

TRONDBUSS, A BILATERAL NORWAY-US MOBILITY PROGRAM

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DESCRIPTION: TRONDBUSS (TRONDheim, ColumBUS and BUSS in Norwegian) is a US-Norway initiative for bilateral student mobility between the [Department of Biomedical Laboratory Science \(IBF\)](#) at [NTNU](#) (Norwegian University of Science and Technology, TRONDheim, Norway, and the [Department of Molecular Genetics](#) at OSU (ColumBUS, Ohio). Dr. Patrice Hamel (OSU) and Dr. Kristin Solum Steinsbekk (NTNU, IBF) act as coordinators of the TRONDBUSS program. In 2019, Marit Barstad from the [Department of Clinical and Molecular Medicine](#) at NTNU was recruited as an additional coordinator to develop an extension of the program. TRONDBUSS led to a formalized agreement between the two participating institutions and a Memorandum of Understanding ([MOU](#)) was signed in 2017 to officialize the partnership. The multiple facets of the TRONDBUSS program have now been captured in a movie (54 mins) that is accessible [here](#) 🎥.

OBJECTIVES: One of the aims of the TRONDBUSS program is to develop a [Norway to US mobility opportunity \(NORUS, NORway to US\)](#) where NTNU students enrolled in the Biomedical Laboratory Science (BLS) B.S. program take part in a three-month research project in laboratories at OSU from March to June. The objective here is to provide theoretical and practical training in the Sciences with a focus on basic research in a laboratory setting. NTNU students are expected to carry out experiments at the bench and disseminate their results orally and in writing. In years 2013-2022, 17 NORUS students pursuing a B.S. degree (in BLS or Biotechnology, see program extension) participated in research programs investigating plant organelle biogenesis, development of crop-based biofuels, plant pollen formation, bacterial central carbon metabolism, signaling pathways in fruit flies, and metal homeostasis in fission yeast. Upon completion of their research project, NTNU students earned credit towards their bachelor degree at their home Institution (NTNU). [Here](#) 🎥 is a recording of Dr. A Bird's experience hosting Norwegian students in her laboratory at OSU (recorded in April 2022).


To enhance the training experiences of NORUS students during their research internship at OSU, a visit to a [diagnostic laboratory](#) in Columbus Ohio ([OhioHealth Riverside Methodist Hospital](#)) was organized in 2019. After completing their studies, the students are accredited to work as health care professionals in diagnostic laboratories in Norway. It is, therefore, extremely valuable for their future professional life to understand how US versus Norway diagnostic laboratories are organized and perform their routine analysis. NORUS research experience opportunities have now been extended to NTNU students enrolled in a Master's program. Two students from the [Molecular Medicine Master's program at NTNU](#) already benefited from this opportunity and stayed for a 10 month training period at OSU in 2013-2014 and in 2018-2019. [Here](#) 🎥 is an interview of the NORUS 2022 students capturing their impressions doing research at OSU and living in Columbus (recorded in April 2022).

The other aspect of TRONDBUSS is concerned with the [US to Norway mobility opportunity \(USNOR, US to NORway\)](#). Under USNOR, OSU undergraduate students pursuing a degree in the Biological Sciences, were part of a study abroad program (MolGen 5797) at IBF/NTNU (Trondheim) focused on an introduction to medical laboratory technology, a strength and expertise at IBF/NTNU. In addition, the [Genomics Core Facility at NTNU](#) and the Department of Medical Genetics at [St. Olavs' Hospital](#) contributed to this study program by introducing the students to large-scale genomic sequencing approaches in a clinical setting. Special emphasis was given on the choice of the methodology and the bioethical considerations pertaining to its application in diagnosis. These goals were achieved through a variety of course work, including but not limited to, hands-on work at the

bench, visit of medical facilities and direct interaction with healthcare professionals. The class was specifically designed for OSU students and only offered to them. The program is divided into [three modules](#): fundamentals of laboratory techniques, evaluation of the methods of analysis and an introduction to genome sequencing in clinical practice with a particular focus on the practical and ethical challenges arising from the use of this technique in the medical diagnosis of patients. A [fourth module](#) centered on medical Microbiology was added in 2022. Click [here](#) to view a syllabus of the class. On-line evaluations of the class are accessible [here](#). OSU students participated in the study program at NTNU during the summer and were enrolled as international students at the host institution. The number of participants was limited to 10. OSU students enrolled in the program received a grade at the host institution upon completion of the class. The letter grade earned at NTNU was posted in the OSU system (3 credit hours). Click [here](#)  to listen to USNOR (2017, 2018 and 2019) participants reflecting on the impact of their experience in Norway (recorded in November 2021). Click [here](#) to read testimonials from USNOR students.

In addition to the academic content of the program, NORUS and USNOR students also benefited from the cultural immersion experience in the host country by staying with families. Homestays in the USA and Norway were arranged by the coordinators of the program. In 2013-2022, 38 TRONDBUSS students opted for a homestay in Norway or the USA. One NORUS student in 2016 arranged for her own accommodation and the dormitory option was decided by the coordinators of the program for the USNOR students in 2019 and 2022. Click [here](#)  to listen to an interview of two host families in Columbus. Host families have hosted 18 out of the 19 NORUS students since 2013.

FINANCIAL SUPPORT: Support came from four grants awarded by [the Norwegian agency for international cooperation and quality enhancement in higher education](#) (DIKU) to the program (total: 950,000 NOK, ~\$115,000 eq. for years 2016-2022.) and the Norwegian Ministry of Education and Research ([Lånekassen](#)) for NORUS students. Awarded funds from DIKU were disbursed as stipends for NORUS and cash cards for USNOR students, support toward travel (from Norway to the USA), reimbursement of visa processing fees at the host institution (OSU) and to defray the cost of the social/educational activities in Trondheim for USNOR participants. In addition, at OSU, the [College of Arts and Sciences](#), the [Department of Molecular Genetics](#) and the [Office of Undergraduate Research and Creative Inquiry](#) provided a total of ~\$60,000 towards the USNOR component of the program including support towards living expenses for students, the cost of lab-based and social activities at NTNU and Dr. Hamel's travel expenses.

PROGRAM EXTENSION: An extension (now no longer offered) was implemented in 2019 to include the Department of Biological Sciences at NTNU Ålesund ([NTNU Ålesund - NTNU](#)), a satellite campus of NTNU Trondheim. Two NORUS students pursuing a B.S. in Biotechnology were recruited for a three month research experience at OSU (March-June 2019). To expose NORUS students to possible career paths in their chosen field of study, visits to local start-up biotechnology companies and interviews with scientists were also organized ([Central Ohio Startup Studio, Accelerator & Technology Incubator \(rev1ventures.com\)](#)). In addition, USNOR students in 2019 traveled to Ålesund to take part in a module on metagenomics applied to environmental microbiology and the quality of water samples. Starting in Fall semester 2022, TRONDBUSS will offer research experiences (3 months) in the fields of plant biology, ecology and neurosciences to OSU undergraduate students. [Host laboratories at NTNU](#) have been identified and funding from a grant awarded to the program has been secured for future participants. One OSU student (Environment and Natural Resources major) has already been placed in a host laboratory at NTNU. Click [here](#)  to listen to the student's impressions prior to her research experience in Norway. The [integration of internships in industry](#) for NORUS and USNOR students is also a recent development currently under consideration.

RESPONSE TO THE COVID-19 PANDEMIC: In Spring 2021, "[Medical Genetics, MOL3001](#)", a class offered as part of the Master of Molecular Medicine at NTNU became accessible to OSU students pursuing a

degree in the Biological Sciences as an on-line elective. Seven USNOR students (2 graduates and 5 undergraduates) enrolled in this class and were also registered as international students at NTNU. Upon completion of the class at NTNU, students earned 3.75 credits and a letter based grade toward the degree being pursued at OSU.

POST COVID-19 PANDEMIC ACTIVITIES: As of Spring 2022, with the recent lift on several COVID-19-related travel restrictions, NORUS activities have officially resumed. Three NTNU students enrolled in the BLS program have received training at OSU laboratories. USNOR activities resumed in May 2022 with the visit of 10 OSU students to Norway for the 5 week study abroad program offered at NTNU (MolGen 5797).

As of 2022, TRONDBUSS has served a total of 65 students (46 USNOR and 19 NORUS). Among the 46 USNOR students, 39 participated in the study abroad program (MolGen 5797) in years 2017-2022. Students (32 females and 7 males) were pursuing undergraduate degrees with majors in the Biological Sciences (Molecular Genetics: 23, Biology: 9, Microbiology: 1, Health Sciences: 1, Neurosciences: 3, Pharmaceutical Sciences: 2). Out of the 39 participants, 21 were honor students and 2 were minority students.

SOCIAL MEDIA RELEASE:

- * [Claire Limbert \(TRONDBUSS 2017\): Second year Transformative ExPerience \(STEP\)](#)
- * [Emma Stocker \(TRONDBUSS 2017\): Second year Transformative ExPerience \(STEP\)](#)
- * [Savannah Headley \(TRONDBUSS 2017\): Second year Transformative ExPerience \(STEP\)](#)
- * [Regan McGinley \(TRONDBUSS 2019\): Second year Transformative ExPerience \(STEP\)](#)
- * [Ava Willoughby \(TRONDBUSS 2019\): Office of International Affairs](#)
- * [Abby Jung \(TRONDBUSS 2022\): Office of International Affairs](#)
- * [OSU Global \(TRONDBUSS 2022, Emily Raiff\) Twitter post](#)
- * [OSU Global \(TRONDBUSS 2022\)Twitter post](#)
- * [TRONDBUSS, a new science-based study abroad experience | College of Arts and Sciences](#)
- * [Ohio State awarded U.S.-Norway Virtual Exchange COIL Transformational Lab](#)

PEER-REVIEWED PUBLICATIONS (NORUS PARTICIPANTS):

*McClure T, Cocuron JC, **Osmark V**, McHale LK, Alonso AP. (2017). Impact of Environment on the Biomass Composition of Soybean (*Glycine max*) seeds. *J. Agric. Food Chem.* **65**:6753-6761.

*Subrahmanian, N., Castonguay, A.D., **Apelsund Fatnes T.**, and Hamel P. (2020). *Chlamydomonas reinhardtii* as a platform to study mitochondrial complex I dysfunction, *Plant Direct* **4**:1-16.

*Lee BH, Wang R, **Moberg IM**, Reeder SH, Amom P, Tan MH, Amstutz K, Chandna P, Helton A, Andrianova EP, Zhulin IB, Dobritsa AA. A species-specific functional module controls formation of pollen apertures. (2021) *Nat. Plants* **7**:966-978.

DIGITAL MEDIA:

*A [Q&A zoom session](#) 🎤 recorded by former USNOR participants (2017, 2018 and 2019) for future TRONDBUSS participants.