Kosior, N. Pagano, A. Staropoli, C. De Canditiis, V. Longobardi, G. Zullo, F. Vinale, and B. Gasparrini

Stimulated glycolysis is able to maintain ATP levels and motility of bull spermatozoa submitted to mitochondrial depolarisation

Serum testosterone profile in Marwari stallions and its relationship with testicular parameters, semen characteristics, reaction time, stallion age, bodyweight, and height

ProAKAP4 concentrations in semen as a predictive tool of bull fertility: A preliminary study

Tributyltin chloride exposure alters ejaculated bull sperm function and embryo development
B. W. Daigneault and K. E. Latham

Dynamics of drake spermatogenesis

Bull spermatozoon uptake of extracellular vesicles from bovine seminal plasma
N. Pagano, M. A. Kosior, B. Gasparrini, V. Longobardi, C. De Canditiis, G. Albero, M. C. Deregibus, G. Bosi, A. Idda, and A. Lange Consiglio

The second isoform of gonadotrophin-releasing hormone and its receptor affect boar semen quality

α6 Integrin for evaluating sperm quality in bulls with different capacities of in vitro embryo production

Oestrus Synchronisation/Artificial Insemination

Influence of chorionic gonadotrophin, breeding procedure, and gonadotrophin-releasing hormone on pregnancy, embryo viability, and kidding rate of lactating Alpine goats time inseminated during the early transitional reproductive phase
M. Calle, L. Dawson, M. Rojas, and E. Loetz

An effective method of inducing oestrus in superovulation-treated Japanese Black donor cows after egg collection
Y. Aoyagi, M. Takeuchi, T. Oono, K. Hayama, M. Urakawa, Y. Oono, and M. Koiwa

The effects of parity and oxytocin or prostaglandin F, added to insemination doses on reproductive performance of pigs bred in summer
T. Schwarz, P. Jaros, R. Tuz, J. Nowicki, and P. M. Bartlewska

A method of oviductal semen deposition for use in the goat
155 Fertility of sexed semen in Holstein heifers and cows
M. Yamaguchi, M. Takayama, T. Nishisouzu, H. López, and O. Dochi

156 Oestrus response, corpus luteum function, and pregnancy rates following aromatase inhibitor treatment in beef heifers

157 Effect of a slow-release gonadotrophin-releasing hormone analogue on ovarian activity and oestrous behaviour in mares
M. Kaps, C. Gautier, C. Cardoso Okada, J. Kuhl, J. Aurich, and C. Aurich

158 Optimal time of AI and changes in vaginal mucus characteristics relative to the onset of standing oestrus in Beetal goats
A. Murtaza, M. Irfan-ur-Rehman Khan, M. Abbas, W. Ahmad, M. Z. Tahir, and I. Mohsin

159 Laparoscopic insemination method in sheep allows the use of an animal protein-free and inexpensive freezing medium
L. Gavin-Plagne, L. Boyer, A. Baudot, M. Guedes Teixeira, G. Louis, L. Commin, S. Buff, and T. Joly

160 Increasing gonadotrophin-releasing hormone dose at initiation of a 5-day CO-Synch protocol increases ovulatory response but not fertility in yearling beef heifers
E. Rojas Canadas, S. E. Battista, J. Kieffer, S. Wellert, and A. Garcia Guerra

161 Increasing the dose of cloprostenol sodium reduced pregnancy losses but did not increase pregnancies per AI in lactating dairy cows
T. Minela, A. Santos, E. Schuurmans, and J. R. Pursley

162 Detection of ovulation disorders and normal ovulation using wireless sensors of ventral tail surface temperature and neck acceleration data in Japanese Black cows
S. Matoba, M. Saito, K. Abe, S. Higaki, and K. Yoshioka

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Cryopreservation for Canis lupus conservation: Evaluating protocols to freeze grey wolf testicular tissue
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**2020 Recipient of the IETS Distinguished Service Award**

**Dr. Brad Stroud**

Dr. Brad Stroud was born and raised in Weatherford, Texas, and still resides there and operates his embryo transfer (ET) business, Stroud Veterinary Embryo Services Inc., in that town. Stroud was the starting quarterback on his high school football team and impressively set the school record, which still stands, in the 220-yard dash. After earning his undergraduate degree at Texas A&M University, he then earned his veterinary degree from the same institution in 1979. He went on to complete an internship in large animal ambulatory medicine at the Ohio State University in 1980, following which he returned to Weatherford, where he and his wife built and established his ET facility and business.

Stroud attended his first IETS conference in 1981, held in Denver for the seventh consecutive time in Colorado. Stroud recalls that there were approximately 150 participants at that conference and the main subject of conversation seemed to center around whether ova had been fertilized and the morphology of healthy embryos. Although many of the attendees were largely commercially active and competitive ET practitioners, many of them struck Stroud as being willing to openly share what they knew. Following this conference, Stroud vowed to help his colleagues in the industry and planned to one day stand at the podium and present new information.

Starting in 1981, Stroud's business grew steadily and peaked in size with approximately 20 employees, a large in-house donor and recipient facility, and a demand to provide ET services over a wide geographic area. Early on, Stroud started incorporating ART procedures that went well beyond the traditional procedures of classic ET. He successfully used gamete intrafollicular transfer and AI to produce embryos and pregnancies in clinically infertile cows. He was among the first nonacademic veterinarians to utilize ultrasound technology in his practice and, in fact, produced four very comprehensive cassette tapes (later changed to CDs) covering bovine reproductive ultrasonography, direct transfer of frozen embryos, bovine fetal sexing, and a guide to handling frozen embryos and semen. Several thousand of these tapes have been distributed on an international basis, and they continue to be relevant and very useful. In addition, Stroud has given many lectures, talks, and short courses on the use of ultrasound in bovine reproduction and ART.

Stroud was also among the first ART practitioners to incorporate IVF, embryo splitting, and user-friendly embryo recovery and transfer methods into his business. Furthermore, he has always welcomed visitors to his program and generously shared all that he had accomplished. Stroud was elected president of AETA in 1991 and then president of IETS in 1992. He remains the only individual to have served as the president of both organizations. In 1994 he was honored as the Schering Plough ET Person of the Year, and in October of 2019 he was presented with the AETA Edwin Robertson Lifetime Achievement Award. Perhaps most notably, Stroud has operated a large, busy ART facility for the past 40 years, while continuing to write and present papers and give workshops at both domestic and international conferences. In addition, he has openly and generously shared all of his mistakes, discoveries, and data with innumerable individuals and organizations in the ART industry.

Dr. Stroud is a most worthy recipient of the 2020 IETS Distinguished Service Award.
Special Events

CANDES–Morulas Preconference Symposium
Companion Animals and Non-Domestic Species: The Embryo at the Center of All
Thursday, January 16
08:30–17:30
Sutton North, Center, South
This year, CANDES and the Morulas are working together to bring you a preconference symposium that will explore embryo-based techniques in companion animals, non-traditional livestock, and non-domestic species. We will hear presentations from both main speakers and Morulas members in each of the sessions, including the CANDES Trainee Travel Award winners. The program will close with an “enlightening” presentation by Dr. David Gruber, who will share his experience exploring the bioluminescent diversity under the sea. (Ticket required)

Morulas and Mentors Luncheon
Friday, January 17
12:00–13:30
Clinton
One of the main goals of the Morulas is to provide trainees the opportunity to interact with the general members of the IETS. The Morulas and Mentors Luncheon is designed to give trainees an opportunity to sit down with mentors in small groups, providing a chance to interact and develop a connection with leaders in our field. Trainees will have an opportunity to choose a mentor they would like to sit with prior to the conference.

The six amazing mentors will join the lunch and share their wisdom with Morulas: Drs. David Albertini, Pablo Ross, Filippo Miglior, Eduardo Gastal, Katarina Jewgenow, and Katrin Hinrichs. A complete description of mentor research activities will soon be available for trainees to choose from on a first-come, first-served basis. The Morulas Board is very grateful to the mentors for sharing their time with the trainee members. (Ticket required)

Welcome Reception
Friday, January 17
18:00–19:00
Rhinelander Gallery
Sponsored by Professional Embryo Transfer Supply Inc. (PETS)
A welcome reception will be held in the Rhinelander Gallery of the New York Hilton Midtown Hotel, from 18:00 to 19:00. Meet the exhibitors and renew old friendships. Light hors d’oeuvres will be served with a cash bar. (Do not forget to bring your drink ticket.)

Morulas Student Mixer
Friday, January 17
19:00–21:00
Beekman
After business comes fun! Everyone is invited to gather with friends and drinks for a social event. Hosted by IETS, this annual event is a fun time for all trainees to relax and enjoy the atmosphere. Take advantage of meeting new people and establish connections that last a lifetime. It is our pleasure to invite you all to the upcoming annual social event, the Morulas Mixer. We will all be gathering on Friday, January 17, at 19:00. We are excited to have an exclusive time set aside for trainee interaction along with general IETS members. All members are encouraged to join this fun event and relax in an enjoyable atmosphere. Some drinks will be provided. (Registration and tickets are NOT required.)

Morulas Career Luncheon
Saturday, January 18
12:00–13:30
Clinton
Sponsored by CSIRO Publishing
Trainees will have the opportunity to meet and interact with two fantastic speakers who will talk about their experiences, their career paths, and the decisions they made that led to their current position, either within industry or academia. This year we will have two amazing scientists who kindly agreed to share their experience with us. One of the
astounding feathers of this year’s Career Luncheon is that both of our mentors (Dr. Rebecca Krisher and Dr. Lotte Stroebech) have experiences in academia and industry. (Ticket required)

**Practitioners Forum**
Saturday, January 18
16:00–18:00
Sutton North, Center, South
This year’s Practitioners Forum will bring a panel of experts for an interactive Q&A session focused on opportunities, challenges, and the latest information related to these and other common questions that practitioners face in their daily work. For the first time this year, the forum will also feature oral presentations of two selected abstracts from Case Reports and Field Data. We truly hope that this program provides an enjoyable opportunity for learning, networking, and sharing knowledge.

**DABE Forum**
Saturday, January 18
16:00–18:00
Beekman
Narrowing the Gaps Between Embryo Gene Editing and Ethics

**Open Meeting of the Health and Safety Advisory Committee (HASAC)**
Saturday, January 18
18:30–19:30
Sutton North, Center, South

**Morulas Trainee Forum**
Saturday, January 18
18:30–19:30
Beekman
All trainees are invited and encouraged to attend the Morulas Trainee Forum. The Board of Governors will be updating the membership on activities and attending to business matters. In addition, we will welcome the new president and discuss important events and opportunities for all trainees. This is a great time to get involved and boost your international relations. (Everyone is welcome.)

**Closing Party**
Sunday, January 19
19:00–23:00
New York Hilton Midtown Hotel, Rhinelander Gallery
Put on your dancing shoes and join us for an evening filled with music, good food, and old and new friends. (Do not forget your drink tickets.)
**Come and join us for the closing event. (Tickets are required for this event.)**
Recipient of the IETS Lifetime Career Achievement Award

Dr. Richard Fayre-Hosken, BVSc, PhD

Dr. Richard Fayre-Hosken was born January 26, 1954, in Gwelo, Southern Rhodesia (now Zimbabwe), Africa.

Dr. Fayre-Hosken received his BSc in zoology and entomology from Rhodes University in 1975 and his veterinary degree from University of Pretoria in 1981, both in South Africa. He worked in mixed veterinary practices in Zimbabwe and the United States before entering graduate school. His PhD from the University of Georgia (UGA) was granted in 1987 for research on the “Influence of cholesterol sulfate and carbohydrate moieties on rabbit sperm penetration of zonae pellucidae,” which led to 24 years as a professor, 18 of which were tenured, in the College of Veterinary Medicine at UGA. He was honored with a Lilly teaching fellowship and numerous faculty awards for teaching excellence in animal reproduction with special emphasis on horses. Fayre-Hosken shared his technical and research expertise with scores of veterinary and graduate students in the United States and South Africa. Fayre-Hosken was best known professionally for the development of a contraceptive vaccine to control populations of dogs, cats, and elephants, winning creative research awards from UGA and a National Phi Zeta award for research excellence. In later years his research focus, as well as his passion, was the monitoring and protection of elephants in Kruger National Park in South Africa. Following his retirement from the university in 2012, Fayre-Hosken owned and operated SoRhoVet LLC, a solo equine theriogenology practice, while continuing his elephant research.

Dr. Fayre-Hosken was a Diplomate of the American College of Theriogenologists, receiving the Theriogenologist of the Year award in 1999 for “Research in population control of the African elephant.” He was a Founding Diplomate of the European College of Animal Reproduction and was elected Research Fellow of the San Diego Zoo Institute for Conservation Research in 2009. Fayre-Hosken was active in a number of professional organizations including the American Association of Equine Practitioners and the European College of Animal Reproduction, which certified him as a European Veterinary Specialist in Animal Reproduction. He rose to president of the American College of Theriogenologists and the International Embryo Technology Society.

Fayre-Hosken joined IETS in 1985 as a student member, where he developed lifelong friendships and collaborations. He joined the IETS Foundation board in 1998 and presided as president from 2009 to 2011. He was a founding member of the Affiliate Society Committee, which he developed and led until his passing. Fayre-Hosken was elected to the Board of Governors, serving as treasurer, vice president, and president in 2009. That year the annual IETS conference was scheduled for New Orleans, but Katrina struck, leaving Fayre-Hosken to pilot the board in the Herculean task of changing the venue to San Diego just nine months before the meeting.

Dr. Fayre-Hosken authored or co-authored over 250 scientific papers, articles, abstracts, and book chapters and spoke frequently at scientific and specialty group meetings around the world. He developed and taught dozens of continuing education courses covering a wide range of topics including infertility in dogs and cats, bovine physiology, integrated interactive learning systems for veterinary education, and equine oocyte maturation and sperm receptor mechanisms. Despite his rigorous teaching and clinical duties, Fayre-Hosken volunteered his time with several animal rescue groups and was a tireless advocate for animal welfare. On one occasion he risked incarceration by rescuing a horse from a research facility that was planning to conduct a painful experiment. He was indeed arrested, but when the details of the animal treatment were revealed, he was released and subsequently championed for his act of compassion. Fayre-Hosken’s love of animals was most evidenced by his devotion to his treasured Jack Russel terriers.

He left us too soon, but we are richer for having known him.
The IETS Fayrer-Hosken Affiliate Scholarship Fund has been established in Richard’s name. You can donate by clicking “Make an Online Foundation Donation” on the IETS home page, signing in, and clicking “Make a Donation.”
2020 IETS Foundation Early Career Achievement Award (Scientist)

Joanna Maria Gonçalves de Souza-Fabjan

Joanna M. G. Souza-Fabjan studied veterinary medicine and is currently a professor and researcher in the Reproduction Sector, belonging to the Department of Veterinary Pathology and Clinics at the Veterinary School of the Universidade Federal Fluminense, Niterói, Rio de Janeiro, Brazil. Souza-Fabjan is a member of two graduate programs at the same university: Veterinary Medicine (Animal Clinics and Reproduction) and Sciences and Biotechnology. She is also a member of the graduate program in Veterinary Medicine at the Universidad de la Republica, Montevideo, Uruguay. She has been working on reproductive biotechnologies in farm animals, mainly in small ruminant models. Her research interests have been focused on improving the understanding of ovarian function by ultrasonography, tools for estrus synchronization, artificial insemination, in vitro and in vivo embryo production, and gamete/embryo cryopreservation. Recently, her team made important advances in enhancing feasibility of nonsurgical techniques for embryo recovery in sheep. She has organized several events in this field and worked on research projects with national and international collaborators.

Previous Recipients

Alejo Menchaca (Scientist), 2019
Kiho Lee (Scientist), 2018
Pablo J. Ross (Scientist), 2017
Todd Stroud (Practitioner), 2017
Session Speakers and Keynote Biographies

Evelyn Telfer
Professor Evelyn Telfer holds a chair in Reproductive Biology at the University of Edinburgh and heads a research group in Ovarian Development within the Institute of Cell Biology and Genes and Development Group (CDBS). Her group has a particular interest in developing in vitro models to support oocyte development from immature stages in domestic species and human. Telfer’s group has developed a culture system that supports in vitro growth of human and bovine primordial follicles to the metaphase II stage. They are now using these models to study the potential of female germ line stem cells isolated from adult ovaries in a range of species.

Telfer has published widely in this area, is a regular invited speaker at international meetings, and has several international collaborations. Her research is funded by the Medical Research Council U.K. and The Wellcome Trust. Her group has won several awards at international meetings, and in 2019 she received the distinguished scientist award from the Society of Reproduction and Fertility and delivered the Anne McLaren memorial lecture at the U.K. Joint Fertility Societies meeting. Telfer also has an interest in the public understanding of science, and she contributes to workshops and delivers lectures at science festivals and other public groupings.

David Albertini
David Albertini received his PhD from Harvard University working on the cell biology of the mammalian ovary. After postdoctoral work at the University of Connecticut Health Center, he returned to Harvard Medical School as an assistant professor of anatomy and cell biology until 1984. He was an associate professor and professor at Tufts University School of Medicine up to 2004. At Tufts, he served as chair of the Department of Anatomy and Cell Biology (1996–2000), director of the Center for Reproduction (1999–2003), and director of the Confocal Microscopy core (1988–1999). From 2004 to 2016, he held the Hall Professor of Molecular Medicine Chair at the Kansas University Medical Center, where he continued his career-long interests in biomedical imaging and oocyte and embryo development, as it pertains to the practice of human assisted reproduction technologies. He served as director of laboratories and senior scientist at The Center for Human Reproduction in New York City from 2016 to 2019 and is a visiting professor at The Rockefeller University. Since 2009 he has been the editor-in-chief of the Journal of Assisted Reproduction and Genetics (ASRM), and he has been the recipient of many awards including a Basil O’Connor fellowship from the March of Dimes, the Hammond Medal from the Society for Reproduction and Fertility (UK), and the Founder’s Lecturer for the Australian Society of Reproductive Biology.

Pablo Ross
Pablo Ross is an associate professor in reproductive biology in the Department of Animal Science at the University of California Davis. Dr. Ross was born and raised in Argentina, where he received a degree in veterinary medicine from La Plata National University and an MS in animal science from Mar del Plata National University/INTA Balcarce. He obtained a PhD in animal science from Michigan State University in 2007 and held a research assistant professor position at that institution, until he joined the faculty at Davis in 2010. Dr. Ross studies the mechanisms of epigenetic remodeling and transcriptional reprogramming that occur during preimplantation embryo development. Work at the Ross laboratory also relates to developing gene editing approaches and embryo and pluripotent stem cell technologies for use in agriculture and biomedicine.
Kiho Lee

Kiho Lee graduated from Seoul National University with a bachelor’s degree in animal sciences. Then, he received his MS and PhD from Purdue University and postdoc training from the University of Missouri–Columbia. While at the University of Missouri, he generated the first immune-deficient pigs that could support growth and proliferation of human induced pluripotent stem cells. He joined Virginia Tech in 2013 and is currently an associate professor in the Department of Animal and Poultry Sciences. Dr. Lee’s laboratory currently focuses on early embryonic development using the pig as a model. Understanding the mechanisms underlying the dynamic changes that occur during embryonic development can lead us to develop more efficient ways to generate and manipulate embryos in vitro. One of his main research interests is to identify the mechanism of epigenetic reprogramming by oocytes after fertilization. Specifically, he is interested in how oocytes can modulate the status of DNA methylation during early embryo development. His group also focuses on developing optimal use of gene-editing systems to introduce targeted modifications during embryogenesis in domestic animals. Using this approach, his group has generated various types of genetically engineered pigs for agriculture and medicine. His research program has been funded by the US Department of Agriculture and National Institute of Health. He was the recipient of the Early Career Achievement Award from the International Embryo Technology Technology in 2018.

Filippo Miglior

Dr. Filippo Miglior is chief scientific officer and vice president, Sector Innovation and Programs, at Ontario Genomics in Toronto. Miglior is a world renowned researcher in animal breeding and genomics. Most recently, Miglior was chief of research and strategic development at the Canadian Dairy Network, a role he assumed in 2013. Miglior has been an adjunct professor at the University of Guelph since 2004, secretary of the Permanent International Committee of WCGALP (World Conference of Genetics Applied to Livestock Productions), past-president of Canadian Society of Animal Science, and editor-in-chief of Canadian Journal of Animal Science. Miglior is the recipient of several prestigious awards (2018 ASAS Rockefeller Prentice Award in Animal Breeding and Genetics, 2016 CSAS Technical Innovation in Enhancing Production of Safe Affordable Food, 2013 ADSA JL Lush Award in Animal Breeding). Miglior has authored 3 book chapters, 124 scientific journal articles, and over 600 articles and conference proceedings. Dr. Miglior has led several research projects with budgets exceeding $14 million, advising a team of over 20 graduate students and researchers.

Juliano da Silveira

Juliano da Silveira graduated in biological sciences from PUCRS (Brazil) and received his master’s degree in genetics and applied toxicology from ULBRA (Brazil) and PhD in biomedical sciences from Colorado State University (USA). His research focuses on understanding intercellular communication within the ovarian follicle, oviduct, and uterus. His ultimate goals are to decode the roles of extracellular vesicles during folliculogenesis and early embryo development to understand female reproductive biology and develop new biomarkers and supplements to use in the in vitro production system. Additionally, da Silveira investigate the roles of miRNAs during folliculogenesis and early embryo development to find new biological pathways associated with oocyte quality and embryo viability.

Rocío Rivera

Rocío Rivera completed her MS at Iowa State University in the laboratory of the late Dr. Steve Ford. She then pursued a doctoral degree in the laboratory of Dr. Peter J. Hansen at the University of Florida. For her postdoctoral training, Dr. Rivera worked in the laboratories of Dr. Richard Schultz and Dr. Marisa Bartolomei at the University of Pennsylvania. She is currently an associate professor in the Division of Animal Sciences at the University of Missouri. Her area of research is in reproduction and developmental epigenetics. The research conducted in Dr. Rivera’s laboratory aims to identify mechanisms that lead to alterations of the epigenome in oocytes and embryos as a result of procedures commonly used during assisted reproduction in humans and animals. The main projects in her laboratory focus on the characterization of large offspring syndrome (an ART-associated loss-of-imprinting overgrowth syndrome in ruminants) and the study of the effects of superovulation and aging on the oocyte’s epigenome in mice.
Luis Siqueira

Dr. Luiz G. Siqueira is currently a research scientist at the Brazilian Agricultural Research Organization (EMBRAPA), where he conducts research in animal reproduction and physiology. Siqueira has studied ovarian physiology, Doppler ultrasonography, artificial insemination, different aspects of IVF procedures, developmental programming of the preimplantation embryo, and postnatal development of calves and heifers. He received his DVM from the Federal University of Viçosa, Brazil, in 2004 and a MSc degree in animal sciences from the same university in 2007. In 2009 Siqueira completed a master of veterinary sciences (MVetSc) program in theriogenology at the Department of Large Animal Clinical Sciences, University of Saskatchewan, Canada, conducting studies on in vitro fertilization and idiopathic infertility in cattle. In 2017 he finished his PhD in animal molecular and cellular biology at the University of Florida, USA. He studied developmental programing of the bovine embryo by maternal embryokines and postnatal consequences of ART in cattle. Siqueira is also involved in student training and short courses for veterinarians seeking to work with OPU, IVF, and cattle ultrasonography.

Bernard Roelen

Bernard Roelen (1968) studied biology at Utrecht University (graduated 1992) and subsequently performed a PhD study at the Hubrecht Institute (Utrecht) under the supervision of Christine Mummery (graduated 1997). He worked for another three years as a junior researcher at the same institute. Afterward, he worked as a postdoctoral fellow at Massachusetts General Hospital/Harvard Medical School in Boston (USA). After returning to the Netherlands, he worked as a postdoctoral researcher at the Netherlands Cancer Institute in Amsterdam. In 2003 he became assistant professor and later associate professor at the Faculty of Veterinary Medicine, Utrecht University in Utrecht, the Netherlands. His research is focused on mammalian germ cells, stem cells, and pluripotency. His primary research interests are acquisition and maintenance of developmental potential. This includes oocyte development, oocyte maturation, preimplantation embryo development, and early differentiation. As a research model, his group mostly uses bovine and porcine oocytes and embryos but occasionally also human embryonic cells and human ES cells and iPS cells.

Marja Mikkola

Marja Mikkola earned her DVM degree at Helsinki University, Finland, in 1997. She then began working primarily as an embryo transfer practitioner for cattle breeding companies and private farms. During her veterinary career, questions asked by her clients or raised by her daily work inspired her to earn a PhD degree while continuing in her veterinary practice. Her research covered topics including the use of sex-sorted semen on donor females, superovulation protocols, and nutritional management of donors. Since 2018 she has been working for Geno SA, Norway, establishing both MOET and OPU-IVP embryo production in the national breeding program for Norwegian Red cattle. She has served on the board of directors of the Association of Embryo Technology in Europe (AETE) since 2014 and has been responsible for collecting European statistics for commercial ET activity. She is currently the vice president of the AETE.

Theresa Woodruff

Teresa K. Woodruff, PhD, is the dean and associate provost for graduate education in the graduate school at Northwestern University. She is also the Thomas J. Watkins Professor of Obstetrics and Gynecology, the vice chair for research and the chief of the Division of Reproductive Science in Medicine in the Department of Obstetrics and Gynecology, Feinberg School of Medicine. She is professor of molecular biosciences in the Weinberg College of Arts and Sciences and professor of biomedical engineering in the McCormick School of Engineering. She is the director of the Center for Reproductive Science (CRS), founder and director of the Women’s Health Research Institute (WHRI), and director of the Oncofertility Consortium. She is an internationally recognized expert in ovarian biology and, in 2006, coined the term “oncofertility” to describe the merging of two fields: oncology and fertility. She now heads the Oncofertility Consortium, an interdisciplinary team of biomedical and social scientist experts from across the country. She has been active in education not only at the professional level but also with high school students. To
this end, she founded and directs the Oncofertility Saturday Academy (OSA), one of several high school outreach programs that engages girls in basic and medical sciences. She was awarded the Presidential Award for Excellence in Science Mentoring in an oval office ceremony by President Obama (2011). Woodruff holds more than 10 US patents and was elected to the National Academy of Inventors (2017). Her honors include a Guggenheim Fellowship (2017), the Society for Endocrinology Transatlantic Medal (2017), a Leadership Award from the Endocrine Society (2017), and the Mentor of the Year Award from the Society for the Study of Reproduction (2018). She has two honorary degrees: one from the University of Birmingham, College of Medical, UK (2016) and one from Bates College (2011). She is an elected member of the National Academy of Medicine (2018) and a fellow of the American Institute of Medical and Biological Engineering (2017) and the American Association for the Advancement of Science (AAAS; 2005). She is past-president of the Endocrine Society and championed the new NIH policy that mandates the use of females in fundamental research. She is civically active and is an elected member of The Economic Club of Chicago, member of the Adler Planetary of Chicago Board of Trustees, and served on the school board of the Chicago-based Young Women’s Leadership Charter School.
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**Minitube USA Inc.**

Minitube USA, a subsidiary of Minitube International, offers a comprehensive, multispecies reproduction product line ranging from artificial insemination to embryo transfer to meet any theriogenologist’s needs. Our continued collaboration with leading reproductive physiologists, universities, and institutes around the world enables us to be on the leading edge of industry development.

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Vetoquinol, the manufacturer of Folltropin®, is a family-owned, independent company devoted exclusively to animal health. Our product portfolio is divided between livestock and companion animals and includes most therapeutic categories. Vetoquinol embraces the challenge of finding better ways to help animals and is committed to servicing the assisted reproduction industry with its long lasting tradition of excellence. The company boasts one of the largest research facilities in the world, where 100 world-class researchers passionately work to develop new products and protocols.

4250 N. Sylvania Avenue
Fort Worth, TX 76137 USA
[www.vetoquinolusa.com](http://www.vetoquinolusa.com)
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**WTA Technologies LLC**

WTA Technologies LLC is a Brazilian technology company with additional offices in Texas. We specialize in producing tools for animal assisted reproduction, offering high-added-value solutions for ovum pick-up (OPU), in vitro fertilization (IVF), embryo transfer (ET), and artificial insemination (AI).

Our products are mainly for the reproduction of cattle, horses, and small ruminants, but we also meet different laboratory requirements.

WTA distributes throughout Brazil, USA, Canada, and Mexico, as well as in many countries across the five continents. WTA is recognized as one of the leading companies in the animal assisted reproduction market.

Each of our products is designed to provide the very best results and give a sense of security at an economical price, while always being mindful of animal welfare. Every piece incorporates precise design, quality materials, and excellent workmanship.

WTA Brazil: + 55 16 3951 8161
Sales USA: + 979-324-6168
[www.wtavet.com.br](http://www.wtavet.com.br)
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Solutions for Cattle Breeding
CANDES Preconference Symposium
Companion Animals and Non-Domestic Species: The Embryo at the Center of All

Program Co-Chairs: Dragos Scarlet and Gabriela Mastromonaco

08:00–08:30  Registration
08:30–08:40  Welcome, housekeeping, and introductory remarks

Session I
08:40–09:20  Save the cat: Gamete biobanking for species conservation
Katarina Jewgenow, Germany

09:20–09:30  Vitrification of in vitro produced feline embryos
Dana Wright Fuller (Abstract 42)

09:30–10:10  Advancements in canine reproduction: IVF and ET
Alexander Travis, USA

10:10–10:30  Strategies for the improvement of canine oocyte in vitro maturation
Matteo Duque (Abstract 199)
Effect of TCM-199 and synthetic oviductal fluid medium supplemented with varying hormone concentrations on in vitro maturation of canine oocytes
Megan Tscharke (Abstract 190)

10:30–11:00  Coffee break

Session II
11:00–11:40  In vitro manipulation of equine preantral follicles: A review
Eduardo Gastal, USA

11:40–12:10  Genome activation in ICSI-derived horse embryos
Daniel Estanislao Goszczynski (Abstract 59)
Low plasma progestin concentration during the early luteal phase impairs equine conceptus development until placentation
Carolina Okada (Abstract 61)
Horse allogeneic mesenchymal stem cells perform homing and ameliorate endometrial inflammation after induced endometritis of mares
F. Navarrete (Abstract 210)

12:10–13:30  Lunch break

Session III
13:30–14:10  Embryo technologies in the donkey (Equus asinus)
Duccio Panzani, Italy

14:10–14:30  Effect of seminal plasma on the interval to application of eCG for the recovery of COCs in Alpacas (Vicugna pacos)
William Fahrid Huanca (Abstract 228)
Effect of different energy sources on motility and calcium ionophore-induced acrosome reaction in equine sperm
Luisa Ramírez-Agámez (Abstract 116)
14:30–15:00 Coffee break

**Session IV**

15:00–15:40 Embryonic diapause in roe deer: Pluripotent stem cells placed on hold
*Susanne Ulbrich, Switzerland*

15:40–16:00 *In vitro* maturation and fertilization in white-tailed deer (*Odocoileus virginianus*) oocytes vitrified with trehalose or sucrose
*Veronica Alejandra Rubio-Santillanes (Abstract 37)*

Aggregation of yak heterospecific SCNT embryos improves cloning efficiency
*Minera Yauri Felipe (Abstract 20)*

16:00–16:30 CANDES Trainee Travel Awards
The zona pellucida is required for normal development of *in vitro* produced cat embryos
*Daniel Veraguas (Abstract 22)*

Use of eCG in a minimum-handling protocol for oocyte collection in bison
*Miranda Zwiefelhofer (Abstract 175)*

**Keynote Lecture**

16:30–17:15 Visual ecology in the ocean
*David Gruber, USA*

17:15–17:30 Final discussion and remarks
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