Biosystematics 2023
Celebrating the past | Planning the future

Using high-throughput species discovery with robots and Nanopore sequencing to overcome taxon biases in biodiversity science.

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Biodiversity science tends to neglect hyperdiverse arthropod clades although they are species-rich and provide many ecosystem services. In this seminar, I first document that more than half of the flying insect diversity in many samples is concentrated in 20 family-level clades regardless of where the samples were collected. I then demonstrate how little is known about most of these clades by comparing the species richness in samples with the number of described species. This leads to the conclusion that we need new approaches to species discovery and taxonomy of “dark taxa”. At the Center for Integrative Biodiversity Discovery at the Natural History Museum Berlin, we are currently optimizing a robot ("DiversityScanner") that detects, images, and measures individual specimens before they are placed into microplates for DNA barcoding with rapid and cost-effective techniques involving Nanopore sequencers. After presorting the specimens based on DNA barcodes, we use morphological data for selected specimens to validate/fix "barcode clusters" to become species ready to be identified or described. I will show that this approach allows for quickly converting a "dark taxon" from largely unknown to sufficiently well known for biomonitoring. I will also show how the images for common species can be used to train Convolutional neural networks (CNNs) for future specimen identification with images alone. Overall, I will argue that dark taxa can be tackled by applying high throughput methods to one local sample at a time.