# “A novel hydrogel-based system for ambient transport of bovine germplasm”



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RAFT Solutions, UK, Atelerix Ltd, UK, Bow Valley Genetics, Canada

*“Innovation in Sustainable Livestock Food Production”*

EAAP Conference 2024, Florence, Italy
4th September 2024

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***"Innovation in Sustainable Livestock Food"***

RAFT established in October 2010
Developed by Bishopton Vet Group

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sion Our Approach Key Areas Get Involved

# Institute for **Sustainable livestock** Health and Welfare

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MISSION STATEMENT

We aim to promote and develop sustainable livestock health and welfare and the central role of vets in delivering these goals to promote a balance across four Key Areas:

- Food Security
- Animal Health and Welfare
- Environmental Management
- One Health and Antimicrobial Resistance (AMR)

# Sustainable breeding project 2021-2024

*UK-Canada: enhancing agricultural productivity and sustainability*
Application 60115

- Jointly funded project – UK and Canadian partners
- Allowed for mirrored applications of technologies in both countries
- Multiple work packages
  - Semen Analysis
  - Germplasm transportation
  - Semen quality markers
- Combination of UK and Canadian based companies led by RAFT Solutions

## UKRI funds for dairy and beef fertility research

***UK Research and Innovation (UKRI)*** has awarded £400,000 for research into higher cattle fertility and breeding productivity in UK and Canadian dairy and beef herds. The project will be delivered by an agritech and biotech consortium led by Ripon-based ***RAFT Solutions***.

The project aims to reduce wasted genetic potential, while improving sustainability and cattle farm financial results. It will "transform genetic progress, through the adoption of precision technologies, diagnostics, advanced breeding and big data, leading to more sustainable livestock production and export opportunities"w, says RAFT's Jonathan Statham.

This transatlantic initiative has parallel financial support from Canadian government funding body IRAP for a Canadian partner, Bow Valley Genetics. It also involves XL Vets practices in UK and Canada, and the Universities of Guelph and Saskatchewan.

In practical terms, the project's aims include higher conception rates and thereby fewer breeding cycles, says Mr Statham. He says this will come about through screening for higher quality semen and embryos, thereby delivering the promise of genomics by producing more calves that join the herd with better health and fertility.

The funding is awarded through UKRI's 'UK-Canada: enhancing agricultural productivity and sustainability competition'. The competition format brought together UK and Canadian companies, through on-line and in-person events, to identify and build project concepts in sustainable agriculture. RAFT Solutions' UK project partners are Atelerix (stem cell transport), Ostara Biomedical (semen quality marker) and Dyneval UK (mobile semen testing) with Bow Valley Genetics in Canada and XL Vets practices in UK & Canada including Kirkton Veterinary Clinic & Bow Valley Livestock Health.

In addition to RAFT Solutions, six other UK winners are Arden Biotechnology, Devenish, Precision Decisions, Airborne Robotics, Clarity Biosolutions and RS AQUA. With each, Canadian partners will receive funding support through the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP).

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# Bow Valley Genetics

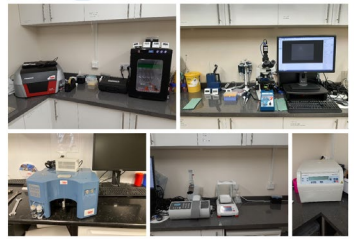

Advanced Breeding company based in Alberta & Saskatchewan, Canada

- Established in 2009
- SemenRate™ Laboratory in Western Canada
- IVF laboratory
- Semen production stud

- Bow Valley Genetics now fully equipped with flow cytometry and a calibrated CASA procedure to the equipment used for SemenRate®
  - SemenRate ™ deployed with BVGL.

The UK-Canada SemenRate Laboratories & Data Hubs

SemenRate



- Collaboration between BVGL and RAFT
- WCVM & OVC members supporting

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University of Saskatchewan
Western College of Veterinary Medicine

University of Guelph
Ontario Veterinary College

# About us - Atelerix

- Formed in 2017
- Newcastle, UK
- Name inspired by hedgehogs (genus: Atelerix) that hibernate when temperatures drop below 20°C
- Hypothermic cell preservation
- Ambient transport of cells – avoid cryopreservation
- A solution that extends the shelf-life of fresh biological products and protects from physical damage during shipment

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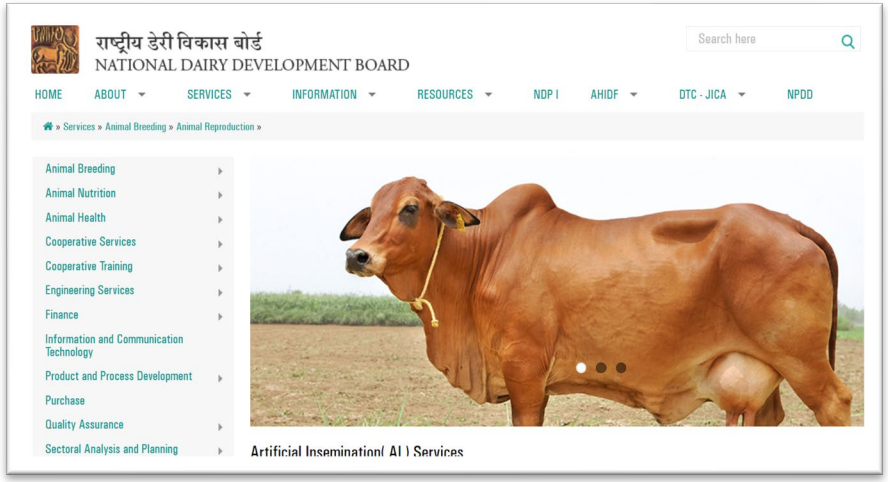
# Background - Germplasm Transport

- Bovine Germplasm Collection - well established
- Global transport of germplasm widens access to genetics to support sustainable cattle production
- Conventional transport challenging
  - Liquid nitrogen
  - Robust cold chain required
    - Rural Canada
    - India
    - Africa

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# India-80 million inseminations/year…

Artificial Insemination (AI) is the most affordable and convenient biotechnological tool for dissemination of improved genetics at farmers' doorstep. However, AI coverage of bovines in the country is about 30 per cent ranging from 71 per cent to even less than 1 per cent for different states. That means 65 per cent animals are still bred through natural service either because the services are not available at farmers' doorstep or they are not convinced with the efficacy of the existing services. About 80 million inseminations are carried out in the country annually with the estimated overall conception rate of 35 per cent as against 60 per cent plus AI success rate in dairy developed countries. This clearly indicates that the benefits of AI can be doubled by improving the quality of AI services.

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# Hydrogels – Atelerix, UK

- Proven technology
  - Human stem cell transport in TissueReady™ kits
- Previous pilot study
  - Showed incompatibility between standard TissueReady kits and semen extenders
    - Resulted in poor spermatozoa survival

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# Adaptation of Hydrogel for bovine semen storage

- Changes to medias and reagents to support semen survival
- Semen collected at routine bull breeding soundness examinations
- Storage at 17°C division into control or modified hydrogel kits (HG)
- Assessment of motility and progressive motility after set storage times

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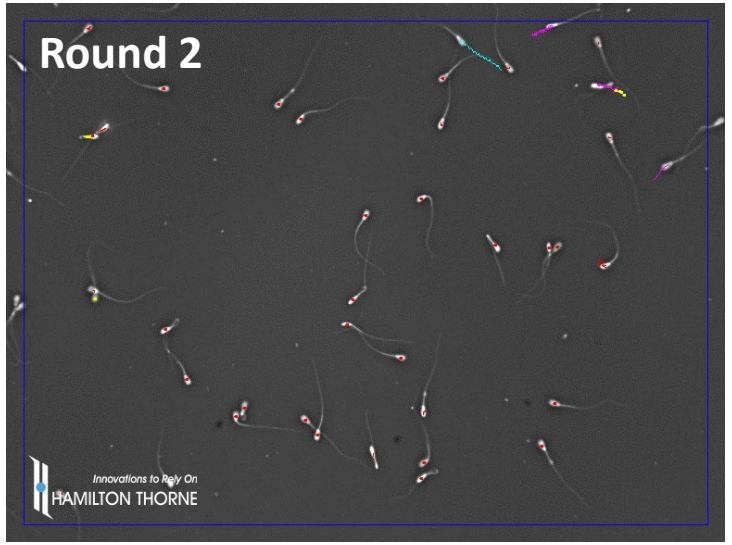
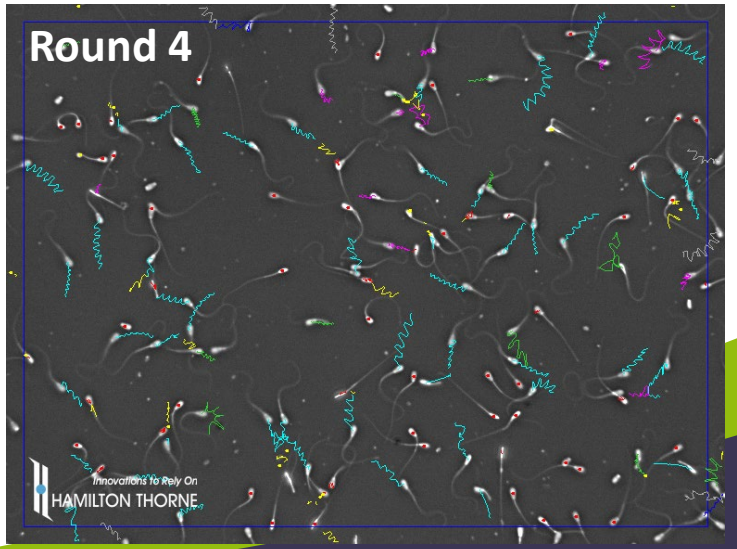
# I. Adaptation of Hydrogel for bovine *semen* storage

- RESULTS
  - Several rounds of modifications resulted in some improvement of semen survival using the hydrogel storage

| time | Control motility (%) | HG Motility (%) | Control progressive (%) | HG Progressive (%) |
|---|---|---|---|---|
| T0 | 61.5 | - | 46.3 | - |
| T5 | 22.6 | 44.23 | 12.2 | 27.23 |
| T72 | 2.8 | 12.4 | 0.6 | 1.78 |

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# II. Adaptation of Hydrogel Bovine *embryo* storage

- Embryos collected by MOET at Bow Valley Genetics, Canada
- Stored for several days in TissueReady™ kits at 4°C
  - 1 day
  - 3 days
- Released from hydrogel kits
- Cultured to assess continued development
  - 72 hours
  - 96 hours

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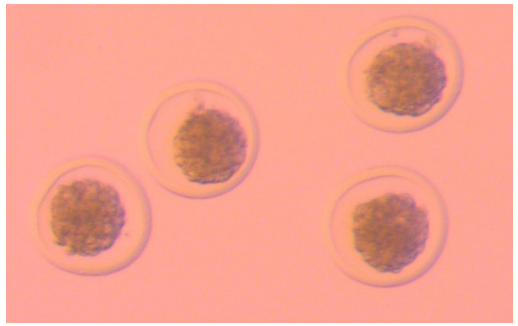
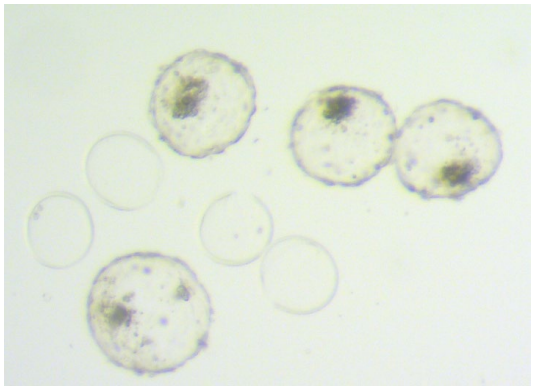
# Bovine embryo storage in hydrogel kits

- RESULTS
  - After dissolution from hydrogel kits, embryos continued to develop in culture media with standard culture for bovine embryos
  - Examined at

Group A:
1 day of
storage

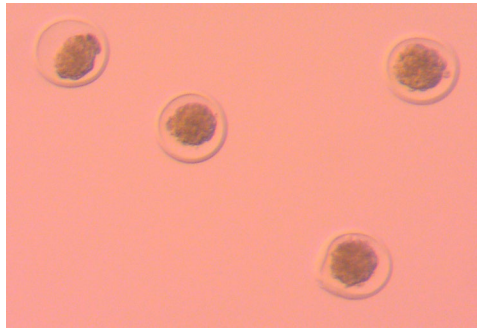


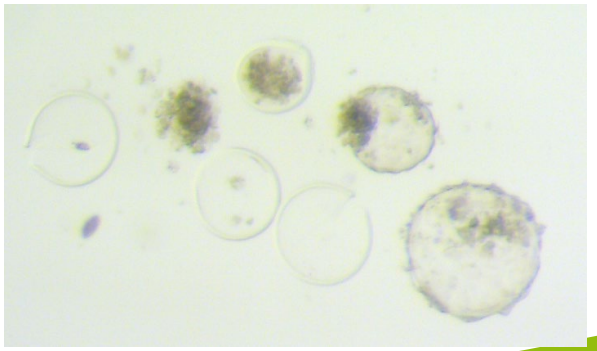
*Embryos at dissolution*



*Hatched embryos @ 72hrs 1 day in kit*

Group B:
3 days of
storage





*Hatched embryos @ 96hrs 3 days in kit*

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# Conclusions and further work

- TissueReady™ hydrogel systems show the potential to extend shelf life of bovine germplasm to several days
- Embryo storage more successful than semen
- Transport of germplasm-embryos>semen- over days without liquid nitrogen is possible
- Lends itself to short term transport in areas where cold chain infrastructure is limited
- Further work to establish limits of germplasm storage

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# Acknowledgments



- Funders
  - Innovate UK
  - IRAP Canada



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# Thank you
# Any questions?

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