

Auditory Brainstem Response

using PetScreener

What is ABR?

Auditory Brainstem Responses, also known as BAER, are potential differences generated when a subject's ear is stimulated with any kind of sound. These potential differences can be evoked using controlled stimulation, allowing acquisition of these differences by averaging the acquired EEG over a specified period of time. The ABR response is commonly found between one and fifteen milliseconds from the time of stimulation.

The recordings acquired will contain certain peaks and valleys, some more identifiable than others. In most species, Peaks I, III and V are the most identifiable. The amplitudes, latencies and relationship of those peaks and valleys can be used to diagnose certain pathological conditions. Animal ABR responses are usually acquired using Sub-dermal electrodes.

Why use ABR Screening?

Auditory brainstem responses may be used to diagnose certain auditory conditions. This type of testing can provide a healthcare professional with very useful information about hearing loss in a subject. This technique is especially helpful to test pets since no behavioral response is required.

ABR testing can help determine the amount and type of hearing loss at specific frequencies, (i.e. hearing threshold), depending on the cause of hearing impairment. Unlike OAE testing, which only tests for cochlear function, ABR testing provides information of the complete hearing pathway, including the neural pathways in the brainstem, providing a more complete functional test, less susceptible to acoustical noise interference.

Pet Screener is pre-programmed with algorithms that detect responses automatically, labeling the responses as Pass or Refer, decreasing the probability of human error.

Creating your Test Protocol

Test settings should match the requirements by an institution, doctor, or local laws. Creating a new test set is very easy:

1. Click on **[SYSTEM > EEG & AMPLIFIER]** to set the high pass, low pass, artifact rejection region, notch filter and designation. Make sure the designation setting matches your electrode setup. Refer to the sections on Amplifier Settings for recommended values. Click **[OK]** to close.
2. Click on **[SYSTEM > TEST PROTOCOL SETUP]** from the main menu to open the protocol setup screen (You must use the system password to open this utility; by default the password is 'ihs').
3. Place check marks next to as many intensities at which you need to test. Modify the intensities in 1 dB increments (e.g. enter 95 in the intensity field). Intensity values are given in SPL and are acquired starting at the top of the list, ending at the bottom of the list.
4. Select the minimum and maximum number of sweeps for each intensity value. At least 300 sweeps per intensity.
5. Make sure to select the correct type of stimulus and stimulator from the right-hand side.
6. Save the protocol as default.

Amplifier Settings

For single channel systems such as the Aria, Solo, and USBLite, the designation should be set to **Right-Left**. The image below shows the settings for a Solo device. For the Aria the High Pass value should be changed to 100 Hz.

EP Channel: A

Gain:	100.0 K	▼
High Pass:	30.0 Hz	▼
Low Pass:	1500.0 Hz	▼
	☒ Line Filter	
Designation:	Right-Left	▼
Electrode Montage:		
A1	Cz	A2
Rejection: 31.00uV		



For additional help:
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SNPSC010 - EN - 241126

The amplifier of dual channel systems such as the Duet and USB should be set up as shown below. Notice the designation of Channel A is set to Right, the designation for channel B should be set to Left.

EP Channel: A

Gain: 100.0 K

High Pass: 100.0 Hz

Low Pass: 1500.0 Hz

☒ Line Filter

Designation: Right

Electrode Montage:

A1 Cz A2

Rejection: 31.00uV

Make sure to carefully select your filter settings in the EEG and Amplifier dialog box. Lack of filtering may result in excessive artifact, while excessive filtering may result in waveforms that are too smooth to assess. EEG and Amplifier settings may not need to be adjusted more than once when saved as default.

Recommended Settings

- **Sweeps:** 300 minimum, more for reduced noise and cleaner recordings.
- **Rate:** 33.3/s, 48.9/s, 48.5/s, 48.3/s or 47.7/s (adjust as needed to reduce noise).
- **Amplifier Designation:** Right-Left for single channel devices such as Aria, Solo and USBLite. Right for Channel A, and Left for Channel B for dual channel devices such as Duet and USB.
- **High Pass Filter:** 100 Hz (30 Hz for Solo)
- **Low Pass Filter:** 1500 Hz
- **Artifact Rejection:** 31% or higher

Subject State

The subject must be in a calm state to avoid EMG activity. Using anxiety reductions methods or devices, such as a Thundershirt, may be helpful with the screening process. Restraint of subjects may be accomplished without the use of sedation; having the animal held or mildly restrained by a team member should be enough for most cases.

The subject should not be under the effect of stimulants, or any drugs that may hinder normal nervous system behavior. If avoidance is not feasible, then the effect of these substances must be considered when evaluating the subject's responses

When using insert earphones as a stimulator, make sure the ear canal is clean of wax and other debris; if necessary, clean the ear canal taking care not to damage the tympanic membrane. Only properly trained personnel should clean the ear canal.

Electrode Usage

Sub-dermal electrodes are the most common choice for acquiring ABR recordings on animals. Shaving the electrode site is often necessary to obtain reliable and secure electrode placement.

It is common practice to use a topical anesthetic (2.5% lidocaine, 2.5% prilocaine) directly to the skin of the subject at the site of the subdermal electrode placement.

Single Channel Electrode Placement

Electrodes may be placed in the following configuration when using a single channel system such as the Aria, Solo, or USBLite:

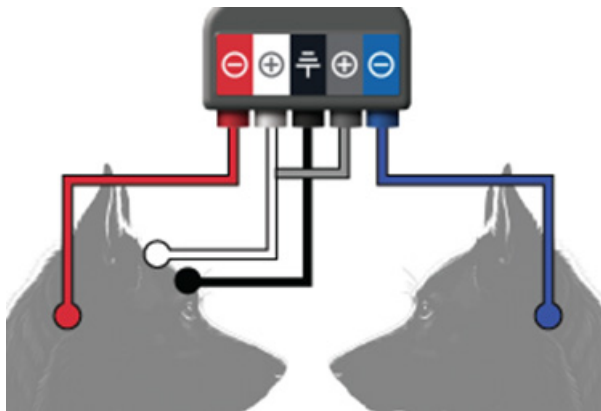


- The electrode on the Right ear is connected to the Red electrode position
- The electrode on the Left ear is connected to the Blue electrode position
- The electrode on the vertex or forehead connected to the White electrode position. Note that for the USBLite, the non-inverting electrode socket is black.

When using this montage, along with the Right-Left designation in the Amplifier window, the Ground and Inverting positions will swap automatically when choosing to test the Right or Left ears.

Dual Channel Electrode Placement

Electrodes may be placed in the following configuration when using a dual channel system such as the Duet:



- The inverting electrode on the Right ear is connected to the Red electrode position
- The inverting electrode on the Left ear is connected to the Blue electrode position
- The non-inverting electrode on the vertex or high forehead connected to the White electrode position, joined to the Gray electrode position using a Y-adapter.
- The ground electrode on the low forehead connected to the Black electrode position. Special care should be given when placing this electrodes as it should never touch the non-inverting electrode.

For a Dual channel USB system, the electrodes can be placed on the same locations as shown above, except the inverting locations have red sockets, while the no-inverting connections have blue sockets. Use channel A for the Right side and B for the Left side.

Acquiring with Pet Screener

Complete the following steps to acquire data:

1. Click the **[ENTER DEMOGRAPHICS]** button and enter all the required information for the subject. If loading an existing patient, click on the **[LOAD]** button on the right hand side of the window.
2. Click on **[SYSTEM > EEG AND AMPLIFIER]** and inspect the EEG, adjust the artifact rejection level if necessary.
3. Click on the **[RIGHT]** or **[LEFT]** buttons to start acquisition for the corresponding ear, the repeat for the opposite ear.
4. If continuing with another subject of the same litter, click the **[NEXT PUP]** button. Open the Amplifier window again with every new test subject to make sure the EEG and artifact rejection level are appropriate.

Analysis

PetScreener will automatically detect the presence of a probable response in every incoming recording. When acquiring, the program will stop once a probable response has been found and the minimum number of sweeps has been acquired. If PetScreener is unable to find a response, up to the maximum number of sweeps specified, it will label the recording as a non-response. The following image shows a good response for a canine subject. Other species may show a different waveform structure.

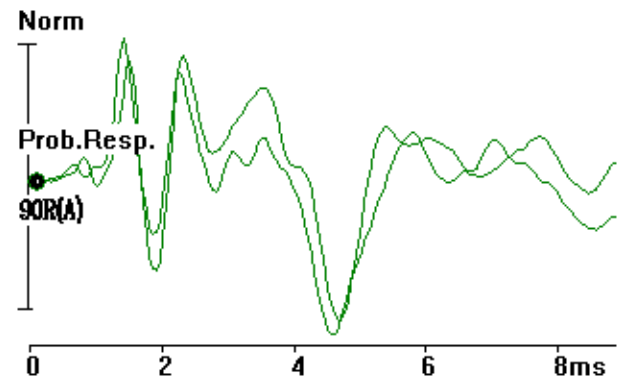


Fig.1 - Sample waveform

Marking Peaks

To better understand the recording, and compare the results to those of normal hearing subjects, you must first place the applicable labels on the recently acquired recording. Peaks may be marked when recognizable, follow these steps for each of the labels:

1. Right click at the point of the recording where the label is to be placed.
2. Select the peak to be marked from the list under **[MARK PEAK]**.
3. Once placed, drag the top marker of the labels to the top of the peak, if needed.
4. Drag the bottom marker to the valley following the peak to obtain a peak amplitude.

You may also select **[MARK OTHER PEAK]** to place non-standard custom labels.