

Bioinspire-Explore:

Browsing Biodiversity Data for Bioinspiration



Saint-Sardos, A.; Aish, A.; Tchakarov, N.; Bourgoïn, T.; Petit, L.-M.; Sun, J.-S.; Vignes-Lebbe, R. Bioinspire-Explore: Taxonomy-Driven Exploration of Biodiversity Data for Bioinspired Innovation. *Biomimetics* 2024, 9, 63. <https://doi.org/10.3390/biomimetics9020063>

OBJECTIVE

Via a taxon of interest (i.e. species, genus, family etc.), Bioinspire-Explore sought to connect bioinspiration practitioners to information about its taxonomic position, distribution, climatic niche and appearance (Fig A). Bioinspire-Explore also aimed to assess the semantic proximity of relevant terms within bioinspired scientific literature (Figs B and C).

METHODOLOGY

The development team connected Bioinspire-Explore to international databases, including the Global Biodiversity Information Facility (GBIF) (based on the Catalogue of Life (CoL) taxonomic backbone), WordClim, Wikidata and INaturalist. Potential relationships between taxa and biological functions, habitat conditions, and physical characteristics were identified using a Word2Vec model trained on tokenized sentences from a corpus of scientific papers on bioinspiration.

RESULTS

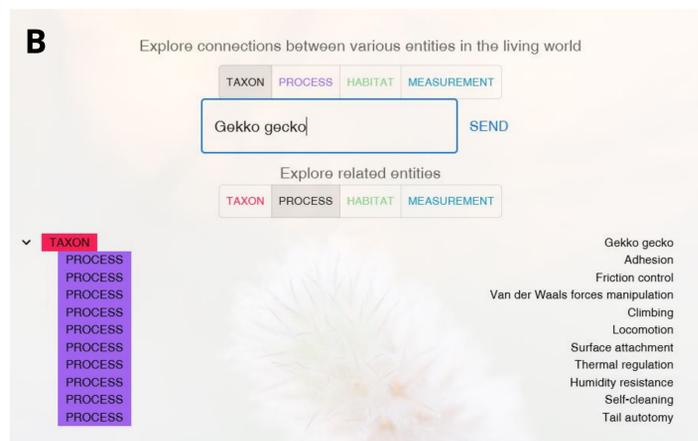
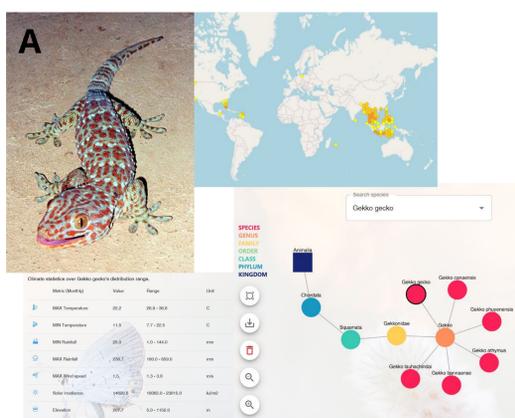
Bioinspire-Explore is a powerful, open-access tool for browsing biological data via user-friendly interfaces and comprehensive associated databases. Its unique value lies in its ability to combine, within a single system (i) taxonomic data; (ii) ecological information; and (iii) indications of the semantic proximity of terms cited in bioinspiration-related literature.

CASE STUDY

Searching for the species ***Gekko gekko*** provides information about its taxonomy, where it is found, what it looks like, and its climatic niche...

...as well as **potential relationships** with other taxa, associated biological processes, environmental conditions and physical measures...

...and **scientific articles** relevant to this taxon within a corpus of bioinspired literature.



C Evidence that gecko setae are coated with an ordered nanometre-thin lipid film

Mette H. Rasmussen, Katinka Rannow Holler, Joe E. Baio, Chernó Jaye, Daniel A. Fischer, Stanislav N. Gorb and Tobias Weidner

Published: 06 July 2022 <https://doi.org/10.1098/rsbl.2022.0093>

Abstract

The fascinating adhesion of gecko to virtually any material has been related to surface interactions of myriads of spatula at the tips of gecko feet. Surprisingly, the molecular details of the surface chemistry of gecko adhesion are still largely unknown. Lipids have been identified within gecko adhesive pads. However, the location of the lipids, the extent to which spatula are coated with lipids, and how the lipids are structured are still open questions. Lipids can modulate adhesion properties and surface hydrophobicity and may play an important role in adhesion. We have therefore studied the molecular structure of lipids at spatula surfaces using near-edge X-ray absorption fine structure imaging. We provide evidence that a nanometre-thin layer of lipids is present at the spatula surfaces of the tokay gecko (*Gekko gekko*) and that the lipids form ordered, densely packed layers. Such dense, thin lipid layers can effectively protect the spatula proteins from dehydration by forming a barrier against water evaporation. Lipids can also render surfaces hydrophobic and thereby support the gecko adhesive system by enhancement of hydrophobic-hydrophobic interactions with surfaces.

CONCLUSIONS

Bioinspiration's success requires straightforward access to biological data, in a form that non-biologists can understand. Bioinspire-Explore provides a unique way to explore biodiversity and visualise biological relationships. This innovative tool acts as a guide, orientating users towards promising information about living systems and presenting those systems in their scientific context. It is intended to create opportunities for education, insight and interaction within bioinspiration teams interested in a "biology-push" approach to innovation.

