



Talking about Taxonomy

Center of Biodiversity and integrative Taxonomy (KomBioTa)

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Museum für Naturkunde Berlin / Center of Integrative
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Photo: Hwa Je-Götz, MfN

Accelerating Biodiversity Discovery in Hyperdiverse Arthropod Clades with Robots and Nanopore Sequencing

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Stuttgart State Museum of Natural History (Löwentor), Großer Saal

The biodiversity of arthropods remains poorly understood although the taxon comprises much of the terrestrial animal biomass, most animal species, and supplies many ecosystem services. One obstacle is specimen-rich samples that are routinely obtained with quantitative sampling techniques (e.g., Malaise trapping). Traditional “morpho-species” sorting of such samples has the disadvantage of requiring too much time, but it preserves valuable vouchers for follow-up taxonomic and ecological research. Modern processing of bulk samples with metabarcoding has the advantage of being efficient, but the link between voucher specimens and sequences is lost.

At the Center of Integrative Biodiversity Discovery at the Museum für Naturkunde Berlin, experts try to combine the best of both worlds with robotics, nanopore sequencing, and specimen identification using artificial intelligence. They developed a specimen-handling robot (“DiversityScanner”) that

detects, images, and measures individual specimens and moves them into the wells of a 96-well microplate for sequencing (“DNA barcoding”). DNA barcodes for each specimen are then obtained with robust and cost-effective barcoding techniques involving Nanopore sequencing. The generated images are used to train Convolutional Neural Networks (CNNs) that will eventually be able to identify and sort specimens without sequencing. The same images are also used to obtain biomass information by measuring specimen length and estimating body volume. Overall, this workflow generates barcode databases and vouchers that can be used for follow-up taxonomic and ecological research.

Robert Meier is Professor at the Humboldt University Berlin and Head of the Center for Integrative Biodiversity Discovery, the Leibniz Institute for Evolution and Biodiversity Science at the Museum für Naturkunde in Berlin.