

Student Free Design Activities (One Health on-site Training)  
 報告書 Report

報告者 [Reporter]

氏名 [Full Name]	SEOK Bong Soo	
学年 [Year]	DC2	E-mail [Redacted]
所属 [Affiliation]	Graduate School of Veterinary Medicine	

担当教員 [Instructor]

氏名 [Full Name]	OKAMATSU-OGURA Yuko
署名 [Signature]	<i>Yuko Okamatsu</i>
所属 [Affiliation]	Graduate School of Veterinary Medicine
E-mail	[Redacted]

活動報告 [Activity Report]

※活動内容が判る様な写真や図表を加えて下さい。 / Provide photos, tables and figures that clearly show the activities during the period.

タイトル [Course Title]	2023 Hibernation Science Workshop
実施期間 [Periods]	2023 August 6 <sup>th</sup> ~ 2023 August 18 <sup>th</sup>
共同実施者 [Other participants]	Mallory Ballinger, Tomasz Bednarski, Ifiigo Yoldi Bergua, Ching Pu Chang, Yue Gao, Vincent Kunze, Aurora Lavin-Peter, Yuko Okamatsu, Adam Olichwier, Takuto Suito, Haoran Cao, Cody Fitzgerald, Mira Kato-Suzuki, Neeraj Lal, Ming-Liang Lee, Jing Lei, Natalia Machado, Adrian Martinez, Adam Myers, Reo Otsuka, Jennifer Moss, Ian Borowski, Mika McCrary, James Currie, Amy Loeffler.
言語 [Language]	ENGLISH
実施場所 [Location]	University of Fairbanks Alaska, Toolik Field Station
申請時計画の実施報告 [Report how you carried out your plan in the application form]	
<p>The details of the workshop schedule of was provided on site. For the first week, we studied the theoretical background of hibernation including natural history, physiology, neurobiology, behavior, ecology, molecular and biochemical bases, potential therapeutic applications, and hibernation science and aging. We visited their dry and wet labs to learn how they are conducting behavioral and molecular experiments on Arctic ground squirrels and bears. Moreover, we actually conducted some basic experiments to understand the physiology of hibernation such as supercooling state and measuring metabolic rate. Then we went to Toolik Field Station which is located in the Arctic circle to carry out field study. We learned how to capture Arctic ground squirrels and studied their behaviors by observing their habitat. Throughout the workshop, I was able to develop good foundation on hibernation and learned how to obtain or capture hibernating subjects in the wild. Hibernating subjects cannot be purchased, so learning their know-how was priceless opportunity.</p>	
目的達成状況報告 [Report how you achieved your goal/objectives listed in the application form]	
<p>The main objectives of the workshop for me was to learn how diets and temperature affects vigilance state; however, the assumptions that I made were not valid. I thought animals exhibit hyperphagic behavior as temperature drops before hibernation, but hibernators exhibit hyperphagia in anticipation of temperature drop during the time when there are plenty of food resources. Moreover, hibernation was not homologous unconscious state like sleep. During hibernation, animal exhibit interbout arousals. The purpose of interbout arousal is still not clear because they do not eat, drink, and defecate. People are speculating that the purpose of the interbout arousal is for animals to</p>	

acquire sleep. I once thought that hibernation is an extended form of sleep, so I wanted to examine the link between temperature and vigilance state by studying hibernation.

After attending the hibernation workshop, new questions arose. Usually, overeating induces whitening of brown adipose tissue, which means it loses the thermogenic ability; however, hibernators seasonally grow brown adipose tissue. Before hibernation, the preference of fatty food and the amount of food consumption increase. The main cause of whitening of brown adipose tissue is the inflammation in white adipose tissue that cannot store the excess fat. Therefore, the number of adipocytes need to be increased to gain healthy weight. The circannual rhythm might regulate the differentiation of adipocytes and increase brown adipose tissue which is required to maintain temperature during hibernation. Before attending the workshop, I wanted to examine how brown adipose tissue plays a part in regulating vigilance states when I return to Hokkaido University. It would be worth investigate the molecular mechanism behind from the healthy weight gain by hibernators.

One Health Approach実践報告 [Report how your activity could link to One Health Approach]

I had a chance to talk with people from different fields of study and we talked about how hibernation can be implemented in human medicine. Hibernation is the low metabolic state that is induced to survive or adapt in harsh environment such as extreme heat and cold. As the metabolic rate decreases, heart rate and respiratory rate dramatically decline in hibernators. The physiology of hibernation could be implicated in several treatment in human disease. Reducing metabolic demand would extend the time for transportation of stroke and heart attack patients to advance medical care. The blood flow in hibernators is slow, so that they alter the blood composition to lower the risk of blood clot blocking an artery. Its implication would reduce the risk of thrombosis. High tau protein level is observed in hibernators during inactive period. The tau protein is well known for the risk factor for Alzheimer's disease, but the high tau level in hibernation is cleared out at arousal. Hibernation might play a role in clearing waste in the brain that could lower the risk of developing Alzheimer's diseases. During the months of inactive period, hibernators maintain muscle mass. The resistance to disuse atrophy of muscle and bone could be implicated in coma or vegetative state. Moreover, we also talked about the climate change due to human activities and how hibernation can help people to adapt into the extreme condition or help us to move to the Mars.

備考 [Remarks]

※ 報告書を作成後、担当教員に確認をお願いし署名をもらってください。PDFファイルとしてVetLogから提出してください。

提出先：「Student Free Design Activities報告書」

※ Please ask your instructor to check this report and get his/her signature before you submit. The scanned report is to be submitted strictly through VetLog. 「Student Free Design Activities Report」

北海道大学  
One Health フロンティア卓越大学院プログラム  
One Health Allyコース  
Student Free Design Activities報告書

Hokkaido University  
WISE Program for  
“One Health Frontier Graduate School of Excellence”  
One Health Ally Course  
Student Free Design Activities Report from



From left to right: Kelly Drew, Matt Andrews, Anya Goropashnaya, Brian Barnes, Domenico Tupone, Yue Gao, Mallory Ballinger, Ming-Liang Lee, Neeraj Lal, Ching Pu Chang, Adam Ollchwieler, Jing Lei, Bong Soo Seok, Natalia Machado, Vy Nguyen (front), Takuto Sulto, Reo Otsuka, Denise Danielle (front), Mira Kato-Suzuki, Cody Fitzgerald, Yuko Okamatsu, Adam Myers, Raechel Sherrick, Aurora Lavin-Peter, Øivind Tøien, Adrian Martinez, Sarah Rice, Bernard Laughlin  
Missing-Don Larson, Slav Bagriantsev, Elena Gracheva, Vince Kunze, Inigo Yoldi Bergua, Haoran Cao







### Hibernation Science Workshop Schedule 2023

Sunday, 6 August 2023

Time	Room	Instructor	Topic
16:00	Nerland Dorm		Recommended activity: Tanana Valley State Fair for dinner (campus dining is closed) - no transportation provided

**Monday, 7 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast - Arctic JAVA opens at 7; Dine 49 opens at 7:30
8:30	Murie 104	Drew	Review of schedule and logistics - optional
9:00	Murie 104	Larson	Introductions [Kelly], people and themes [Icebreakers in small groups-->complex questions
10:00	Murie 104		4 speakers (Brian, Kelly, Elena, Matt: Overview. One objectives, one question slide)
11:00			Break
11:15	Murie 104	Larson	Finish Intro talks and discussion
12:00			Lunch break - Pick food up from Museum Café
13:30	Murie 104	Barnes	Arctic ground squirrel husbandry; how to catch and keep them.
14:00	Murie 104	Drew/Rice	Regulations and compliance when working with USDA covered species in the US/AGS husbandry - best practices
14:30	Murie 104	Andrews	13-lined ground squirrel husbandry
		Gracheva	13-lined ground squirrel husbandry
15:30	Murie 104	Toien	Husbandry Bears in context of scientific questions
16:00	Murie 104	Drew/Rice	Tour of BiRD (group 1)
		Toien	Tour of bear facility (group 2)
		Drew/Rice	Tour of BiRD (group 2)
		Toien	Tour of bear facility (group 1)
18:00	Nerland Hall	Barnes	Meet at Nerland Hall for bus pick-up to 1170 Sundance Loop, Fairbanks, AK 99709
		Barnes	Transport to Barnes/York residence for dinner

**Tuesday, 8 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast-Arctic JAVA opens at 7; Dine 49 opens at 7:30
9:00	Murie 104	Barnes	Annual cycle of arctic ground squirrels, round the year we go.
10:00	Murie 104	Barnes	preparing, entry, steady-state, arousals, marmot synchrony
10:45		Break	
11:00	Murie 104	Barnes	Compare energetics of hibernation between ags and bears
11:30	Murie 104	Toien	Thermoregulation vs metabolic supression in hibernating black bears
12:00	Museum		Lunch - Pick food up from the museum café to take with you on the bus

12:30	Front of Murie Building		Transport to CRREL permafrost tunnel
13:00	Permafrost Tunnel		CRREL permafrost tunnel tour (Group 1)
			CRREL permafrost tunnel tour (Group 2)
15:00			Transport from CRREL permafrost tunnel
15:30	Murie 104	Tupone	Thermoregulatory Circuits
16:30	Murie 104	Tupone	Thermoregulatory Inversion
17:30	Dine 49-after 6PM enter through lower level of Wood Center		Dinner break
19:00	Dine49 (Wood Center, upstairs)	Daniello	Trail Walk/Campus Tour

**Wednesday, 9 August 2023**

Time	Room	Instructor	Topic
7:00	Meet at Arctic Java		Breakfast-Arctic JAVA opens at 7; Dine 49 opens at 7:30
7:30	Meet at Arctic Java	Larson	Overwintering strategies nature walk and bug collection Arctic Java
9:00	Murie 203/207	Larson	Ectotherm overwintering
12:30	Museum		Lunch Break - Pick up food from Museum Café, enjoy on campus
13:30	Murie 107	Bagriantsev	Biophysics of ion channels underlying temperature tolerance in hibernators
14:30	Murie 107	Gracheva	Neurophysiology of fluid/ionic balance regulation
15:30			Break - Museum for coffee
15:50	Murie 107	Gracheva	Neurophysiology of hunger/satiety
16:50	Murie 107	Gracheva	Optogenetics, in vivo imaging and fiber photometry - main challenges and potential solutions
18:00	Dine 49-after 6PM enter through lower level of Wood Center		Pick up hot meal to go from Dine 49 at 18:00
18:30	Nerland or Georgeson pending weather		Applying state-of-the-art neuroscience techniques in hibernating species - opportunities and barriers Journal club discussion of <a href="https://www.biorxiv.org/content/10.1101/2023.03.16.533067v1">https://www.biorxiv.org/content/10.1101/2023.03.16.533067v1</a>

**Thursday, 10 August 2023**

Time	Room	Instructor	Topic
------	------	------------	-------



7:30			Breakfast-Arctic JAVA opens at 7; Dine 49 opens at 7:30
9:00	Murie 104	Grabec-virtual	<a href="#">FaunaBio - Zoom link here</a>
10:00	Murie 104	Barnes	Low hanging fruit
10:15	Murie 104	Andrews	Genomics (historical) and metabolomics of hibernation
11:00	Murie 104	Andrews	Metabolic fuel use during hibernation
12:00	Museum		Lunch break - Pick up food from Museum Café
13:30	Murie 104	Andrews	Pros and cons of nonmodel organisms Genomic resources
14:00	Murie 104	Goropashnaya /Yoldi Bergua	Genomic resources Zoonomia; S Martin - "Squirrel Box" AGS and 13-lined ground squirrel genomes on NCBI
15:00	Murie 104	Rice	Carbon, nitrogen shuttling and recycling and insights of metabolomics and fluxomics in hibernators
16:00	Murie 104	Andrews/Sher rick	Metaboanalyst - <a href="https://www.metaboanalyst.ca/MetaboAnalyst/ModuleView.xhtml">https://www.metaboanalyst.ca/MetaboAnalyst/ModuleView.xhtml</a>
17:30	Dine 49-after 6PM enter through lower level of Wood Center		Dinner break
19:00	Georgeson Botanical Gardens		Music in the Garden

**Friday, 11 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast - Dine 49 opens at 7:30; Arctic Java is closed
9:00	Murie 104	Zieschang	Hand out COVID tests/Pick up test (for those going to Toolik)
9:00	Murie 104	Drew	Brain Energy Metabolism of hibernation
10:00	Murie 104	Drew	Resistance to cerebral ischemia/reperfusion injury
11:00	Murie 104	Goropashnaya	Resistance to muscle atrophy and ischemia/reperfusion injury
12:00	Museum		Lunch break - Pick up food from Museum Café
13:30	Murie 104	Toien	The downstate of hibernation in bears - a human sized hibernator
14:30	Murie 104	Toien	Scaling & respirometry
2-hour session. Pick one of the following:			
15:30 - 17:30	Murie 230	Drew	Rigor and reproducibility of behavioral pharmacology of hibernation - journal club discussion (group 1) Arrive guidelines
15:30 - 17:30	WRRB 004	Andrews/Sher rick	More time with metaboanalyst (group 2)



15:30 -			Working with genomic resources (group 2) (bring laptop if possible)
17:30	Murie 130	Goropashnaya	
18:00	Dine 49-after 6PM enter through lower level of Wood Center		Pick up hot meal to go from Dine 49
18:30	Murie, 3rd floor- south end by windows		Discussion- Seeking funding for hibernation research-Round table stories and discussion

**Saturday, 12 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast - Dine 49 opens at 7:30; Arctic Java is closed
9:00	Murie 104	Barnes	Heading towards spring, reproduction
9:30	Murie 104	Barnes	Loss and resumption of circadian rhythms in AGS
10:00	Murie 104	Williams - virtual	T3 signaling and activation of the reproductive axis
11:00	Murie 104	Drew	Biomarkers of the seasonal phenotypes and Translating the adenosine model of hibernation
12:00			Lunch at Farmers Market or Lunch at Dine 49 - carpool
14:00	Murie 104		Biomedical applications, translation and commercialization
	Murie 104	Drew	Customer Discovery and Traditional drug discovery-identify a novel target
14:15	Murie 104	Andrews	Biomedical applications of hibernation research
15:30	Murie 104	Andrews	Bringing a hibernation-based therapy to the marketplace
16:30			Meet charter bus at Nerland Hall  Depart for Trail Breaker Kennels (\$30/person; 5-7:00 - <a href="https://trailbreaker kennel.com/summer-tours/">https://trailbreaker kennel.com/summer-tours/</a> ) - 1700-1900
19:00			Stop for food purchase on the way home from Trailbreaker Kennels
			Arctic Java and Musem closes at 4pm; Dine 49 closes at 3pm

**Sunday, 13 August 2023**

Time	Room	Instructor	Topic
			Breakfast and Lunch - Dine 49 opens at 7:30 and closes at 3pm; Arctic Java is closed
			Take COVID tests (for those going to Toolik) -report if positive
			Free Day - On Your Own. See map in welcome packet for restaurants within walking distance from campus.

**Monday, 14 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast at Dine 49 (opens at 7:30 a.m.) or Arctic Java (opens at 7:00 a.m.)
			Take COVID tests (for those going to Toolik)
9:00	Murie 104	Toien	How to design a bear hibernation facility
10:00	Murie 104	Rice	Surgical, husbandry and experimental design techniques and strategies for hibernators
11:00	Murie 104	Duddleston	Urea Nitrogen Salvage
12:00	Museum		Pick up food at Museum Cafe
12:30	Meet bus at Murie front entrance		Depart for LARS-AGS Breeding Facility Tour MRI tour with discussion of imaging in hibernation
14:30	Murie 104	Carl Murphy	Closing remarks-History of hibernation research and where do we go from here?
15:30	Murie 104		
16:30			<a href="https://www.research.net/r/2023Hibernation">Please complete the Annonymous Exit Survey (for those not going to Toolik) https://www.research.net/r/2023Hibernation</a>
			Dine 49 is open for dinner and closes at 18:00
			Prepare for departure to Toolik

m

**Tuesday, 15 August 2023**

Time	Room	Instructor	Topic
7:00			Pick up Breakfast and Lunch to go at Dine 49 at 7:00 a.m.
8:00			Depart for Toolik (Pick up from Nerland Hall)
19:00			Arrive at Toolik
			Evening Orientation and Room Assignment

**Wednesday, 16 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast
8:30			Tour of Research Station
12:00			Lunch
18:00			Tour of ground squirrel burrows, trapping demo in afternoon
19:00			Dinner

TBD	Toolik	Barnes	Climate changes is altering physiology and phenology of an arctic hibernator.
-----	--------	--------	---

**Thursday, 17 August 2023**

Time	Room	Instructor	Topic
7:30			Breakfast
			Pack lunch and drinks
			Drive on bus to Atigun River
			Tour study site
			4-hour hike on either side of gorge to waterfall (5-mile round trip)
17:00	Toolik	Barnes	Return to station for dinner at 6pm
18:00			Dinner

**Friday, 18 August 2023**

Time	Room	Instructor	Topic
7:00			Breakfast
			Pack lunch, drinks, snacks
8:00			Depart from Toolik
			<a href="https://www.research.net/r/2023Hibernation">Once in wifi range please complete the Annonymous Exit Survey at https://www.research.net/r/2023Hibernation</a>
19:00			Arrive to Fairbanks, on own thereafter