

The Class of 2022

DOCTOR OF PHILOSOPHY DEGREES

COLLEGE OF ENGINEERING AND MINES

Dr. William E. Schnabel, Dean

Hongli Chang

Ph.D. Engineering: Petroleum Engineering

B.E., Northeast Petroleum University, 2015; M.E., China University of Petroleum-Beijing, 2018.

Thesis: Study on Emulsification/Demulsification Behavior and Mechanism of

Produced Liquid from Polymer Flooding on Alaska North Slope

Emulsion issue after polymer breakthrough is one of the major concerns for the first-ever polymer flooding field pilot on Alaska's North Slope. This dissertation predicts the emulsification behavior of produced liquid, explains the emulsifying mechanism and proposes an adaptive and cost-effective method to demulsify the produced liquid from polymer flooding.

Major professors: Dr. Yin Zhang and Dr. Abhijit Dandekar

Yaoze Cheng

Ph.D. Engineering: Petroleum Engineering

B.E., Missouri University of Science and Technology, 2015.

Thesis: Experimental Investigation of Nonthermal Enhanced Oil Recovery

Techniques for Improving Oil Recovery on Alaska North Slope

Oil production on Alaska's North Slope has declined since 1988. In this dissertation, hybrid nonthermal enhanced oil recovery techniques are proposed to improve recovery factor on Alaska North Slope viscous and heavy oils. In addition, clay's effect on low salinity waterflooding and CO₂'s influence on solvent-alternating-LSP flooding are investigated.

Major professors: Dr. Yin Zhang and Dr. Abhijit Dandekar

Chinmay Shah

Ph.D. Engineering: Electrical Engineering

B.T., Nirma University, 2012; M.S., University of Houston, 2017.

Thesis: Optimization and Forecasting Algorithms for Converter Dominated Distribution Networks using Blockchain and AI

With the increasing integration of renewable energy resources (RES) in power grids, sophisticated algorithms are needed to optimize dispatch from these resources. This dissertation presents a blockchain-based architecture for co-optimization of energy dispatch and scheduling reserves to reduce the impact of RES uncertainty and enhance the power distribution network flexibility.

Major professor: Dr. Richard Wies Jr.

Eva Stephani **

Ph.D. Permafrost Geosystems: Interdisciplinary Studies

B.E., Laval University, 2009; M.S., University of Alaska Fairbanks, 2013.

Thesis: Understanding Permafrost Dynamics and Geohazards with a Terrain-Cryofacies Approach

This study contributes to advancing our understanding of permafrost dynamics in varying environments using approaches that recognize linkages between terrain and subsurface conditions. The main findings included identifying properties of taliks and cryopegs related to deltaic channel migration, and the development cycle of thaw slumps initiated by interactions with infrastructure.

Major professors: Dr. Yuri Shur and Dr. Guy Dore

Molly Elizabeth Tedesche *

Ph.D. Hydrology: Interdisciplinary Studies

B.S., Rochester Institute of Technology, 2004; M.S., Colorado State University, 2010.

Thesis: Brooks Range Perennial Snowfields: Mapping and Modeling Change in Alaska's Cryosphere

Changes in perennial snowfield extents in the Brooks Range of Alaska were derived across multiple temporal and spatial scales, using optical and synthetic aperture radar satellite imagery, field data and snowmelt modeling. These snowfields provide habitat for many species and influence hydrology. Results show areas decreasing over decadal time scales.

Major professors: Dr. David Barnes and Dr. Steven Fassnacht

* Summer degree recipient

** Fall degree recipient

COLLEGE OF FISHERIES AND OCEAN SCIENCES

Dr. S. Bradley Moran, Dean

Patrick Dylan Barry *

Ph.D. Fisheries

B.A., Carleton College, 2005; M.S., University of Alaska Fairbanks, 2010.

Thesis: Spatio-temporal Genetic Structure, Effective Population Size and Parentage Simulations from Contemporary Genetic Samples and Historic Demographic Data From Sockeye Salmon (*Oncorhynchus nerka*) in Auke Lake, Alaska

Understanding the genetic diversity of Pacific salmon populations is critical for their effective management and conservation. This dissertation discovered broad spatial genetic structure among sockeye salmon populations in Southeast Alaska, fine-scale temporal genetic structure within the Auke Lake population, and the primary demographic factors that limit its effective population size.

Major professors: Dr. Anthony Gharrett and Dr. Megan McPhee

Kelly Ann Cates *

Ph.D. Fisheries

B.S., Western Washington University, 2012.

Thesis: Current and Novel Tools in the Health Assessment of Large Whales

This dissertation sought to better understand the basic physiology of humpback whales. Specifically, six hormones were validated for use in humpback whales, an algorithm was developed to automate morphometric measurements, and hormones and body condition metrics were paired to determine whether pregnancy status can be detected from aerial photographs.

Major professor: Dr. Shannon Atkinson

Brittany Robinson Charrier

Ph.D. Marine Biology

B.S., Gettysburg College, 2012; M.S., University of Washington 2015.

Thesis: Benthic Carbon Demand and Community Structure Across the Pacific Arctic Continental Shelves

Benthic community structure, function and carbon demand were evaluated in the Pacific Arctic. Polychaete and nematode functional traits were linked to habitat characteristics, and species-specific carbon consumption rates were found for individual benthic organisms. This research can aid regional ecosystem models to predict potential impacts of environmental changes.

Major professor: Dr. Sarah Mincks

Jason Christopher Leppi *

Ph.D. Fisheries

B.S., Montana State University, 2005; M.S., University of Montana, 2010.

Thesis: Broad Whitefish (*Coregonus nasus*) Ecology and Habitat Use in Arctic Alaska: Spawning Habitat Suitability, Isotopic Niches, Life–History Variations, and Climate Change Risks to Subsistence Fisheries

The broad whitefish is an important subsistence species for Alaska's Indigenous communities, yet little is known about the basic ecology of this species. This dissertation presents new information on the ecology of broad whitefish and provides crucial knowledge to understand habitats used, which will help conserve this vital subsistence resource.

Major professors: Dr. Mark Wipfli and Dr. Daniel Rinella

Veronica M. Padula

Ph.D. Fisheries

B.A., Columbia University, 2006; M.S., University of Alaska Fairbanks, 2013.

Thesis: Marine Debris in the Bering Sea: Combining Historical Records, Toxicology, and Local Knowledge to Assess Impacts and Identify Solutions

Marine debris, particularly plastic, has numerous impacts on the environment, wildlife and human communities. This research examines dimensions of marine debris in the Bering Sea, including impacts on wildlife and the environment; the history of marine debris research, monitoring and cleanup activities; and community perspectives on local to global solutions.

Major professors: Dr. Douglas Causey and Dr. Anne Beaudreau

* Summer degree recipient

** Fall degree recipient

COLLEGE OF LIBERAL ARTS

Dr. Ellen D. S. Lopez, Dean

Christopher Michael Cannon **

Ph.D. Anthropology

B.S., University of Alaska Fairbanks, 2007; M.A., University of Alaska Fairbanks, 2014.

Thesis: Northern Dene Astronomical and Sky-Related Knowledge: A Comparative Anthropological Study

Traditional astronomical knowledge and practices are regularly overlooked in Northern Dene studies. This research was a comparative and multisited anthropological study of the ways that Northern Dene peoples integrate the sky and its contents into a system of knowledge and practices, worldview, cosmology and spirituality.

Major professors: Dr. Patrick Plattet and Dr. Gary Holton

Ron DeWitt *

Ph.D. National Security Studies: Interdisciplinary Studies

B.S., Wayland Baptist University, 2007; M.A., American Military University, 2011.

Thesis: The Catalyst for Contemporary Jihad: The Religious Leaders and Their Strategies

Methodologies utilized by Islamist leaders of jihadist terrorist organizations were revealed. These religious imams and philosophers instilled radical ideology amongst their followers in a sustained effort to establish a global caliphate. These strategies included the use of religious doctrine, restrictive edicts, coercion, cultural usurpation, political influence and terrorism.

Major professors: Dr. J. Robert Duke and Dr. Walter Skya

COLLEGE OF NATURAL SCIENCE AND MATHEMATICS

Dr. Kinchel C. Doerner, Dean

Gazi Mahmud Alam

Ph.D. Mathematics

B.S., Shahjalal University of Science and Technology, 1998; M.S., Shahjalal University of Science and Technology 1999; M.S., Stockholm University, 2013.

Thesis: Control Problems for the Wave and Telegrapher's Equations on Metric Graphs

The dissertation focuses on control problems for wave and telegrapher's equations on quantum graphs. Numerical algorithms are developed to solve the control problems for the wave equation. The necessary and sufficient conditions of the exact controllability for the telegrapher's equation are proposed, and the minimal control time is indicated.

Major professor: Dr. Sergei Avdonin

Janelle Jean Badger *

Ph.D. Biological Sciences: Wildlife Biology and Conservation

B.S., Washington State University, 2015; M.S., University of Alaska Fairbanks, 2020.

Thesis: Drivers of Life History Variation in a Long-Lived, Marine Predator: Individual Heterogeneity in Reproductive Performance of Grey Seals (*Halichoerus grypus*)

Dynamics of reproductive heterogeneity were explored in grey seals (*Halichoerus grypus*) breeding on Sable Island, Nova Scotia. Results indicate that individual variation is a main driver in life histories that interacts with ecological conditions and may stem from early life characteristics, shedding new light on eco-evolutionary processes in long-lived animals.

Major professor: Dr. Greg Breed

Matthew S. Balazs **

Ph.D. Geology

B.A., University of Alaska Fairbanks, 2010; B.S., University of Alaska Fairbanks, 2010.

Thesis: Novel Applications of Remote Sensing and GIS in Mass Wasting Hazard Assessments for Two Fjords of South-Central Alaska

This research uses remote sensing techniques to identify and map mass wasting hazards in Seward and Whittier, Alaska. Mapping efforts are improved by creating a 3D landscape and viewing it in an immersive virtual reality environment. Sedimentation in critical infrastructure is calculated through time series analyses using multiple elevation models.

Major professors: Dr. Anupma Prakash and Dr. Gabriel Wolken

* Summer degree recipient

** Fall degree recipient

Tynan Alison Becker *

Ph.D. Biological Sciences

B.A., University of Maine at Machias, 1995; M.S., New York Chiropractic College, 2013.

Thesis: Presentation of Immunodominant Peptides is Strongly Dependent on Cathepsin Resistance and Preliminary Cleavage of Antigens

An understanding of the initiation of adaptive immunity is critical in disease management and vaccine development. This work supports the hypothesis of multiple pathways in antigen processing, and that pH and the reducing environment are critical factors influencing pathogen-degrading protease activity in the early steps of adaptive immunity.

Major professors: Dr. Thomas Kuhn and Dr. Andrea Ferrante

Maile Branson **

Ph.D. Biological Sciences

B.A., University of Alaska Anchorage, 2012.

Thesis: Naturally Occurring Etiologic Factors Affecting the Health of Breeding Seabirds in the Bering Sea

This work analyzes a selection of the naturally occurring pathogenic and toxicological factors affecting breeding seabirds in the Bering Sea region of Alaska using an approach focusing on zoonoses and bioaccumulating toxins. Findings included pathogens such as *Coxiella*, *Plasmodium*, *Toxoplasma*, and influenza A virus, in addition to paralytic shellfish toxins.

Major professors: Dr. Kevin Winker and Dr. Eric Bortz

Matthew D. Cameron

Ph.D. Biological Sciences: Wildlife Biology and Conservation

B.A., Whitman College, 2009.

Thesis: Drivers and Mechanisms of Migration for an Arctic Caribou Herd

This dissertation presents three chapters that seek to better understand the drivers and mechanisms of spring and autumn migration for the Western Arctic Caribou Herd, a population of barren-ground caribou (*Rangifer tarandus*) that completes some of the longest terrestrial migrations on the planet.

Major professor: Dr. Knut Kielland

Melynda Sheri Coker *

Ph.D. Natural Resources and Sustainability

B.S., University of Central Arkansas, 1979.

Thesis: Health Benefits of the Hunter/Gatherer Lifestyle

The hunter/gatherer lifestyle is considered healthy. Three separate studies used methodology to determine alterations in metabolism during backcountry hunting and dietary response to amino acids often found in wild game. Results suggest that hunter/gatherer activities and game meats may improve lipids, body composition and/or whole-body protein retention.

Major professor: Dr. Joshua Greenberg

Aline Louise Collin **

Ph.D. Biochemistry and Molecular Biology

A.A., Mineral Area College, 2009; B.S., Missouri University of Science and Technology, 2011.

Thesis: 3T3-L1 Adipocytes as a Model of Glut4 Translocation

3T3-L1 adipocytes demonstrated phenotype variations based on their differentiation protocol, and the adipocytes did not properly uptake glucose. Alaska blueberries revealed an insulin-like effect on glucose uptake in 3T3-L1 adipocytes. Weight gain in sled dogs demonstrated a significant effect on biomarkers of type II diabetes compared to exercise.

Major professor: Dr. Lawrence Duffy

Else N. S. A. Demeulenaere **

Ph.D. Biogeography, Ethnobotany, and Policy: Interdisciplinary Studies

B.S., University of Ghent, 1998; M.S., University of Ghent, 2000.

Thesis: Rooted in Environmental Justice: Phytogeography and Ethnoecology of *Serianthes*

An interdisciplinary study integrated genomic, biogeographic and ethnoecological approaches to develop appropriate recovery actions and conservation policies that protect the indigenous biocultural diversity of *Serianthes* trees. Ethnoecology foregrounded the importance of spirituality. Phylogenomics confirmed the monophyly of the genus and inferred the biogeography and phylogenetic relationships within *Serianthes*.

Major professor: Dr. Stefanie Ickert

Alexandra Francian *

Ph.D. Biochemistry and Neuroscience: Biochemistry

B.S., University of Alaska Anchorage, 2014.

Thesis: Enhancing Tumor Antigen Presentation with Complement Targeted Liposomes

This research describes a promising cancer immunotherapy utilizing a liposome nanoparticle (C3-liposomes) that is specifically internalized by antigen-presenting cells (APCs). C3-liposomes reduced tumor growth in mice and induced expression of costimulatory molecules and proinflammatory cytokines, indicating that C3-liposome delivery of tumor antigens to APCs initiates a potent antitumor immune response.

Major professors: Dr. Max Kullberg and Dr. Thomas Kuhn

Thomas Rutherford Winder Glass V

Ph.D. Biological Sciences: Wildlife Biology and Conservation

B.A., Whitman College, 2013.

Thesis: Snow as Structural Habitat for Wolverines in a Changing Arctic

Arctic wolverines rely on snowpack for resting burrows and reproductive dens. Using field observations, collar-mounted biologgers and numerical snowpack modeling, the properties and wolverine behaviors associated with these sites were investigated. Wolverines select deep, dense snow and use burrows for thermoregulation and avoiding predators.

Major professor: Dr. Knut Kielland

Nicole Jacobs *

Ph.D. Environmental Chemistry

B.S., University of Alaska Southeast, 2014.

Thesis: Vetting Model and Satellite-Based Estimates of Regional Scale Carbon Exchange at Northern High Latitudes Using Solar-Viewing Infrared Spectroscopy

Ground-based and satellite-based atmospheric remote sensing of CO₂, CH₄ and CO in the Fairbanks area filled an important gap in global coverage for these measurements, which led to improvements in methods for high-latitude observations and a global scale analysis of CO₂ seasonality across northern high-latitude regions.

Major professor: Dr. William Simpson

Andrew Carl Johnson **

Ph.D. Geophysics

B.S., North Park University, 2012.

Thesis: Melt on Antarctic Ice Shelves: Observing Surface Melt Duration from Microwave Remote Sensing and Modeling the Dynamical Impacts of Subshelf Melting

A record of Antarctic surface melt duration over 1979–2020 from passive microwave remote sensing is presented, with analysis of spatial and temporal trends of melt. The methodology is evaluated using a comparison with Sentinel-1 SAR. Dynamic impacts of subshelf melt on the Filchner–Ronne Ice Shelf are shown using numerical modeling.

Major professor: Dr. Regine Hock

Devin Leland Johnson *

Ph.D. Biological Sciences

B.A., Colorado College, 2015.

Thesis: Stable Isotope Ecology of an Arctic Raptor Guild

This research investigated foraging ecology of three Arctic raptors (gyrfalcons [*Falco rusticolus*], rough-legged hawks [*Buteo lagopus*] and golden eagles [*Aquila chrysaetos*]), validating and refining Bayesian stable isotope mixing models to characterize diet while introducing a novel approach. It revealed how resource variability influences niche dynamics in an Arctic predator guild.

Major professor: Dr. Cory Williams

Bishwa Raj Neupane *

Ph.D. Physics

B.S., Tribhuvan University, 2009; M.S., Tribhuvan University, 2012.

Thesis: Plasma Transport and Magnetic Flux Circulation in Saturn's Magnetosphere

Saturn's magnetosphere rapidly rotates and has its own plasma source. The magnetosphere's strong magnetic field picks up the plasma, which experiences a strong centrifugal force in the noninertial reference frame. The study tried to determine potential transport mechanisms of plasma in Saturn's magnetosphere and estimated the outward plasma mass transport rate.

Major professor: Dr. Peter Delamere

Elizabeth Fleur Nicklen

Ph.D. Biological Sciences

B.A., Rutgers, The State University of New Jersey, 2002; M.S., University of Alaska Fairbanks, 2006.

Thesis: Seeing the Forest Through the Trees: How Site Conditions Mediate Black and White Spruce Responses to Climate in Interior Alaska

Using tree ring measurements from white and black spruce in Interior Alaska, the study quantified how local variation in site and stand conditions forced diverging growth responses to similar climate conditions, providing insight into how these species' productivity may play out with ongoing climate changes across a heterogeneous landscape.

Major professor: Dr. Roger Ruess

Matthew Christopher Rogers *

Ph.D. Biological Sciences

B.S., University of Michigan, 2000; M.S., University of Alaska Anchorage, 2008.

Thesis: Applications of Stable Isotope Analysis to Advancing the Understanding of Brown Bear Dietary Ecology.

Brown bear dietary ecology was investigated using stable isotope analysis to infer seasonal dietary patterns of individual bears in five Alaska ecosystems. Most bears display dietary patterns that persist through time, and they potentially maintain foraging patterns even when resource availability changes due to natural fluctuations, disturbance or climate change.

Major professors: Dr. Brian Barnes and Dr. Jeffrey Welker

William Franklin Swanson *

Ph.D. Environmental Chemistry

B.S., Washington University in St. Louis, 2012.

Thesis: Tropospheric Reactive Bromine and Meteorology over the Arctic Ocean

Reactive bromine is seen at elevated levels in the springtime over the Arctic Ocean. This study found that two distinct meteorological conditions are related to reactive bromine events. Two reactive bromine sources were added to global chemistry models and found agreement between global models and long-term Arctic Ocean observations.

Major professor: Dr. William Simpson

* Summer degree recipient

** Fall degree recipient

COLLEGE OF RURAL AND COMMUNITY DEVELOPMENT

Mr. Bryan Uher, Dean

Margaret Susan Draskovich Mete **

Ph.D. Indigenous Studies

B.S., St. Francis School of Nursing, 1977; M.P.H., University of South Florida, 1994; M.S., University of Alaska Anchorage, 1999.

Thesis: Celebrating Alutiiq Cultural Revitalization: Pathways to Holistic Individual Health and Community Wellness

The promotion of balanced holistic health by addressing root causes, accessed through communication with the natural and spiritual realms versus merely treating physical manifestations, was explored. The active cultural revitalization efforts in Kodiak and application of the Alutiiq core values were determined to be pathways for healing or maintaining wellness.

Major professor: Dr. Theresa John

Olga Jennifer Skinner

Ph.D. Indigenous Studies

B.A., University of Alaska Fairbanks, 1998; M.Ed., University of Alaska Fairbanks, 2009.

Thesis: The STEM Trail: Alaska Native Undergraduates Find the Right Path in Higher Education

This research explores decision-making of Alaska Native undergraduates pursuing science, technology, engineering and mathematics degrees. Using participant observation, this research explores the Indigenous metaphor of “the trail” to frame student persistence. Participants represented various STEM fields and Alaska Native cultures, and shared their motivations and aspirations through interviews and photographs.

Major professors: Dr. Beth Leonard and Dr. Maria Williams