MouseDB Documentation

Release 1.1.1

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Contents:

MouseDB Concepts

Data storage for MouseDB is separated into packages which contain information about animals, and information collected about animals. There is also a separate module for timed matings of animals. This document will describe the basics of how data is stored in each of these modules.

1.1 Animal Module

Animals are tracked as individual entities, and given associations to breeding cages to follow ancestry, and strains. Animals are the main objects in the database, and most other data is linked to and can be accessed from animals.

1.1.1 Animal

Most parameters about an animal are set within the `Animal` object. Here is where the animals strain, breeding, parentage and many other parameters are included. Animals have foreignkey relationships with both `Strain` and `Breeding`, so an animal may only belong to one of each of those. As an example, a mouse cannot come from more than one Breeding set, and cannot belong to more than one strain.

Backcrosses and Generations

For this software, optional tracking of backcrosses and generations is available and is stored as an attribute of an animal. When an inbred cross is made against a pure background, the backcross increases by 1. When a heterozygote cross is made, the generation increases by one. As an example, for every time a mouse in a C57/BL6 background is crossed against a wildtype C57/B6 mouse, the backcross (but not the generation) increases by one. For every time a mutant strain is crosses against itself (either vs a heterozygote or homozygote of that strain), the generation will increase by one. Backcrosses should typically be performed against a separate colony of purebred mouse, rather than against wild-type alleles of the mutant strain.

1.1.2 Breeding Cages

A breeding cage is defined as a set of one or more male and one or more female mice. Because of this, it is not always clear who the precise parentage of an animal is. If the parentage is known, then the Mother and Father fields can be set for a particular animal. In the case of Active, if an End field is specified, then the Active field is set to False. In the case of Cage, if a Cage is provided, and animals are specified under Male or Females for a Breeding object, then the Cage field for those animals is set to that of the breeding cage. The same is true for both Rack and Rack Position.

1.1.3 Strains

A strain is a set of mice with a similar genetics. Importantly strains are separated from Backgrounds. For example, one might have mice with the genotype ob/ob but these mice may be in either a C57-Black6 or a mixed background. This difference is set at the individual animal level. The result of this is that a query for a particular strain may then need to be filtered to a specific background.

1.2 Data Module

Data (or measurements) can be stored for any type of measurement. Conceptually, several pieces of data belong to an experiment (for example several mice are measured at some time) and several experiments belong to a study. Measurements can be stored independent of experiments and experiments can be performed outside of the context of a study. It is however, perfered that measurements are stored within an experiment and experiments are stored within studies as this will greatly facilitate the organization of the data.

1.2.1 Studies

In general studies are a collection of experiments. These can be grouped together on the basis of animals and/or treatment groups. A study must have at least one treatment group, which defines the animals and their conditions.

1.2.2 Experiments

An experiment is a collection of measurements for a given set of animals. In general, an experiment is defined as a number of measurements take in a given day.

1.2.3 Measurements

A measurement is an animal, an assay and a measurement value. It can be associated with an experiment, or can stand alone as an individual value. Measurements can be viewed in the context of a study, an experiment, a treatment group or an animal by going to the appropriate page.

1.3 Timed Matings Module

Timed matings are a specific type of breeding set. Generally, for these experiments a mating cage is set up and pregnancy is defined by a plug event. Based on this information, the age of an embryo can be estimated. When a breeding cage is defined, one option is to set this cage as a timed mating cage (ie Timed_Mating=True). If this is the case, then a plug event can be registered and recorded for this mating set. If the mother gives birth then this cage is implicitly set as a normal breeding cage.

1.4 Groups Module

This app defines generic Group and License information for a particular installation of MouseDB. Because every page on this site identifies both the Group and data restrictions, at a minimum, group information must be provided upon installation (see installation instructions).

MouseDB Installation

2.1 Configuration

MouseDB requires both a database and a webserver to be set up. Ideally, the database should be hosted separately from the webserver and MouseDB installation, but this is not necessary, as both can be used from the same server. If you are using a remote server for the database, it is best to set up a user for this database that can only be accessed from the webserver. If you want to set up several installations (ie for different users or different laboratories), you need separate databases and MouseDB installations for each. You will also need to set up the webserver with different addresses for each installation.

2.2 Software Dependencies

1. **Python**. Requires Version 2.6, is not yet compatible with Python 3.0. Download from http://www.python.org/download/.

2. **pip**. The python package manager, this will assist in the installation of dependencies. See http://stackoverflow.com/questions/4750806/how-to-install-pip-on-windows#answer-4921215 for installation instructions.

3. **MouseDB source code**. Download from one of the following and place in a folder on your computer. Downloading and/or unzipping will create a directory named mousedb. You can update to the newest revision at any time either using git or downloading and re-installing the newer version and copying over the existing version. Changing or updating software versions will not alter any saved data, but you should back up your database prior to this just in case:

1. If you plan on developing the software, Make your own fork of https://github.com/davebridges/mousedb and clone via git.

2. If you do not plan on developing the software, but want to be able to upgrate it via git, clone it from git://github.com/davebridges/mousedb.git

3. If you do not plan on developing the software, and only want a specific version download and unzip the source code from https://github.com/davebridges/mousedb/archive/master.zip or a particular version from https://github.com/davebridges/mousedb/tags. Unzip/extract the package into your destination folder

4. **Other Python Packages**. Several other python packages are also required. These are listed in the requirements.txt file. To install these, open a command line and move into the mousedb directory. You may need administrative priviledges to install these. Do get the required python packages enter:

```
pip install -r requirements.txt
```

5. **Database software**. Recommended to use mysql, available at http://dev.mysql.com/downloads/mysql/ . It is also possible to use SQLite, PostgreSQL, MySQL, or Oracle. See https://docs.djangoproject.com/en/1.4/topics/install/#get-your-database-running for more information.

6. **Webserver**. Apache is recommended, available at http://www.apache.org/dyn/closer.cgi . It is also possible to use FastCGI, SCGI, or AJP. See https://docs.djangoproject.com/en/1.4/topics/install/#install-apache-and-mod-wsgi for more details. The recommended way to use Apache is to download and enable mod_wsgi. See http://code.google.com/p/modwsgi/ for more details.

2.3 Database Setup

1. Create a new database. Check the documentation for your database software for the appropriate syntax for this step. You need to record the user, password, host and database name. If you are using SQLite this step is not required.

2. Go to localsettings_empty.py and edit the settings:

- ENGINE: Choose one of 'django.db.backends.postgresql_psycopg2','django.db.backends.postgresql', 'django.db.backends.mysql', 'django.db.backends.sqlite3', 'django.db.backends.oracle' depending on the database software used.

- NAME: database name

- USER: database user

- PASSWORD: database password

- HOST: database host

3. Save this file as **localsettings.py** in the same folder as localsettings_empty.py

2.4 Web Server Setup

You need to set up a server to serve both the django installation and saved files. The preferred setup is to use Apache2 with mod_wsgi to serve the project files and a separate webserver to serve media and static files. Static files are website files such as javascript, images and css files. Media files are user-specific files such as images. As of this version there are no media files in this project. These can both be served from a separate webserver but below is an example where Apache is used for both. The default is to serve static files from **mousedb/static** to the url **/mousedb-static**. These locations can be altered in the localsettings.py file using STATIC_ROOT and STATIC_URL respectively. The following is a httpd.conf example where the code is placed in **/usr/src/mousedb**:

```
Alias /robots.txt /usr/src/mousedb/mousedb/static/robots.txt
Alias /favicon.ico /usr/src/mousedb/mousedb/static/favicon.ico

Alias /mousedb-media/ /usr/src/mousedb/mousedb/media/
<Directory /usr/src/mousedb/mousedb/media>
    Order deny,allow
    Allow from all
</Directory>

Alias /mousedb-static/ /usr/src/mousedb/mousedb/static/
<Directory /usr/src/mousedb/mousedb/static>
    Order deny,allow
    Allow from all
</Directory>
```

```
<Directory /usr/src/mousedb/mousedb/apache/django.wsgi>
    Order deny,allow
    Allow from all
</Directory>
WSGIScriptAlias /mousedb /usr/src/mousedb/mousedb/apache/django.wsgi
```

If you want to restrict access to these files, change the Allow from all directive to specific domains or ip addresses (for example Allow from 192.168.0.0/99 would allow from 192.168.0.0 to 192.168.0.99) If you want to restrict access to these files, change the Allow from all directive to specific domains or ip addresses (for example Allow from 192.168.0.0/99 would allow from 192.168.0.0 to 192.168.0.99).

To move all static files (css/javascript/images) to the directory from which static media will be served run the following command. This will move the files to the directory defined in STATIC_ROOT:

```
python manage.py collectstatic
```

2.5 Enabling of South for Future Migrations

Schema updates will utilize south as a way to alter database tables. This must be enabled initially by entering the following commands from /mousedb/bin:

```
python manage.py schemamigration animal --initial
python manage.py schemamigration data --initial
python manage.py schemamigration groups --initial
python manage.py schemamigration timed_mating --initial
python manage.py syncdb
python manage.py migrate
```

Future schema changes (se the UPGRADE_NOTES.rst file for whether this is necessary) are accomplished by entering:

```
python manage.py schemamigration schemamigration <INDICATED_APP> --auto
python manage.py schemamigration migrate <INDICATED_APP>
```

2.6 Final Configuration and User Setup

Go to a command prompt, navigate to inside the mousedb/src directory and enter the following to get to a python prompt:

```
python manage.py shell
```

Go to servername/mousedb/admin/groups/group/1 and name your research group and select a license if desired

Go to servername/mousedb/admin/auth/users/ and create users, selecting usernames, full names, password (or have the user set the password) and then choose group permissions.

2.7 Testing

From the mousedb directory run **python manage.py test** to run the test suite. See https://github.com/davebridges/mousedb/wiki/Known-Issues—Test-Suite for known issues. Report any additional errors at the issue page at https://github.com/davebridges/mousedb/issues.

Users and Restriction

All pages in this database are restricted to logged-in users. Users are defined using the standard Django `User` objects. It is also recommended that data is secured by only allowing access of specific IP addresses. For more details on this see the documentation for your webserver software (for example, for Apache see here http://httpd.apache.org/docs/2.2/howto/access.html). Each database should have at least one superuser, and that user can create and designate permissions for other users. When a user does not have the permissions to view a page or to edit something, the link to that page will not be visible and if they enter the address, they will be redirected to a login page.

3.1 Creating New Users

Create users by going to **../mousedb/admin/auth/user/add/** and filling in both pages of the form. Permissions are set by going to **../mousedb/admin/auth/user/** selecting the user and manually moving the permissions from the box on the left to the box on the right. If you want the user to have access to the admin site, select staff. Only select superuser if you want that user to have all permissions. Users can change passwords on the administration site as well.

3.2 Removing Users

Remove inactive users by selecting their username from the **../mousedb/admin/auth/user/** page and deselecting the active box. Only delete a user if it was generated mistakenly and that the particular user had not been used to edit any data.

Animal Data Entry

4.1 Newborn Mice or Newly Weaned Mice

1. Go to Breeding Cages Tab

2. Click on Add/Wean Pups Button

3. Each row is a new animal. If you accidentaly enter an extra animal, check off the delete box then submit.

4. Leave extra lines blank if you have less than 10 mice to enter

5. If you need to enter more than 10 mice, enter the first ten and submit them. Go back and enter up to 10 more animals (10 more blank spaces will appear)

4.2 Newborn Mice

1. Enter Breeding Cage under Cage

2. Enter Strain

3. Enter Background (normally Mixed or C57BL/6-BA unless from the LY breeding cages in which case it is C57BL/6-LY5.2)

4. Enter Birthdate in format YYYY-MM-DD

5. Enter Generation and Backcross

4.3 Weaning Mice

1. If not previously entered, enter data as if newborn mice

2. Enter gender

3. Enter Wean Date in format YYYY-MM-DD

4. Enter new Cage number for Cage

4.4 Cage Changes (Not Weaning)

1. Find mouse either from animal list or strain list

2. Click the edit mouse button

3. Change the Cage, Rack and Rack Position as Necessary

4.5 Genotyping or Ear Tagging

1. Find mouse either from animal list or strain list, or through breeding cage

2. Click the edit mouse button or the Eartag/Genotype/Cage Change/Death Button

3. Enter the Ear Tag and/or select the Genotype from the Pull Down List

4.6 Marking Mice as Dead

4.6.1 Dead Mice (Single Mouse)

1. Find mouse from animal list or strain list

2. Click the edit mouse button

3. Enter the death date in format YYYY-MM-DD

4. Choose Cause of Death from Pull Down List

4.6.2 Dead Mice (Several Mice)

1. Find mice from breeding cages

2. Click the Eartag/Genotype/Cage Change/Death Button

3. Enter the death date in format YYYY-MM-DD

4. Choose the Cause of Death from Pull Down List

Studies and Experimental Setup

Set up a new study at /mousedb/admin/data/study/ selecting animals

You must put a description and select animals in one or more treatment groups

If you have more than 2 treatment groups save the first two, then two more empty slots will appear. For animals, click on the magnifying glass then find the animal in that treatment group and click on the MouseID. The number displayed now in that field will not be the MouseID, but don't worry its just a different number to describe the mouse. To add more animals, click on the magnifying glass again and select the next animal. There should be now two numbers, separated by commas in this field. Repeat to fill all your treatment groups. You must enter a diet and environment for each treatment. The other fields are optional, and should only be used if appropriate. Ensure for pharmaceutical, you include a saline treatment group.

Measurement Entry

6.1 Studies

If this measurement is part of a study (ie a group of experiments) then click on the plus sign beside the study field and enter in the details about the study and treatment groups. Unfortunately until i can figure out how to filter the treatment group animals in the admin interface, at each of the subsequent steps you will see all the animals in the database (soon hopefully it will only be the ones as part of the study group).

6.2 Experiment Details

- Pick experiment date, feeding state and resarchers

- Pick animals used in this experiment (the search box will filter results)

- Fasting state, time, injections, concentration, experimentID and notes are all optional

6.3 Measurements

- There is room to enter 14 measurements. If you need more rows, enter the first 14 and select "Save and Continue Editing" and 14 more blank spots will appear.

- Each row is a measurement, so if you have glucose and weight for some animal that is two rows entered.

- For animals, click on the magnifying glass then find the animal in that treatment group and click on the MouseID. The number displayed now in that field will not be the MouseID, but don't worry its just a different number to describe the mouse.

- For values, the standard units (defined by each assay) are mg for weights, mg/dL for glucose and pg/mL for insulin). You must enter integers here (no decimal places). If you have several measurements (ie several glucose readings during a GTT, enter them all in one measurement row, separated by commas and *NO spaces*).

CHAPTER 7

Automated Documentation

7.1 Animals Application

7.1.1 Animal Data Models

7.1.2 Animal App Views and URLs

Breeding URLS

Cage URLS

Date URLS

Mouse URLS

Strain URLS

ToDo List URLS

Views

Administrative Interface

7.1.3 Animal App Unit Tests

7.1.4 Animal App Utilities

7.2 Data Application

7.2.1 Data API Access

7.2.2 Data Models

7.2.3 Data Views and URLs

Cohort URLS

Experiment URLS

Parameter URLS

Study URLS

Indices and tables

- genindex

- modindex

- search