The Student Conference in Science and Technology October 17, 2022

In Ekman and Fries lecture halls, The Evolutionary Biology Centre

Program

In Ekman lecture hall

13.15-13.25 Welcome and introduction

13.25-13.40 **Keynote**: **Pia Lindberg,** Dept of Chemistry, Uppsala University
Tiny green factories – solar powered biotechnology using cyanobacteria

13.45-14.00 ***Biodiversity of food webs in response to warming across ecosystems***
Nolwenn Le Guyader, Master student in Biology

14.00-14.15 ***Using AI to detect ghost particles*** Lukas Liland, Master student in Astronomy

14.15-14.30 ***Aptamer-based detection of Interleukin-6 for sepsis diagnosis*** Favour Nzekwe, Master student in Chemistry

14.30-14.45 ***A fishy situation - Baltic cod (Gadus morhua) and its survival in the Baltic Sea***
Amanda Adam Jansson, Bachelor student in Biology

14.45-15.00 Voting and award for best student presentation. Concluding remarks.
Directly after the conference upstairs in lecture room 3: Feedback session for presenters and feedback providers.

In Fries lecture hall

13.15-13.25 Welcome and introduction

13.25-13.40 **Keynote: Thomas Schön** Dept of Information Technology, Uppsala University
Artificial Intelligence – how clever are the machines?

13.45-14.00 ***Does MHC diversity and regional European variation affect infection by avian malaria in collared and pied flycatchers?*** Alpha Nwana, Master student in Biology

14.00-14.15 ***Investigation on the Use of Magnetic Beads as Target Structures for LigandTracer***
Qingtian Gong, Master student in Chemistry

14.15-14.30 ***Where is everyone? The search for life*** Emil Björnström, Bachelor student in Biology

14.30-14.45 ***Nitrogenases, a sustainable solution for fertilizers production?***
Yassine Abdessamie Belaziz, Bachelor student in Biochemistry

14.45-15.00 Voting and award for best student presentation. Concluding remarks.
Directly after the conference upstairs in lecture room 2: Feedback session for presenters and feedback providers.

Abstracts

Ekman Lecture Hall

Biodiversity of food webs in response to warming across ecosystems Nolwenn Le Guyader
Global warming is undoubtedly contributing to biodiversity loss. However, the mechanisms by which ecosystems respond to rising temperatures remain unclear. Preventing biodiversity erosion requires to understand the patterns driving species coexistence within feeding networks of species, known as food webs. Food webs are studied within ecosystems, which are ecological units comprising all species living in the same area, there are several types of ecosystems such as terrestrial, aquatic, marine or streams. We assess how these different ecosystem types and food-web structures determine the response of species persistence to warming using a dynamic model on a dataset of 219 empirical food webs. Our model highlights differences in food-web responses to increasing temperatures across ecosystem types: stream ecosystems being more fragile than marine, lake or terrestrial ecosystems. We reveal that structures facilitating the circulation of energy across species have a protective effect against temperature increase. Similarly, we pointed out that structures acknowledging for similarities in species' diet enhance community resistance to warming. These mechanisms driving species persistence in response to warming are universal across food webs. However, the set of descriptors associated with these two types of structural characteristics was not able to explain the variation across ecosystem types. Therefore, the response of communities to temperature is driven by these universal mechanisms as well as some that are ecosystem specific, both interacting to determine the future of ecosystems in a warming world.

Using AI to detect ghost particles Lukas Liland
Neutrinos are elementary particles that travel through the universe at almost the speed of light. So called ultra high energy neutrinos can carry information about some of the least known phenomena in the universe, but they are extremely elusive and hard to detect. Therefore, one has built enormous detectors in Greenland and Antarctica, using the ice capes themselves as detector medium in order to observe as many neutrinos as possible. However, their signals when interacting with ice are hard to distinguish from noise caused by random thermal fluctuations. Artificial intelligence (AI) in the form of a neural network can be trained to distinguish between noise and signal events with great efficiency, thus making it possible to detect more neutrinos.

Aptamer-based detection of Interleukin-6 for sepsis diagnosis Favour Nzekwe
Sepsis is a life-threatening condition where the host's immune system overreacts to an infection, causing damage to self-tissues and organs. Sepsis affects over 30 million people annually and accounts for 20% of deaths worldwide. Interleukin-6 (IL-6) is a blood protein identified as a potent biomarker for early-stage sepsis. The UppSense team has developed an electrochemical aptamer-based sensor for measuring IL-6 concentration in blood plasma within 5 minutes. Our measuring technique, electrochemical impedance spectroscopy, leverages the change in aptamer conformation upon binding the IL-6 in the sample. Our team also developed a user-friendly app to visualize the test results. With great enthusiasm, we present a sensitive, specific, cost-effective, and user-friendly biosensor for rapid detection of IL-6.

A fishy situation - Baltic cod (*Gadus morhua*) and its survival in the Baltic Sea
Amanda Adam Jansson
The Baltic Sea is unique; the brackish water results in a flora and fauna that cannot be compared to any other sea. However, the Baltic has changed over the last years which have had consequences for the organisms living there. The Baltic cod is a commercially valuable fish, and because of the recent changes in the Baltic, there are problems with low recruitment and diminishing cod populations. In response to this, Uppsala University and BalticWaters2030 have launched a research project aiming to deepen the understanding of Baltic cod; *project ReCod*. I will give an overview of the consequences a changing Baltic Sea has had for the Baltic cod and present the work I conducted while doing research training within the project ReCod.

Fries Lecture Hall

Does MHC diversity and regional European variation affect infection by avian malaria in collared and pied flycatchers? Alpha Nwana
Avian malaria is a parasitic disease of birds that is mainly caused by parasites that belongs to the genus Plasmodium. This parasite results in long lasting chronic phases that affect individuals and populations. The prevalence of malaria has been studied quite intensively in birds, but we still understand little about what causes differences in prevalence or resistance to the parasite between individuals. To address this we are working on two closely related Flycatchers which are collared and pied (*Ficedula albicollis* and *F. hypoleuca*) species that co-occur on the Swedish Island of Öland and have been studied for over 20 years by the Qvarnström group at Animal Ecology. They follow them during the breeding season from the first egg until the nestlings leave the nest. These birds are migratory and spend most of the year in Africa, and they can contract malaria both in Africa and in Sweden during the breeding season. I hypothesize that differences in alleles of the Major histocompatibility complex (MHC) complex between individuals and/or populations may be linked to malaria prevalence or resistance across Europe.

Investigation on the Use of Magnetic Beads as Target Structures for LigandTracer Qingtian Gong
LigandTracer is a series of analytical instruments that can measure ligand-target interactions in cellular context in real-time. Although cells, as the common targets for LigandTracer, can be immobilized on the Petri dish, protein immobilization on the Petri dish only depends on the non-specific adsorption, which suffers from several problems. One way to improve the application is to immobilize the target protein on magnetic beads by covalent bonds to increase the robustness of target immobilization and ensure the target orientation on the bead surface. Herein, we established and optimized the use of magnetic beads as the target structure to study the binding kinetics of protein A-trastuzumab interaction. Moreover, as protein A can bind to the antibody at its F_c region, the orientation of the antibody can be well controlled, and after examining the binding kinetics of trastuzumab, a therapeutic antibody that specifically binds to HER2 receptor, to a HER2-receptor expressing cell line, we explored to capture cells using antibody-conjugated magnetic beads via trastuzumab-HER2 interaction. The results confirmed that the magnetic beads can capture cells from the medium via physical adsorption and specific binding, but the interaction dynamic cannot be explained by conventional models for binding kinetic analysis.

Where is everyone? The search for life Emil Björnström

The universe has always been an interesting place to me. When I was a small kid I was staring up at the sky wondering if there was someone out there. This question has been asked by so many people from around the world and today we use a lot of resources to answer this simple question; are we alone? Around this question a new science has emerged; astrobiology. Astrobiology is not like every other science since it binds together almost all the natural sciences. Biology, chemistry, physics, astronomy, and geology are united with the goal to figure out if we are alone and how we even came into existence. Astrobiology even relates to philosophy that are asking the big questions, for example, where is everyone? Because if the universe is as old as we think, life should be everywhere. Then why don't we find it outside of earth? What are we missing?

Astrobiology is a new area of science that is evolving fast and I hope humanity will continue to find friends in our universe. And I hope that humanity will take the following quote by James T Kirk to its heart and continue to explore the world around us; "To boldly go where no one has gone before".

Nitrogenases, a sustainable solution for fertilizers production? Yassine Abdessamie Belaziz

Nitrogenase is an enzyme, a particular protein which can produce ammonia from the nitrogen available at 80% in the atmosphere. First, I will present its structure and how the reaction is catalized. Then, I will explain the current limitations to its worldwide use. Finally, I will discuss about the potential of nitrogenases, their impact on our societies and their future biotechnological applications.

The Student Conference at the Faculty of Science and Technology, Uppsala University, is arranged by DiaNa Communication Training. The goal of DiaNa is to prepare students for their future careers by offering subject integrated training in communication skills. Oral and written presentations as well as group interaction is part of the training. The Student Conference offers an opportunity to listen to exciting talks and also the chance to talk in front of a larger audience and to get feedback afterwards.

Next year it may be your turn to accept the challenge!

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