



## **v3.0 Quickstart Guide**

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**Last Updated:** March 2012

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With support from the National Science Foundation, Divisions of Environmental Biology and Geosciences, NESCENT and NOAA

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# Chapter 1. What is MorphoBank?

## A Short Description

MorphoBank ([www.morphobank.org](http://www.morphobank.org)) is a web application with tools and archives for evolutionary research, specifically systematics (the science of determining the evolutionary relationships among species). Study of the phenotype, which is often visually-based, is central to contemporary systematics and taxonomic research. MorphoBank was developed specifically to provide much needed tools for the expansion and modernization of phylogenetic work on the phenotype. MorphoBank provides four interrelated toolsets for researchers:

- one for management of uploaded images and affiliation of data with those images (labels, species names, etc.)
- another that allows researchers to manage uploaded morphological data and affiliations with phylogenetic matrices.
- supporting tools for managing the taxonomic names, characters and states, specimens and views used to classify images and populate phylogenetic matrices.
- administrative tools for managing access, publishing and backing up your data.

MorphoBank is project-centered, meaning teams of researchers can create project-specific workspaces and share images and other data with each other in a password-protected environment. Because MorphoBank is web-based, team members can easily and efficiently work together no matter where they are located. Furthermore, MorphoBank's web-centric foundations make it a natural tool for online publishing of project data once a paper associated with the project goes to press in a peer-reviewed scientific journal.

The phylogenetic matrix capabilities of MorphoBank are designed to aid systematists working alone or in teams to build large phylogenetic trees using morphology (anatomy, histology, neurology, or any aspect of the phenotype). In contemporary systematic methods in which morphology is used to build trees of species (or higher taxa), one starts by constructing a matrix made of characters and taxa. Characters are features of an organism that appear in different forms. Examples include "eyes: blue, green or brown" or wings: present or absent. To convert these to a form that fits in a matrix, one might translate these as, for example, "eyes: state 1 (blue), state 2 (green), state 3 (brown)." Traditionally this has been done with desktop programs such as MacClade or Mesquite, which encode this information in files adhering to a standard format such as NEXUS (arguably the most popular format in use today).

Desktop software cannot accommodate images associated with character states or matrix cells in a robust fashion, something that is becoming essential for researchers actively studying the phenotype and for later researchers trying to understand the anatomical basis of some comparisons that might have been made decades ago. MorphoBank allows researchers to upload and download their NEXUS files, and to collaboratively edit them in the MorphoBank online workspace. It also allows researchers to upload high-quality images affiliated with each cell in a matrix, to zoom in on these images for details, to collaboratively label the images and to affiliate various kinds of metadata with an image (e.g., species, specimen number, notes, etc.).

Data in MorphoBank have been deposited by professional scientists and the students supervised in their laboratories. Once a MorphoBank project is published on-line, however, these data are made accessible to the public.

## Advantages over desktop phylogenetics software

Previous generations of desktop systematics software - MacClade in the 1990's and Mesquite, NEXUS Data Editor, etc. in this decade - were a boon to the community, greatly enhancing researcher

productivity. However, in the last several years, with the explosive growth of the World Wide Web and the increasing sophistication of web-browser software, a new category of software has emerged, the "web-application." Web-applications leverage existing web-based data services (mapping, taxonomic lookups, and access to specimen and bibliographic databases, for example) and enhanced user interface techniques to produce software that combines many of the best features of desktop software with the ever increasing capabilities of the Internet.

MorphoBank was designed to address shortcomings in existing desktop systematics software using modern web-application techniques. Areas of concern included:

1. Seeing the images that document the basis for a character state is enormously helpful to researchers both during and after the research process. This is particularly important if the matrices are large, with hundreds of taxa and thousands of characters. Before MorphoBank there was little support for inclusion of imagery in phylogenetics software. A researcher would have had to trust her memory as she made comparisons among hundreds or thousands of species. It is much more effective to store an image of a character with labels to refer to repeatedly while adding new data.
2. A large quantity of documentary information - and the majority of visual documentation - was being lost when morphologists produced phylogenetic trees. No archive existed for morphologists to store the images that backed up their character designations. This was wasteful and incurred a lot of repeated work due to lost information. The field of morphological systematics could subsequently not grow as fast (in terms of numbers of characters) as molecular systematics, the latter being well-databased in GenBank.
3. Single-user file-based systems are wholly unsuitable for collaborative work, whether team members are dispersed across the hall or across the globe. For all but the smallest and most disciplined of teams, file version control and conflicts quickly becomes untenable, with copies of files proliferating in e-mail inboxes and on FTP sites with no one certain as to what the "real" dataset is. MorphoBank provides a central database for project data, ensuring that all team members are using the same dataset at all times. Changes made by one member are instantly visible to the rest of the team. Further, all changes are logged making it possible to determine how any element of a project's dataset arrived in its current state.
4. Many valuable phylogenetic datasets are available on the Internet only in truncated form (typically lacking images and other context) or not at all, in part because there is no simple mechanism with which to publish data from most desktop applications to the Web. Treebase has been a useful site for archiving matrices but is not a tool-based application for collaborating on and viewing phylogenetic matrices and does not store images. MorphoBank is inherently web-based, and publishing of project data is a matter of pushing a button.

## Why use MorphoBank?

Here is a hypothetical case: you are working on a morphological phylogenetic matrix with a team of investigators. Because MorphoBank is a web application, your team can work on exactly the same data *at the same time*. All collaborators can see contributions from members of the team, including images associated with homology statements, as soon as they are made. Since everyone is always using the most up-to-date data, e-mailing of files and reconciliation of file versions is completely unnecessary.

All project information is kept private to the team, protected by password, until the team chooses to make it public. In conjunction with a peer-reviewed scientific paper, you may need to allow reviewers to access your data. MorphoBank provides the ability to allow anonymous, password protected, reviewer access to your data.

When a paper is in press or published in a journal is often the time an investigator wishes to place online his morphological matrix (including labeled images of your homology statements), images, lists of specimens and taxa, etc. that you have assembled in a form that is easy for your readers to access. Morphological data collection increasingly requires visual documentation of homology, but journals cannot always publish all images that support the research in a project. MorphoBank provides tools to simplify the online publishing of data resources including:

- Publishing of project data via a simple online form
- Ability to hold back publication of project data on a per-item basis
- Automatic conversion of images to web-viewable formats
- Built-in advanced image viewing client supporting efficient "pan and zoom" viewing and annotation of high-resolution imagery
- Online viewing of matrix data using a full-featured web-matrix software interface
- Virtually unlimited number of images and matrices
- Support for persistent URLs for MorphoBank-hosted data resources

Note that you do not need to be working with a matrix to use MorphoBank. Many investigators have other scientific reasons to store media online in association with an upcoming publication, with associated information such as the repository and specimen number. MorphoBank welcomes these contributions.

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# Chapter 2. Basic Concepts

## The "Project" Workspace

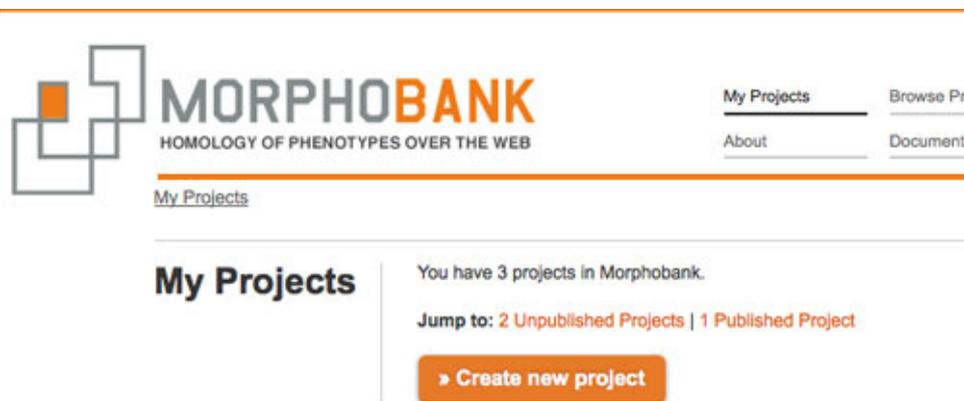
Workspaces on MorphoBank exist as separate "projects," completely independent from all others and accessible only to the creator of the workspace and those to whom the creator has explicitly granted access. As we shall see, a workspace contains all of your project data - taxa, characters and states, specimens, bibliographic references, media (typically images, but also video and sounds) and matrices. These data are completely private to the workspace and cannot be modified or, prior to publication, accessed by those outside of the project.

You are free to develop your dataset in any way you choose. While use of character ontologies, taxonomic authorities and specimen databases is in general good practice and highly encouraged, MorphoBank does not mandate their use. How you conduct your research in your workspace is entirely up to you.

## Creating a project

You can create as many projects as you need; in general you should create a project for each discrete research problem or paper you are working on. Remember that workspaces are completely independent from one another and do not interact in any way. There is no sharing of data between project workspaces, and each workspace is only accessible to those to whom you explicitly grant access. If you have multiple workspaces with identical member lists and/or need of shared data, then you should consider consolidating them into a single project workspace.

**Figure 2.1. Selecting the new project option from the project list**



To create a new project, login to MorphoBank and navigate to the My Projects section. You will see an orange "Create New Project" button at the top of the page. This will display a New Project form, which includes fields for project title and abstract, publication information and settings for allowing anonymous reviewer access to your data. To start you need only to specify a title, although an abstract is strongly suggested. You may edit this information at any time, many users provide provisional information at the start.

## Types of Data You Can Deposit

Once your project workspace is established you and your collaborators can deposit various types of data, to share amongst project members, to edit collaboratively or for use in phylogenetic matrices. MorphoBank can accept the following kinds of data:

## Taxonomic names

Your project workspace has a single "directory" of taxonomic names with which you can identify specimens (and by extension media) or populate a matrix. You may load your taxa by hand, one at a time, using the taxon entry forms or in a batch process using a tab-delimited file from a database, Microsoft Excel or a similar application. For more information on adding taxa see ???.

Each distinct taxon is represented once, and only once, in your taxonomic directory. When you use a taxon to identify specimens and in matrices, you are doing more than just tagging those items with a taxonomic name. Rather, you are actually linking your specimens and matrices to a taxonomic *concept*. If you subsequently change the taxon, your changes will automatically propagate to all of the specimens and matrices that reference the taxon.

## Specimens

As with taxa, your workspace has a directory of specimens that are referenced in your project. Specimens can (and should) be associated with a taxonomic identification. They may also be depicted using uploaded media.

There are two types of specimens: vouchered and unvouchered.

For vouchered specimens – specimens from a formal collection – you must at a minimum provide an institution code and catalog number for each specimen. Both of these values should conform to the standards of the institution from which the specimen originates. If you are not sure of the formats for these values, contact the institution's collections manager. Typically, the institution code will be a 2-4 letter abbreviation of the institutional name (e.g., AMNH = American Museum of Natural History, YPM = Yale Peabody Museum). Whenever possible a collection code should be provided. As with the institutional code and catalog number, this should conform to institutional standards. Many, but not all, institutions use collection codes.

Unvouchered specimens are those obtained from sources other than formal collections, including literature and the Internet. You are encouraged to provide detailed notes about the origins of the specimen in the "notes" field. You can also attach a formal bibliographic citation to a specimen.

A taxonomic identification of the specimen should be provided for all specimens. The identification is used by MorphoBank's matrix editor to retrieve relevant media, and by the search/filtering system to organize your media. Unidentified specimens will be much less useful than identified ones.

Figure 2.2. A vouchered specimen

**Specimens**

Editing: AMNH

[Back to list >](#) [Add new specimen >](#) [Bibliography Citations >](#)

[> Save](#) [> Delete](#)

Specimen reference source    
 Vouchered

Taxonomic name   
 †Achaenodon uintens

Institution code for specimens repository   
 AMNH

Collection code for specimens repository   
 VertPaleo

Repository catalog number    
 1823

Notes

Created on   
 December 31 1969 at 19:00

Last modified on   
 December 31 1969 at 19:00

This item is owned by: Maureen O'Leary, [maureen.oleary@stonybrook.edu](mailto:maureen.oleary@stonybrook.edu)

Access    
 Anyone may edit this specimen

[> Save](#) [> Delete](#)

*(Left sidebar menu items: Project Overview, Matrices, Media, Views for Media, Folios, Specimens, Taxa, Bibliography, Documents, Search results)*

Figure 2.3. An unvouchered specimen

**Specimens**

Editing: AMNH

[Back to list >](#) [Add new specimen >](#) [Bibliography Citations >](#)

[> Save](#) [> Delete](#)

Specimen reference source    
 Unvouchered

Taxonomic name   
 †Achaenodon uintens

Notes

Created on   
 December 31 1969 at 19:00

Last modified on   
 December 31 1969 at 19:00

This item is owned by: Maureen O'Leary, [maureen.oleary@stonybrook.edu](mailto:maureen.oleary@stonybrook.edu)

Access    
 Anyone may edit this specimen

[> Save](#) [> Delete](#)

*(Left sidebar menu items: Project Overview, Matrices, Media, Views for Media, Folios, Specimens, Taxa, Bibliography, Documents, Search results)*

## Media

You can upload any number of media documenting specimens to MorphoBank. Most uploaded media are images, although video and audio formats are also supported. (Thus our use of the more neutral "media" terminology).

You will typically upload an image and tag it with a specimen identification, any pertinent copyright information and a view description (eg. "dorsal", "lateral", "palatal").

MorphoBank accepts a variety of image formats including JPEG, GIF, PNG, TIFF and Photoshop. Note that Photoshop files that use layer effects may not render properly on MorphoBank. For consistent results we recommend converting these files to TIFF format before uploading. All image files should be in RGB mode. Files in CMYK mode may not render properly.

You should upload image files at the highest resolution that makes sense for your project. MorphoBank will automatically create sized versions for use on the site as well as a full-resolution version optimized for online viewing. The original uploaded file will be retained and can be made available for download.

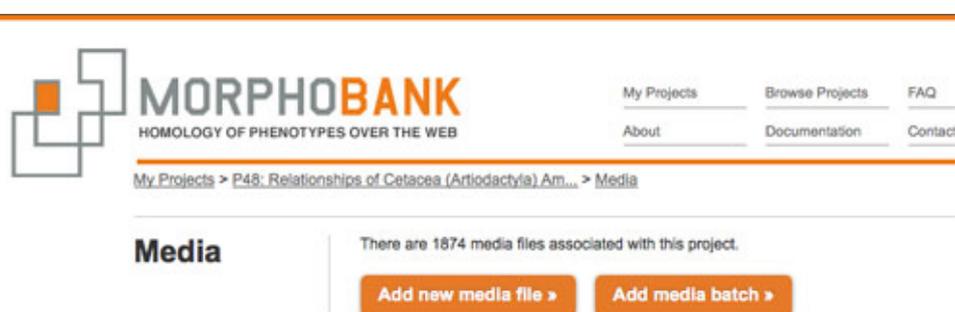
MorphoBank also accepts the following video file formats: MPEG-4, QuickTime and WindowsMedia. The preferred video file format for upload to MorphoBank is MPEG-4. Files in QuickTime and WindowsMedia format will usually work so long as the compression method used is supported by MorphoBank's video processor. In general, videos compressed with WindowsMedia will work, as will most QuickTime compression methods (some very old and rarely used methods like GIF compression are the notable exceptions). AVI files usually will not work and should be converted to MPEG-4 prior to upload. In general if your uploaded file is being rejected by MorphoBank it is recommended that you try re-encoding the file in MPEG-4 format using one of the many video conversion tools available for Mac OS X, Windows and Linux.

Audio files may be uploaded to MorphoBank in MP3, AAC, AIFF or WAV format. Other formats are not supported. If you need to convert or edit your audio files use a sound editing application such as Audacity (<http://audacity.sourceforge.net/>).

MorphoBank does not support the PowerPoint file format. If you need to upload images from a PowerPoint presentation, you should export them from PowerPoint in a supported format such as JPEG and then upload those files.

Media may be uploaded one file at a time using the "Add new media file" button. For large numbers of files, the Batch Media Upload tool may be more efficient. It is accessed with the "Add media batch" button and allows you to enter all the information on the standard media form for a group of media files that are uploaded as an archive in either Zip or Tar format. For more information about using the Batch Media Upload Tool, including how to prepare your archive for upload, see ???.

**Figure 2.4. Add Media Buttons**



## Matrices

Project members may create, edit and publish phylogenetic matrices using MorphoBank's matrix viewer/editor application. A matrix's axes are composed of characters (see the section called

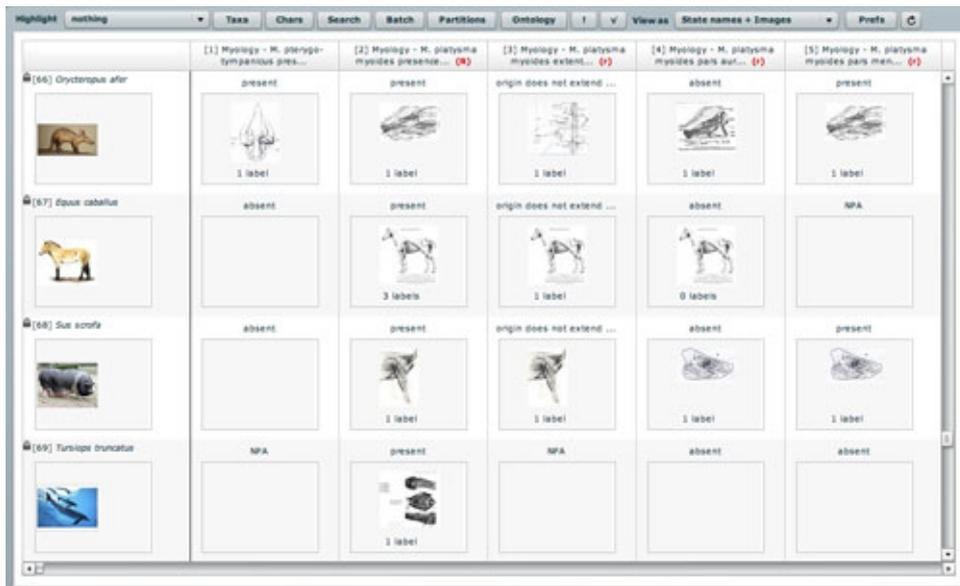
“Characters”) and taxa (see the section called “Taxonomic names”). The cells of the matrix contain character states and, optionally, media (see the section called “Media”) with (also optionally) labels. Labels applied in a matrix cell are specific to that cell and automatically include text describing the cell's character and taxon. Cells may also have attached bibliographic references, member comments and research notes.

You can start a matrix from scratch and populate it solely using the MorphoBank matrix editor or you can use an existing NEXUS format file as a starting point. Regardless of how you begin, you can import the contents of additional NEXUS format matrix files (produced by applications like MacClade or Mesquite) into your MorphoBank matrix at any time. All taxa and characters that do not already exist in your project will be automatically created when the file is imported, and states for existing taxa/character pairs merged with the existing data.

In projects with multiple matrices taxa, characters and media are shared across all matrices in your project. A change made to a taxon, character or media item in one matrix, or in the item-specific editing screens, will instantly be reflected in all matrices where the item is used.

It is possible to download your matrix from MorphoBank as a NEXUS or TNT file at any time. The file will include all characters, taxa, cells and notes, but not images since they are not formally supported in the NEXUS or TNT format. Images can, however, be downloaded as a zipped folder to the desktop by clicking on the "Download Project" link on the [Project Overview](#) page. The archive will contain SDD XML format data files with associated matrix, character, taxon and specimen data. Note, however, that these images will not be viewable associated with cells in desktop programs reading the NEXUS or TNT file.

**Figure 2.5. Matrix editor/viewer**



## Characters

As with taxa, your project has a single directory of characters and their associated states. Each distinct character is represented once, and only once, in your project's character list. When you use a character in a matrix, you are doing more than just bringing in the character's name. Rather, you are actually linking a characteristic *concept* to your matrix. Consequently, if the character is changed in one place, the change will propagate to all other places where the character is used.

Unlike taxa and other deposited data, characters cannot exist independently of matrices. That is, to exist in your project at least one matrix must reference the character. Put another way, if you delete a matrix all characters referenced only by that matrix will be removed as well.

A character may have as many states as required. Each state has an associated name and number, as well as any number of exemplar images. Images may also be associated with the character independent of a specific state. Characters may also have bibliographic citations and member comments attached.

## Other data

Any number of documents can be added to a project. Documents may be in any format, and can document aspects of the project or provide data in formats that are not directly supported by MorphoBank. Each document may include an optional title and description, and may be published along with other data (media, matrices, etc.) or kept private to the project.

When a project is published, all documents with a "publish when project is published" status will be listed and made available for download on the project's MorphoBank project page, accessible from the project browser and through the site search.

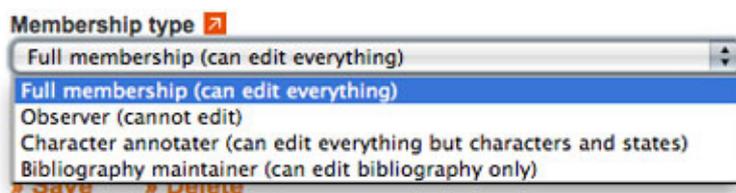
## Tools for Collaboration

MorphoBank provides many advantages over traditional desktop software for collaborative workgroups. As a web-based system, it is available to anyone with internet access and reasonably modern web browser software, including Internet Explorer versions 8 and 9, FireFox versions 5.0 or better and Safari 5.0 or better. There is no need for specialized software; virtually every modern operating system is supported (Windows, Mac OS X and Linux/Unix). Furthermore, because all project data are centrally stored in the MorphoBank database, collaborators are always using the most up-to-date data. This is in marked contrast to collaborative projects using traditional desktop software where versioning issues often quickly become frustrating and time-consuming. Upgrades and bug-fixes to the MorphoBank software are done on a central server ensuring that all users are always benefiting from the most up-to-date version of the software.

## Membership

Up until the project is published, a project's creator (who is also known as its "project administrator") may grant collaborators access. Any number of collaborators can be invited and they need not already be registered MorphoBank members to receive an invitation.

**Figure 2.6. Membership type menu**



There are four types of project membership:

- *Full members* may add, edit and delete project data, subject to access restrictions on individual data items discussed below.
- *Observers* may view all project data but are not allowed to add or change data in any way.
- *Character annotators* may add, edit and delete all project data *except characters and character states*, subject to access restrictions discussed below.
- *Bibliography maintainers* may only edit bibliographic entries. They can also view project data.

## Reviewer Access

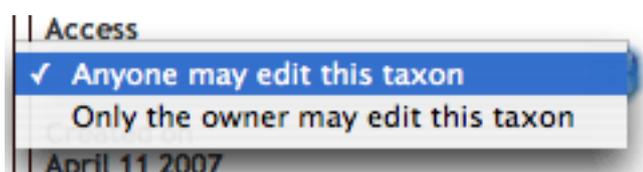
Project Administrators can enable an anonymous, read only reviewer login for their project in the Project Info form accessed through the "Edit project info" link on the Project Overview page. Once

enabled, reviewers can login by entering the project number in the email address field and the reviewer login password entered by the Project Administrator in the Project Info form. Don't forget – you have to tell editors and reviewers your project number and reviewer password when you invite them to review your project.

## Managing access to data

MorphoBank adopts a streamlined approach to data access within a project. All primary data items (taxa, characters, specimens, media and matrices) are "owned" by the member who created them. The owner has the option of reserving editing access for themselves or allowing all full project members to edit. (Editing access includes the ability to delete an item.) By default all newly created items are editable by all; restricted access must be explicitly set by the creator.

**Figure 2.7. Access control menu**



## Tracking changes to your data

Changes to all data items and their constituents (taxa, characters and states, specimens, media and matrices including cells, taxa and characters and states) are logged by MorphoBank. Detailed change histories for any item, including the nature of the change, the time and date and who executed the change, may be accessed by project members.

## Publishing

Newly created project workspaces are unpublished. Their contents are available only to members of the project, and to anonymous reviewers if anonymous reviewer access is enabled. When your research is completed you can publish your project, which will have the following effects:

1. Data will be publicly accessible via the MorphoBank search engine and project browser.
2. Data will be accessible using MorphoBank PermaLinks (see the section called “ Linking to a published project using permalinks ”). Permalinks are unchanging, easy-to-cite URLs that will always lead to your project data. They are a convenient way to cite data hosted on MorphoBank in a published paper.
3. Your project is **effectively frozen**, just as with a traditionally published scientific paper. Data can no longer be modified and members no longer added. However, building on your data simply requires the creation of a new project.

**The last item is particularly important.** As with a paper or book, a project shouldn't be published until you are sure all elements are as you and your collaborators wish them to be.

## Copyright considerations

MorphoBank does not own or assert any copyright on project data. Once a project is published, it becomes publicly accessible and the copyright status of the constituent data becomes a concern. In general, before uploading an image (or other data) to your project, make sure that one of the following applies:

1. You own the rights to the image (usually meaning that you created the image yourself).
2. You can prove that the copyright holder has licensed the image under a free license.

3. You can prove that the image is in the public domain.
4. You believe, and state, a fair use rationale for the specific use of the image that you intend.
5. You have obtained the required clearances from the copyright holder that specifically allow you to use the image on MorphoBank.

When cataloging media you will have the opportunity enter information about the copyright status of the media file you are uploading. You will first be asked to indicate if the media is under copyright by checking the "Is under copyright?" checkbox. Leave this box blank if the owner of the media you are loading wants to release those media to the public domain (a CC0 designation). Checking the checkbox will add additional elements to the form to allow you to apply a different copyright license, indicate who the copyright owner is and that they have granted you permission to use the media in MorphoBank.

## Selectively publishing project content

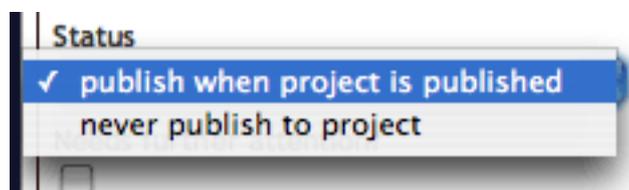
By default, when a project is published all data in it are made publicly accessible. It is possible, however, to keep specific media, matrices, folios and documents in a published project un-published. To hold back an item you must change the item's status from `publish` when project is published to `never publish to project` *prior to publishing the project*. The item status drop down, shown below is present in the primary editing forms for media, matrices, folios and documents.



### Warning

Once a project is published you cannot change the status of any items in that project.

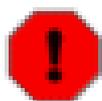
Figure 2.8. Item-level publishing status menu



## Linking to a published project using `permaLinks`

Each MorphoBank project is issued a unique identifier beginning with the letter 'P' for project. This identifier is displayed in many places through the site, for example it is next to your project title in the `My Projects` list and in the breadcrumb trail at the top of the page when editing a project. Once your project is published you may link to your project with a URL in the format `http://morphobank.org/permalink/?P00` where 'P00' is replaced with your project identifier. This URL will always lead to your data and is a reliable way to cite MorphoBank-hosted datasets in published papers.

An alternative linking scheme based upon the Life Sciences Identifier (LSID) standard is in the works and will be available in an upcoming software revision.



### Warning

For unpublished projects, the only way to access data is by logging into MorphoBank.

## Other ways to access published data

In addition to `permaLinks`, published data is accessible:

- as lists of published matrices, media, views for media, folios, specimens, taxa, bibliographic citations and documents linked to from a project summary displayed in the Browse Projects section of MorphoBank . All published projects on MorphoBank are displayed in the Browse Projects section. The lists of project data are similar to those found in the MorphoBank editing interface, but without editing capabilities.
- in the MorphoBank search engine. Your media and matrices will be included in the results of searches on the MorphoBank.org site.

**Figure 2.9. Browse Projects list**

**Projects**

There are 121 publicly accessible projects as of March 21, 2012 in MorphoBank. Publicly available projects contain 5,636 images and 69 matrices. MorphoBank also has an additional 398 projects that are in progress. These contain an additional 63,313 images and 387 matrices. These will become available as scientists complete their research and release these data. 670 scientists and students have joined MorphoBank.

**Project 668:** Blanucol, G. and P. D. Gingerich, 2011  
*Aegyptocetus tarta*, n. gen. et sp. (Mammalia, Cetacea), from the Middle Eocene of Egypt: Clinorhynch, Olfaction, and Hearing in a Protocetid Whale  
 > view project

**Project 682:** Williamson, T. E., S. L. Brusatte, T. D. Carr, A. Weil, and B. R. Standhardt, 2012  
 The phylogeny and evolution of Cretaceous-Paleogene metatherians: New cladistic analysis and description of new  
 > view project

**Project 675:** Zack, S. P., T. A. Penkrot, J. I. Bloch, and K. D. Rose, 2005  
 Affinities of 'hypsodontids' to elephant shrews and a Holarctic origin of Afrotheria  
 > view project

## Project summary information

It is important that as much information as possible about a project is provided *before* it is published. In addition to project preferences and review login information, the `project information` form contains fields for the following information that is used to display a summary of your project in the `Browse Projects` section of the site and on the `Project Overview` page:

- *Title*. The title of your project, not necessarily the same as your article's title.
- *Abstract*. The abstract for your project. This is often, but not necessarily, the same as that of your published article.
- *Exemplar Media*. The media file you would like to feature in your project summary.
- *Journal title*. If the project data serves as the basis of a published article, this and the following fields should be filled in with citation information.
- *Journal url*. Address of your published article online.
- *Journal volume*. The journal volume in which your article appears.
- *Journal number*. The journal number in which your article appears.
- *Journal year*. The year of the journal in which your article appears.

- *Journal cover image.* You may upload a scan of the cover of the journal in which your article appears. This will make your project summary a little more colorful, and is highly encouraged but not mandatory.
- *Article authors.* The list of article authors as it should appear in a citation.
- *Article title.* The article title as it should appear in a citation.
- *Article pagination.* The article pagination as it should appear in a citation.

Many of these fields are used on the project summary page when the project is published. If you fail to fill in these fields your summary page will be incomplete and will improperly cite your article. Be sure to fill out all fields fully and accurately.



### **Warning**

You must specify at least a working title for your project. An abstract is strongly recommended for all projects at all times and must be provided before the project is published.

## **Folios**

Folios are a useful mechanism for publishing annotated groupings of selected project media. Using the folios tab, you can create as many named folios as needed. You can then select specific media to add to your folios by clicking the "Edit folio media" link in your list of folios or by using the "Folio options" tool on the Media page. This tool allows you to add multiple media to a folio directly from media search results. Once you have added items to your folio you can return to the folios tab to change the order of the media and preview the resulting folio. Folios are published when the project is published, unless you set your folio's access dropdown to "never publish to project" and may be linked to using a permalink URL in the format: <http://morphobank.org/permalink/?F00> where 'F00' is your folio identifier. Folio identifiers always begin with the letter 'F' and appear next to the folio name in the project folios tab. Your project must be published for folios to be accessible to the public.

An example of a folio in use: you want to reference a sequence of images in a paper but there is not enough space, so you opt to publish the images online and print the URL in the paper. If those images are in your published MorphoBank project you can create a new folio (complete with title and introductory text), add the relevant images and place them in the proper order. When readers go to the URL printed in the paper they will see your introductory text and be able to click through to each image in the proper order.

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# Chapter 3. Common Types of Projects

MorphoBank provides a generally useful set of tools to assist you with your research. While no particular workflow is mandated, many MorphoBank projects tend to fall into one of the three categories, described in the following sections. Your work need not conform to these examples, but they should give you an idea of the types of project for which MorphoBank can be useful.

## Phylogenetic Projects with Matrices

MorphoBank's most important innovation is the support of collaborative editing of phylogenetic matrices and associated data (taxa, characters and states, cells with or without images, bibliographic citations), thus it includes a full-featured browser-based matrix viewing and editing application. This, combined with its ability to integrate annotated media with matrix cells, characters and character states make MorphoBank a natural fit for projects developing matrices.

MorphoBank is able to import and consolidate existing matrices contained in NEXUS files. This means you can take existing datasets created in MacClade, Mesquite, NEXUS Data Editor, or any other NEXUS-capable application and bring them into MorphoBank for collaborative editing, addition of media and, ultimately, online publishing.

MorphoBank can also output matrices in NEXUS, allowing MorphoBank to be integrated into an analytical workflow that includes NEXUS consuming programs such as PAUP.

## Image-only Projects

While its matrix tools are a major asset, you don't need to be developing matrices to use MorphoBank. MorphoBank also provides a robust set of tools to view, annotate and classify (taxonomically and otherwise) large sets of images.

A `Batch Media Upload` tool allows you to upload large numbers of images for streamlined tagging with metadata. Many file formats are supported, including most popular image and video formats, and all files are automatically converted into web-viewable formats and sized appropriately. A media browser allows you to filter by taxonomic name and/or view, or to search for specific items. And MorphoBank's built-in pan-and-zoom viewer allows users to view high-resolution images online efficiently by preserving the full resolution of the uploaded file and only downloading the portions of an image that are actually visible on screen.

Its media handling features, its support for collaborative workgroups and web-based nature make MorphoBank an ideal platform for:

- sharing images with your colleagues in a password-protected environment
- developing an image-based dataset with colleagues
- publishing media online in support of a manuscript

## Collaborations Fusing Large Lists of Characters and Taxa from Many Matrices

For projects merging many source matrices into one large matrix where there may be a subsequent need to evaluate, merge or edit extensive lists of characters and taxa by consensus, MorphoBank's taxonomic and character directories can provide useful services.

In a typical super-matrix project, a group of experts convene to survey existing literature for characters and, perhaps, taxa to be included in a single "super-matrix" covering all significant aspects of area of

taxonomy. MorphoBank's central character list provides a tool for managing large lists of characters, annotating them with notes, reordering them arbitrarily, and attaching exemplar images to characters and specific character states.

It is particularly critical in projects of this type that all participants have access to the most up to date data at all times. MorphoBank's centralized database and web-based access ensures that this is always the case.

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# Chapter 4. Navigation

One navigates among the various tools and options in MorphoBank using the main navigation bar at the top of the screen and the left, sub-navigation menu available on some site sections. The main navigation bar is composed of links which lead to a specific section of the site or tool.

The top-level set of links, as shown in the figure below, is the most general and provides access to the following features:

- Home: a link to the home page of MorphoBank.org. This link is only available when you are *not* logged in to MorphoBank.
- My Projects: once you have logged in to MorphoBank, the Home link is replaced with the My Projects link. The My Projects section of the site is where you will find a list of your current projects, have the ability to make new projects and get access to all project-specific setup and editing tools. This is where you will spend most of your time when using MorphoBank. This link is only available when you *are* logged in to MorphoBank.
- Browse Projects: a list of project summaries for all published MorphoBank projects.
- FAQ: A list of frequently asked questions and answers.
- About: general information about the MorphoBank project.
- Documentation: contains tutorials and guides, including this document.
- Contact Support: contains a form for contacting MorphoBank system administrators. You can use this form to submit questions, bug reports and requests for new features.
- Search: a search form you can use to search published projects, and when logged in, data in projects for which you are a member, no matter their status.
- Log In: a form allowing existing members to log in to their account. This link is only available when you are *not* logged in to MorphoBank.
- Register: a form allowing new members to register for access to MorphoBank. This link is only available when you are *not* logged in to MorphoBank.
- Logout: a link to logout of MorphoBank. This link is only available when you *are* logged in to MorphoBank. It is displayed in place of the Log In link.
- Profile: a form allowing members to update the information they provided during the registration process and change their account password or email address. This link is only available when you *are* logged in to MorphoBank. It is displayed in place of the Register link.

**Figure 4.1. MorphoBank main navigation bar when not logged in**



**Figure 4.2. MorphoBank main navigation bar when logged in**

When editing a project in the My Projects section of the site or exploring a published project in the Browse Projects section, there will be additional sub-navigation options on the left-hand side of the screen resembling the menu shown in the figure below:

**Figure 4.3. Typical side navigation bar**

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## Chapter 5. How to Get Access

There are two ways to join Morphobank: through invitation or registration. To register fill out the form at <http://www.morphobank.org/index.php/LoginReg/form/showRegister/1>. Don't forget to include a brief and accurate description of your project. After review of your registration, a MorphoBank administrator will contact you with access information. Invitations to join MorphoBank can also be given out by current members who are the project administrators of a particular project and who wish to invite collaborators. To add a member to your project, click the Manage Members link at the right side of the Project Overview page. YOU will then see an Add New Member button that allows you to link existing MorphoBank users to your project or invite new member to join your project on MorphoBank. Once a new person has joined by either means, he or she is free to create his own new, separate projects.

We welcome and encourage students to join and use MorphoBank in their studies. It is the policy of MorphoBank, however, to request that the student's advisor be made a member of any student project.

### Resetting the Password for an Existing Account

If you already have an account but have forgotten your password, click on the "Forgot your Password?" link on the login page. You will be presented with a page explaining how to reset your password. Simply enter your e-mail address on that page, click the "go" button and a message will be sent with a link to another page where you may enter a new password for your account.

If you are still having trouble after resetting your password, or you fail to receive the reset password e-mail, contact us via the Contact Support form linked to in the main navigation.

Note that once logged in you will remain logged in for up to 72 hours, unless you explicitly log out.

### Duration of login

Note that once logged in you will remain logged in - even if you close or quit your browser - for up to 72 hours, unless you explicitly log out.

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## Chapter 6. Funding for MorphoBank

MorphoBank was built with funding to Maureen A. O'Leary from 2001 to the present. The work performed was prepared by the MorphoBank project, in part, under an award from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. This funding came from:

- National Science Foundation, Division of Environmental Biology
- National Science Foundation, Division of Geosciences
- Stony Brook University, School of Medicine, Medical Informatics
- National Oceanographic and Atmospheric Administration, U.S. Department of Commerce
- NESCENT

The statements, finding, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Department of Commerce.

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# Chapter 7. Citing MorphoBank in your publications

We would appreciate it if you would include the following citation in publications where you have used this software:

O'Leary, M. A., and S. G. Kaufman. 2012. MorphoBank 3.0: Web application for morphological phylogenetics and taxonomy. <http://www.morphobank.org>.