This report should be submitted within 2 weeks after you return to Japan. Please do not change the formatting

(Abroad・Domestic) Internship report form (Student) 2023/05/10

(Year/Month/Day)

Name	Vuong Tuan Phong
Laboratory	Theriogenology
Year (Grade)	4th
Internship institution	Dairy Education and Research Centre, University of British Columbia
Internship period	Internship period: 04/16/2023 - 05/07/2023 (Departure Date from Sapporo: 04/15/2023, Arrival Date in Sapporo: 05/08/2023)
Purpose	- To learn the robotic milking system - To learn the application of automated activity monitor in reproductive management at the dairy farm - To learn the standard operating procedure at the dairy farm

- The reason why you chose this institute

The University of British Columbia's Dairy Education and Research Centre is a teaching and research unit located within UBC's Faculty of Land and Food Systems. It operates both a typical modern dairy farm and an intensive dairy cattle research center. The herd of approximately 500 animals (230 milking cows) is large enough to provide an adequate number of research animals to meet the teaching and research demand. The centre become the largest robotic milking research facility in North America, providing more research opportunities and new educational experiences for both students and dairy farmers. Prof. Ronaldo Cerri, Director of UBC Dairy Centre, is a well-known scientist in the field of Theriogenology, especially in improvement of reproduction efficiency in cattle. His publications and research interest perfectly fit not only my current study at Hokkaido university but also my future career path after graduation.

In my PhD, I am working in a study project on etiology of reduced fertility caused by alterations of the endometrial epidermal growth factor (EGF) profile in subfertile cows. I am examining the effects of low progesterone during the growth phase of ovulatory follicles on the EGF profile in the next cycle. The results from my research may give more understandings about the physiological mechanisms leading to low conception rate in dairy cows and may open a new pathway in reducing the economic loss in dairy farming due to reproductive problems. After graduation, I have a plan to continue to find a post-doctoral position in the field of dairy cattle reproductive management, in order to improve my knowledge and experience not only at the laboratory but also at the farm.

As doing internship at UBC Dairy Education and Research Centre with Prof. Ronaldo Cerri, I hope that I can

expanding my network with global researchers and having more information about post-doctoral positions in short-term and build up a close-knit academic relationship in long-term. This is a vital point when I come back and work as an independent researcher in my hometown.

- Result of the activity (about 800 words, provide photos, tables and figures that clearly show the activities during the period)

During my internship at the UBC Dairy Education and Research centre, I worked with the graduate students and farmers in 04 main activities as followings:

(1) Barn chores

- Moving cows: Two times per day, the cows move from their pens to the milking parlour. Basically, I created a pathway by walking and opening gates along the route to the holding area in the milking parlour. Then, I walked slowly into the flight zone of the animal at point of balance to make them move forward the expected direction (Fig. 1). While doing so, I observed the cow's gait and look for any obvious signs of health problems or heat. While the cows are being milked, I helped the milker by:

+ Encouraging cows to move into the parlour.

+ Dipping teats of the cows that have finished milking with the post teat dip.

When moving the cows back to their pens, I must make sure the gates are locked when closed and cows go back to the correct pen!

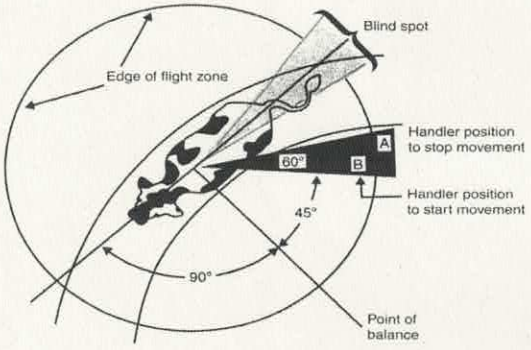

Figure 1. Flight zone diagram showing the most effective handle positions for moving an animal forward

Figure 2. The cows are moving to the milking parlour

- Night check: This work was carried out each evening around 10 pm by students working at the UBC Dairy. During my internship, I did the night check two times with a senior student. We checked for calving, sick animals, animal out of pens or anything out of the ordinary. We also ensure that all animals have access to feed and water. In the maternity pen, if a cow is close to calving, we need to move her to the maternity pen and fill a bucket with food.

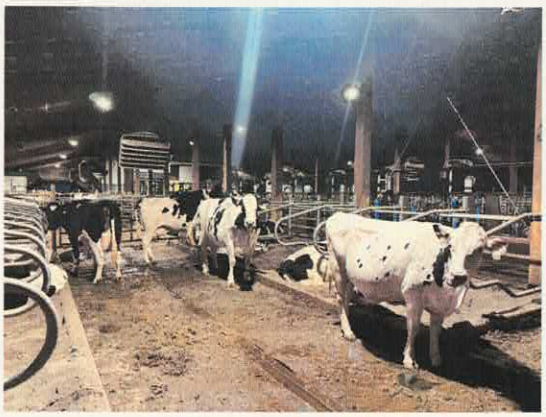

Figure 3. Check and observe for the calving signs of the cows in the maternity pen

Figure 4. Ensure enough feed and water for the cattle

(2) Reproductive management

Two times per week, students from Laboratory of Animal Reproduction (including me) checked the reproductive status of cattle at the farm. We sorted the information of all cows that need to be checked on the automated activity monitoring system (Fig. 5). All cows were monitored continuously by one leg-mounted pedometer which determine the change of cow's activity according to the walking steps per hour. Cows are in estrus if there is a relative increase in walking activity, we make a list of cows in heat, then give it to the farmer for doing the artificial insemination (AI) (Fig. 6). On the other hand, if the cows showed a decrease in walking activity, it may be a sign of health problems in the animal, we inform the farmer to check the cow.

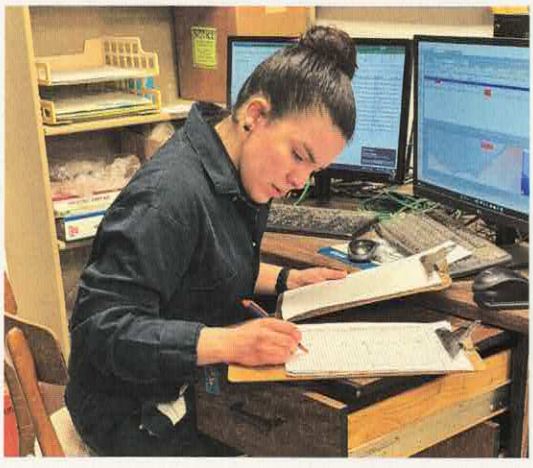

Figure 5. Classify the cows with alert from the automated activity monitoring system

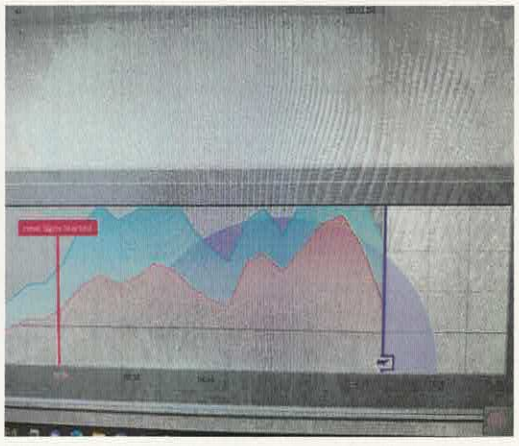

Figure 6. Changes in walking activity from the onset of estrus and the optimum window for AI (purple zone)

We also did the pregnancy diagnosis via ultrasonography around 32 and 60 days after AI, and a cows considered pregnant when a viable embryo was found. If the cows were not pregnant, she will be submitted AI again on the next estrus cycle or will be given a timed AI protocol. The synchronization protocol (Fig. 7) was used as follows: one injection of GnRH, followed 1 wk later by an injection of PGF2α, then 56 h later by a GnRH injection, and finally AI was performed 16 h after the final GnRH injection.

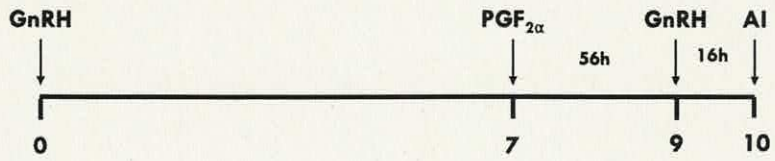

Figure 7. Synchronization protocol used in the UBC Dairy farm

In addition, I worked with other students in a genome project and the transition from automatic milking parlor to robotic milking parlor.

(3) Learn about the robotic milking system

The UBC Dairy farm is on the transition from the herringbone milking parlour (Fig. 8) to the robotic milking system (Fig. 9). Therefore, I had opportunities for working and learning about the robotic system during my internship.

- The robotic milking system is an automated milking system (AMS) that allows cows to set their own milking schedule.

- The technology is rapidly adopted to the need of dairy farmer with 25,000 systems working worldwide. In Canada, around 7% of all dairy farms have introduced AMS.

- The majority of producers found health detection to be easier with AMS.

- Cows in AMS have more freedom to control their daily activities and rhythms and have more opportunities to interact with their environment.

- Farmers were able to increase herd size and milk yield, and decrease time devoted to milking-related activities and the number of employees.

- AMS improved perceived profitability, quality of producers, and their cow's lives and had met producer's expectations.

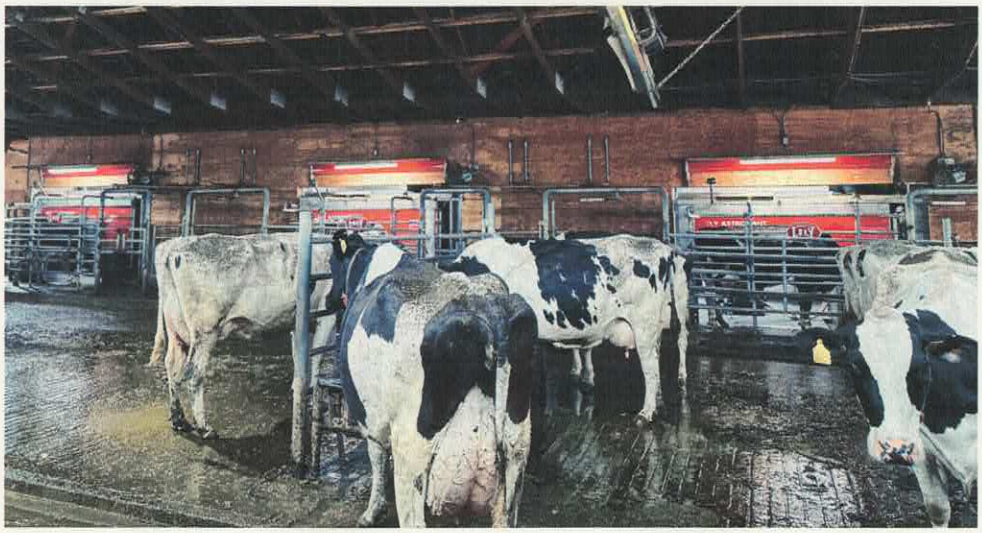

Figure 8. Cows in the holding area waiting for milking in the automated milking system

Figure 9. A cow are milked in the automated milking system

(4) Learn about the intergration of automated activity monitor (AAM) into reproductive management program of dairy cows

In the last decades, AAM systems, such as pedometers and accelerometers have become more reliable and more common in identifying cows in heat and properly indicating time of insemination. Prof. Ronaldo Cerri and his students have focused on using the AMM systems to improve the fertility of dairy cows in UBC Dairy farm. According to the publications and the practices at the farm, I can understand and use the system in supporting the reproductive management program in dairy herd.

- A variety of sensors to monitor individual animals, their status relative to their herd mates, herd-level technologies used for better dairy management, such as daily milk yield recording, milk component monitoring, pedometers and accelerometers.

- Pedometers attach to the leg and measure the number of steps and quantify lying and standing behaviours.

- Accelerometers measure movements of cow's head and neck during walking activities.

- At the estrous phase, there were changes in activity and lying time at estrus and in the non-estrus period in dairy cows (Table 1).

- Using AAM for the detection of estrus within a Presynch - Ovsynch program resulted in similar pregnancy per AI (ACT) compared with a reproduction program that was strictly based on timed AI (TAI) (Table 2.)

- Intervals from activity alerts, using AAMs, to ovulation were impacted by estrous expression, stage of lactation, parity, and lameness (Table 3 and Table 4).

Table 1. Comparison of automated activity monitor parameters during estrus and non-estrus in lactating dairy cows

Variable	Monitor[1]	Estrus	Non-estrus
Activity	HR tag activity neck (index/2h)	61.6 ± 2.0	28.2 ± 0.8
	Icequbе number of steps (per h)	300.8 ± 10.9	79.1 ± 4.1
	Cow Manager SensOor ear activity (min/h)	17.4 ± 0.7	4.3 ± 0.4
Lying time	Icequbе lying times (min/h)	10.2 ± 2.0	24.8 ± 1.0
	Track a cow lying time (min/h)	6.6 ± 2.6	18.2 ± 2.0

(Adapted from Dolecheck et al., 2015, doi:10.3168/jds.2015-9645)

[1] CowManager SensOor (Agis Automatisering, Harmelen, the Netherlands); DVM bolus (DVM Systems, LLC, Greeley, CO); HR Tag (SCR Engineers Ltd., Netanya, Israel); IceQube (IceRobotics Ltd., Edinburgh, Scotland); and Track a Cow (Animart Inc., Beaver Dam, WI)

Table 2. Pregnancy per AI (P/AI) for treatments (ACT vs. TAI)[1]

Factor	N	P/AI (%)	P-value
Entire study	848		
ACT	439	30.8	0.39
TAI	409	33.5	

(Adapted from Tracy A. Burnett et al., 2017, https://doi.org/10.3168/jds.2016-12246)

[1] Treatments were (1) first insemination based on the detection of estrus by activity monitors after the pre-synchronization, all remaining non-inseminated cows were enrolled in a timed AI protocol (ACT) and (2) first insemination performed by timed AI (TAI).

Table 3. Descriptive statistics of ovulation timing variables in two groups using different AAM systems (AAM_C = neck collar; AAM_L = leg pedometers)

Factor	N	Mean interval time (h)	SD	Minimum	Maximum
AI - Ovulation	426	15.0	8.8	-8.0	62.7
AAM_C					
AAM Alert - Ovulation	627	627	25.8	-2.5	87.1
AAM Alert - AI	498	498	5.2	-19.3	23.5
AAM_L					
AAM Alert - Ovulation	499	24.7	9.2	-0.2	89.8
AAM Alert - AI	384	10.1	6.5	-21.7	27.8

(Adapted from Tracy A. Burnett et al., 2015, DOI: 10.3168/jds.2018-15151)

Table 4. Factors impacting ovulation failure and false alerts using AAMs

Factor	Classification	Ovulation failure (%)	SE	P-value	False Alerts (Odds ratio)	CI	P-value
Parity	Multiparous	8.0	1.2	0.05	ref.		0.05
	Primiparous	3.2	2.1		1.8	1.0 - 3.2	
BCS	Thin (< 2.75)	6.2	2.8	NS	ref.		0.06
	Average (2.75)	5.3	1.5		3.0	1.1 - 8.0	
	Moderate (> 2.75)	6.1	2.8		3.5	1.3 - 10.0	
Stage of lactation	Early (30 - 60 DIM)	5.5	1.8	NS	Ref.		< 0.01
	Mid (61 - 119)	6.7	1.6		3.4	1.7 - 7.0	
	Late (≥ 120)	3.5	1.9		2.9	1.3 - 6.1	
Milk production	1000 kg of 305d mature equivalent yield	-0.005	0.005	NS	1.00	1.0 - 1.0	NS
Gait score	Sound (≤ 2)	6.1	1.4	NS	ref.		NS
	Lame (> 2)	4.2	2.0		0.84	0.5 - 1.5	

(Adapted from Tracy A. Burnett et al., 2015, DOI: 10.3168/jds.2018-15151)

- What do you think the positive impact of the activity will have on your further career path?

The internship helped opening my eyes about the dairy farming operation using the automated technologies and expand my professional network in the field of animal science.

- Provide new techniques and knowledge in reproductive management using the AAM of dairy cattle. It opens a new room for me in doing research after graduation.

- Learn about the standard operating procedure in the intensive dairy farming not only at the UBC Dairy farm but also in the commercial farms in British Columbia region. This is very important when I do my own business as a consultant agency for reproductive management in dairy herd for the local farmers.

- Understand the education program of graduate students at the laboratory of Animal Reproduction, UBC. It gives me some ideas in establishing and operating a laboratory in my hometown which is balanced between theoretical - practical knowledge and work - life.

- Establish a connection with Prof. Ronaldo Cerri and the UBC Dairy centre. It is important when I want to support and send my students to this laboratory for internship in the future.

- Advice for your junior fellows

- Preparation progress can be started from the first grade such as creating the list of hosting professors, writing the statement of purposes (SOP) and CV;

- Taking any opportutnities to growing your own multidisciplinary professional networking;

- Always discuss and follow the instruction of WISE office;

	Institution・Official title・Name
Approval of supervisor	繁殖 教授 片桐成二

※1 Send the electronic file to the WISE Program Office

※2 Attach a copy certificate of the content of internship activity that is prepared by the counterpart at the internship institution (any form with a signature of the counterpart).

※3 The Steering Committee for the WISE Program will first confirm the content of this report and report will be forwarded to the Educational Affairs Committee for credits evaluation.

Submit to : VETLOG