

Neonatal Mouse ECG

Equipment

1. Faraday Cage
2. Platform with internal heater
3. A-NME-BE: Bar Electrode
4. A-NME-B: Silicone Bumpers
5. A-NME-P: Silicone Pad
6. C-USG-B: Grounding Cable
7. Electrode Gel
8. Computer (Windows or Mac OS operating system)

Supplies

1. 70% Ethanol
2. Wipes and cotton swabs

Overview

The Neonatal Electrocardiogram (ECG) is recorded and analyzed using the iWorx data acquisition and analysis system. Lead I and Lead II ECG is collected through surface electrodes on the mouse. Lead III, aVF, aVL, and aVR can be calculated and analyzed using the ECG Analysis Module in Labscribe. This non-invasive procedure eliminates the need for anesthetics, allowing for the recording of mice as young as 1-2 days old.



Figure 1: RS-NMECG system components.

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Downloading LabScribe

New Users: The equipment comes with a Temporary User Name and Password, so that you can immediately get started with your system by downloading and installing the software. You must register as a User with your own UN and PW. The one that comes with the system may be shared with your IT department as needed.

Important: *LabScribe must be installed under the administrator's account to enable data saving.*

Note: *iWorx has an open site license, permitting the software to be installed on any number of computers within the licensed site. This benefits researchers by enabling access from any location, allowing for off-site data analysis.*

1. Navigate to www.iworx.com on your computer.
2. In the toolbar at the top of the iWorx web page, select 'Support'.
3. Select 'Software Download'.
4. Select 'Research'.
5. Select 'Complete Installer' for either Windows or Mac OS.

Note: *On the LabScribe Software Download Page, there is a tutorial video titled “[LabScribe101 – Basic Training](#)” This video is a basic introduction to LabScribe to learn how to set-up, record and analyze your data.*

Recorder Setup

Reference Video: [NMECG01 - Neonatal Mouse ECG Setup \(youtube.com\)](#)

1. Place the platform on the bench close to the computer.
2. Connect the USB cable to the computer.
3. Allow the platform to preheat for 15 minutes to reach 37 °C/98.6 °F. The internal heating unit is contained within the measuring unit and heats only the plastic surface.
3. Open LabScribe software. A Device Status Dialog will pop up recognizing the devices.
 - From the Main window, select the **Settings** tab and then click **Load Group**.
 - Locate the **Research Settings** folder: C:\Program Files\iWorx\LabScribe\Research Settings
 - Open the Neonatal Mouse folder which contains the settings group **Neonatal-mouse.iwxgrp**. Select this group and click Open.
 - Now that the settings group is loaded, select the **Settings** tab. Below “**Default Setting**” is a list of settings, select the **mouse-neonatal** settings file from the list.

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- LabScribe will be configured by the **mouse-neonatal** settings file, and a pdf setup document will open.

***Note:** Once the research settings are loaded, they will open the same every time LabScribe is launched. If you do not see the Research Settings folder in the LabScribe folder, reinstall LabScribe, making sure that the Research settings are installed.*

Animal Setup

1. Once the measuring unit has heated, wipe the thorax of the mouse with 70% ethanol sprayed on a wipe.
2. Place the electrode gel on each of the four electrodes using a swab. Ensure that each electrode is covered thoroughly.
3. Apply electrode gel to the electrode that will be placed on the back of the mouse.

***Note:** Make sure to set up the mouse to the platform within 5-10 minutes of applying electrode gel. When applying gel, make sure to press gently and pull away at an angle so that the gel does not adhere to more than a single electrode. Adhesive strands that form can conduct charge and interfere with the electrical signal.*

4. Gently place the mouse sternum down on the platform with its underside making contact with all four electrodes. The mouse's head should be facing the outgoing USB edge, and the mouse's tail should be facing the non-USB edge. Hold for approximately one minute to let the electrode gel set.
5. Restrain the mouse using the silicone bumpers as blockers on the right and left sides.
6. Place the back electrode on the top of the mouse. Use the third piece of silicone to keep the back electrode in place.

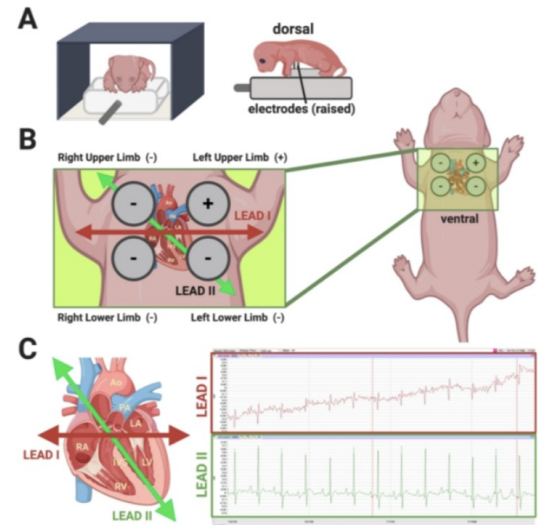
***Note:** Do not apply excessive force while placing the final piece of silicone as this could cause discomfort to the mouse and/or displace the grounding electrode. Make sure the head of the mouse is able to move somewhat freely to prevent suffocation.*

7. Carefully put the entire platform into the Faraday cage. Prior to recording, make sure the mouse is not moving excessively and make sure the body and head of the mouse appears secure.

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Figure 2: Neonatal Mouse setup with right and left silicone bumpers.



Fitzsimons, L. A., Brewer, V. L., Forrester, J., Moran, A. M., Tucker, K. L. Noninvasive Electrocardiography in the Perinatal Mouse. *J. Vis. Exp.* (160), e61074, doi:10.3791/61074 (2020).



Figure 3: Neonatal mouse system setup with faraday cage.

Recording with LabScribe

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1. Initiate recording by pressing the red icon labeled “REC”. The icon will now change to black and be labeled “STOP”.



2. It may take up to 30 seconds for the ECG signal to level out.

3. Select the ‘AutoScale all Channels’ button at the top of the toolbar.



- This button can be pressed as many times as necessary throughout recording, or the recording can be continually AutoScaled in real time by selecting: View → Display → and Online AutoOffset. This will use the mean values of your data to adjust the trace view so you don't need to keep clicking Autoscale.

4. When the recording is finished Click the “STOP” icon.

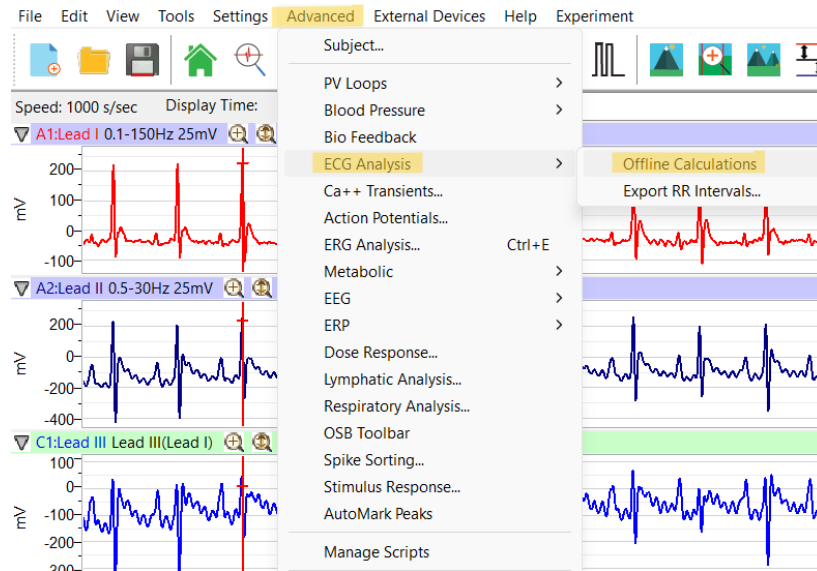
LabScribe Software Analysis



Figure 4: Sample recording of Lead I (Dark Blue), Lead II (Green), and Lead III (Blue) from a Neonatal Mouse.

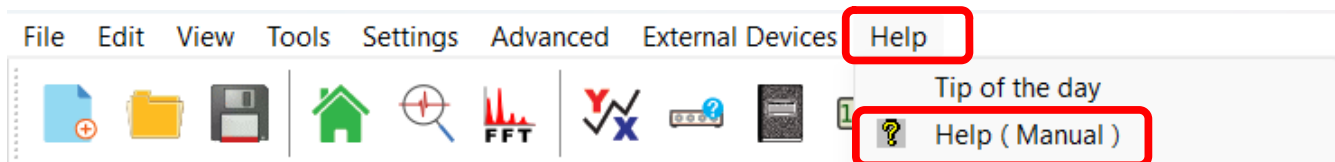
Open the Advanced ECG Analysis Module. Select: Advanced → ECG Analysis → Offline Calculations

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Detailed information on ECG Analysis and the Advanced ECG Analysis Module can be found in the LabScribe manual by navigating to:

- In the LabScribe toolbar Select: Help → Help (Manual)
- Section 8.3 ECG Analysis



Basic Cardiac Functions

The Cardiac functions can be accessed through the add function (fx) on the channel of an ECG recording.

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Four of the Cardiac functions calculate leads: III, aVR, aVL and aVF from the recordings of Lead I and Lead II. You can specify which channel corresponds to Lead I and Lead II in the Cardiac Setup dialog which will open when a new lead is selected.

