Introducing **PBot,** The Integrative Paleobotany Portal

The community gateway to fossil plant research and education

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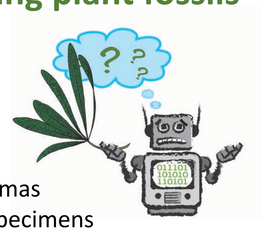
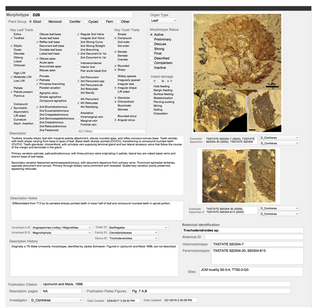
Introducing PBot

A free workbench for describing plant fossils

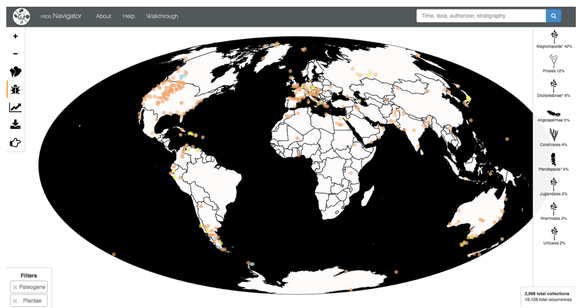


Create schemas
Describe specimens
Compare descriptions
Search & ID
Discuss & Resolve

Data management without extra work



Track plants through space and time via Paleobiology Database



Addressing Paleobotany's Dark Data

1. Fossil plants are severely underrepresented in existing databases
- <5% of occurrences in the Paleobiology Database & <7% of fossil specimens in iDigBio (vs. 45% of modern specimens) are plants
- Isolated plant organs are hard to map to a recognized Linnaean taxonomy.
- Informal taxonomies are incompatible with existing databases.

2. No easy way to recognize synonymies across research groups, geographic areas, geologic ages

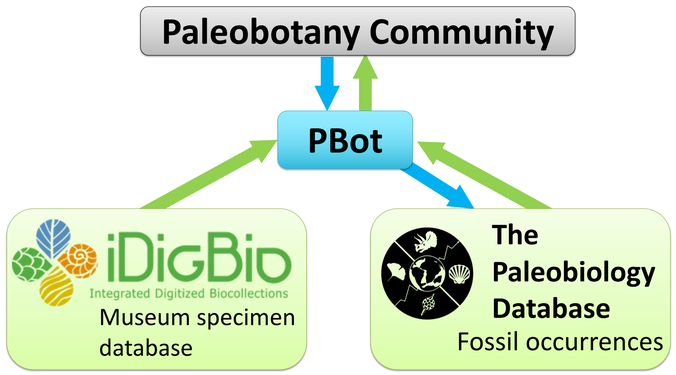
3. Only some plant organs/clades have community-standardized characters (schemas) for description

4. Lack of time/personnel for data entry in databases

How PBot Works

Leveraging Existing Databases

Paleobotanists will have a single point of entry to create schemas and describe and annotate specimens. Specimen data & images pulled from iDigBio, fed to PBDB.



A Research Workbench

- Free online software for specimen-based research
- Streamlined data input so there is no need to re-enter for publication or data management plans
- Search portal returns descriptions and images of previously described specimens

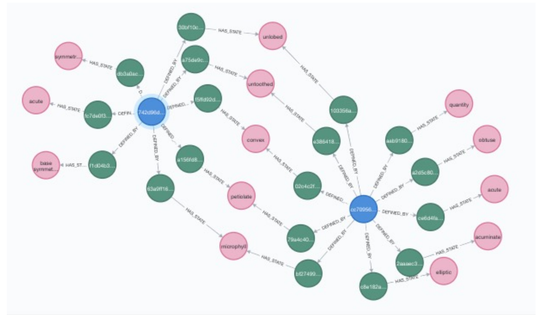
A Repository for Descriptions & Taxonomies

Schemas & Characters
- Multiple schemas (collection of characters) can be used to describe a specimen.
- Schemas include: categorical descriptors, quantitative traits (e.g., measurements), functional traits (e.g., vein density), or ecological (e.g., insect damage)
- Developed and entered by users so it will grow and evolve with user needs

Operational Taxonomic Units (OTUs)
- A distinct taxonomic identity with description and exemplar specimen(s)
- Includes formal (Linnaean) and informal (morphotypes) taxonomies
- Comparison of OTUs across time, space, and working groups by computer technology and users

Our neo4j Graph Database

Specimen descriptions (blue circles) consist of characters (green circles) and states (pink circles) from a schema. Each description is attached to a specific specimen record (metadata + photographs pulled from iDigBio). The graph structure allows for fast and powerful comparisons.



Community Engagement

Tools for Community-Wide Collaboration

1. Private workbenches can be shared with user-selected collaborators.

2. Once data are made public, any registered user can provide feedback. All comments will be tracked and searchable, available in discussion forums, and displayed on the relevant PBot schema/OTU page. Potential feedback includes suggestions to:
- Update schemas, characters, and character states
- Modify OTU descriptions
- Synonymize OTUs
- Assign Linnaean taxonomy
- Connect plant organs belonging to the same species

3. PBot will include a public space for community members to upload fossil plant education and outreach content.

Yearly Workshops for Paleobotanists

Our goal is to design a system that is "of the community, by the community, and for the community." To do this, we are holding free public workshops! Workshops include substantial time in breakout groups of ~5 people. Google Jamboards are used to focus discussions and capture all voices.

- PBot concept introduced at MPC in May 2020
  - ½-day virtual workshop, 75 participants
- Year 1 workshop, April 2021
  - Feedback on initial design & schema development kickoff
  - 2-day virtual workshop, ~100 participants
- Year 2 workshop, Winter 2022
  - Beta testing PBot
  - To be held virtually; stay tuned for invitations
- Year 3 workshop, Winter/Spring 2023
  - Hack-a-Thon to enter Cretaceous – Eocene paleobotanical data

Schema Working Groups

In our Year 2 workshop, we established working groups to create (or refine) schemas for:

- Ferns & Fern-like Foliage
- Conifer & Cycad Foliage
- Monocots & Monocot-like Foliage
- Dicot Leaves: Updates to the Manual of Leaf Architecture
- Cuticle
- Leaf & Shoot Anatomy
- Pollen & Spores
- Seeds & Fruits

New working group members are welcome! Email us if you are interested.