Comparing Different Species (ECG)

Overview

Electrocardiogram (ECG) waveforms vary significantly across species due to differences in heart size, heart rate, and cardiac physiology. When comparing ECG data from different animals, it is important to understand how these physiological differences affect waveform morphology and timing.

Background - Key Differences Between Species

1. Heart Rate: Smaller animals generally have faster heart rates, while larger animals have slower heart rates. Faster heart rates result in shorter intervals between ECG components.

2. Waveform Duration: P wave, QRS complex, and T wave durations are shorter in smaller animals. Larger animals exhibit longer, more separated waveforms.

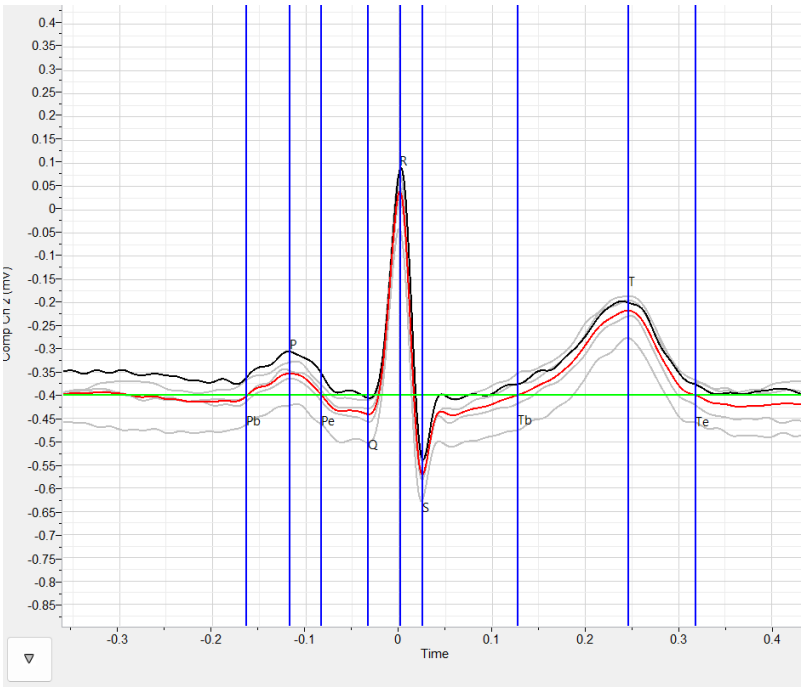
3. QRS Complex Morphology: The shape of the QRS complex can differ due to variations in cardiac conduction pathways. For example, rodents often show simpler, narrower QRS complexes. Larger mammals may show more complex or broader QRS shapes.

4. Electrical Axis: Differences in heart orientation within the chest cavity can change ECG polarity and waveform appearance between species.

Human ECG

Typical Features

- **Heart Rate:** 60–100 bpm
- **Waveform Morphology:** Distinct P, QRS, and T waves
- **Intervals:**
  - PR: ~120–200 ms
  - QRS: ~80–100 ms
  - QT: ~350–440 ms
- **Notes:**
  - Serves as a reference for many comparative physiology studies



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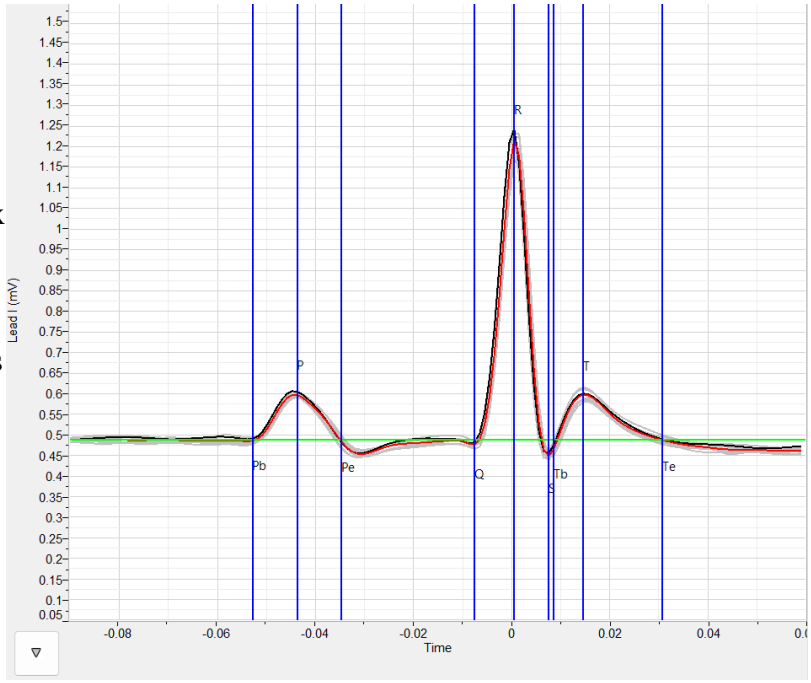
Mouse ECG

Typical Features

- **Heart Rate:** 300–600 bpm
- **Waveform Morphology:** Very narrow P wave and QRS complex
- **Intervals:**
  - PR interval: extremely short
  - QRS duration: ~10–20 ms
  - QT interval: short due to rapid ventricular repolarization
- **Notes:**
  - High-frequency signal requires high sampling rate (≥1 kHz)
  - Waveforms appear tightly compressed due to fast rate



Neonatal Mouse ECG

Typical Features

- **Heart Rate:** Often slightly lower than adult mice but still very rapid; may range **250–450 bpm** depending on age and temperature
- **Waveform Morphology:**
  - P wave and QRS complex are **small and narrow**
  - T wave may be shallow or less distinct
- **Intervals:**
  - Extremely short PR and QRS durations
  - QT interval short but may be slightly longer relative to adults when scaled to heart rate
- **Notes:**
  - Neonates can have greater variability in heart rate
  - ECG amplitude is lower due to smaller cardiac mass
  - High sampling rates (≥1 kHz) are needed for clear detection
  - Electrode placement and contact quality are more sensitive due to smaller size

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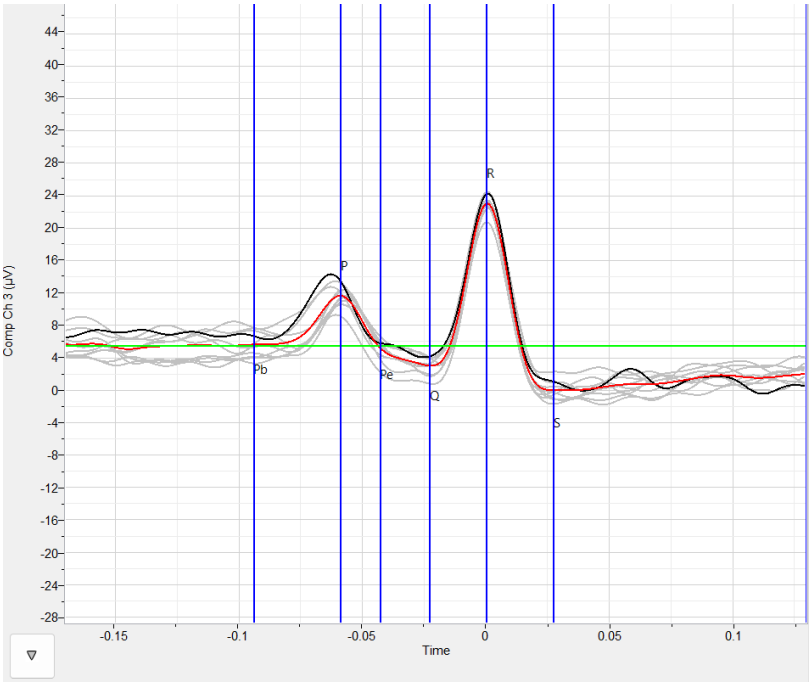
Zebrafish ECG

Typical Features

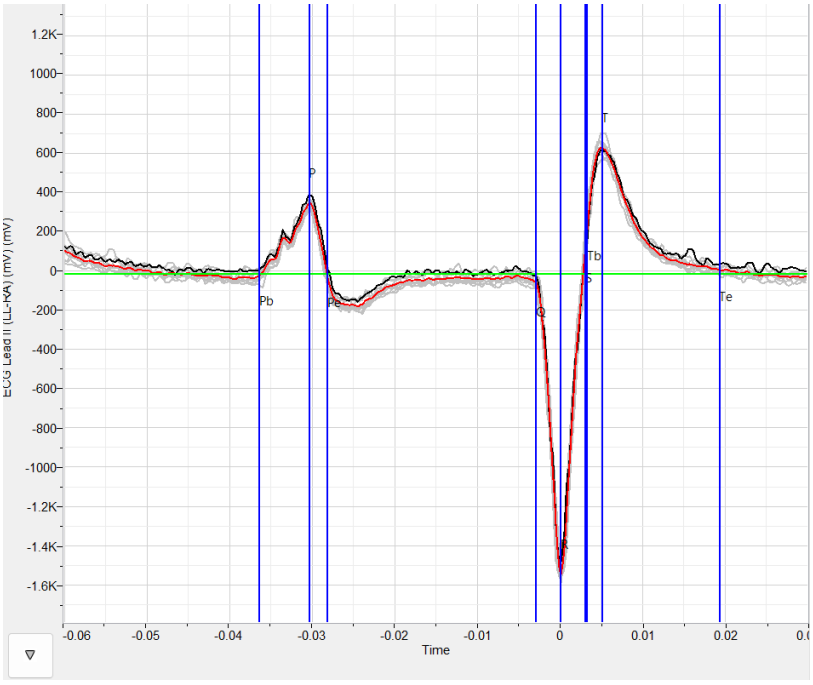
- **Heart Rate:** ~120–180 bpm (varies with temperature)
- **Waveform Morphology:**
  - Clear P wave and QRS
  - T wave sometimes less pronounced
- **Intervals:**
  - QRS is narrow and fast
  - QT interval is shorter than human but longer relative to mouse (scaled to HR)
- **Notes:**
  - Single ventricle/atrium physiology influences waveform shape



Hummingbird ECG

Typical Features

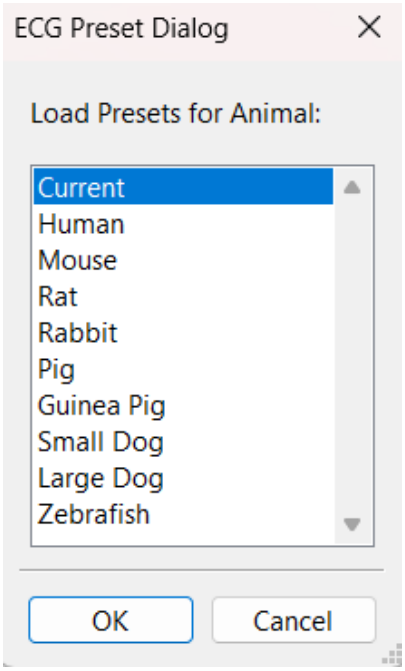
- **Heart Rate:** 600–1,200+ bpm (among the fastest of any vertebrate)
- **Waveform Morphology:**
  - Extremely rapid cycling
  - Very small, sharp QRS
- **Intervals:**
  - RR interval extremely short
  - P–QRS–T waves may appear partially blended depending on sampling rate
- **Notes:**
  - Requires very high sampling rate to resolve distinct peaks



Comparing Different Species (ECG)

Using LabScribe for Analyzing Different Species

LabScribe includes predefined detection settings optimized for different species. These presets help ensure that ECG cycles are displayed correctly and that P, QRS, and T points are accurately detected.



How to Load Species-Specific Presets

1. Open the Advanced ECG Analysis Module.
2. In the settings tab, Click **Load Presets**.
3. Choose the species from which your ECG was recorded.
4. LabScribe will automatically populate the preset values for:
    - **Typical QRS Width**
    - **Pre-P Baseline Duration**
    - **Maximum P>R Duration**
    - **Maximum RT Duration**
    - **Measure ST Elevation At**

These default settings can also be edited manually if needed.

Why Selecting the Correct Species Matters

Choosing the appropriate preset ensures:

- Proper scaling of the ECG cycle in the ECG Graph
- Accurate placement of P, QRS, and T detection points
- Reduced need for manual correction
- Better comparisons when analyzing multiple animals