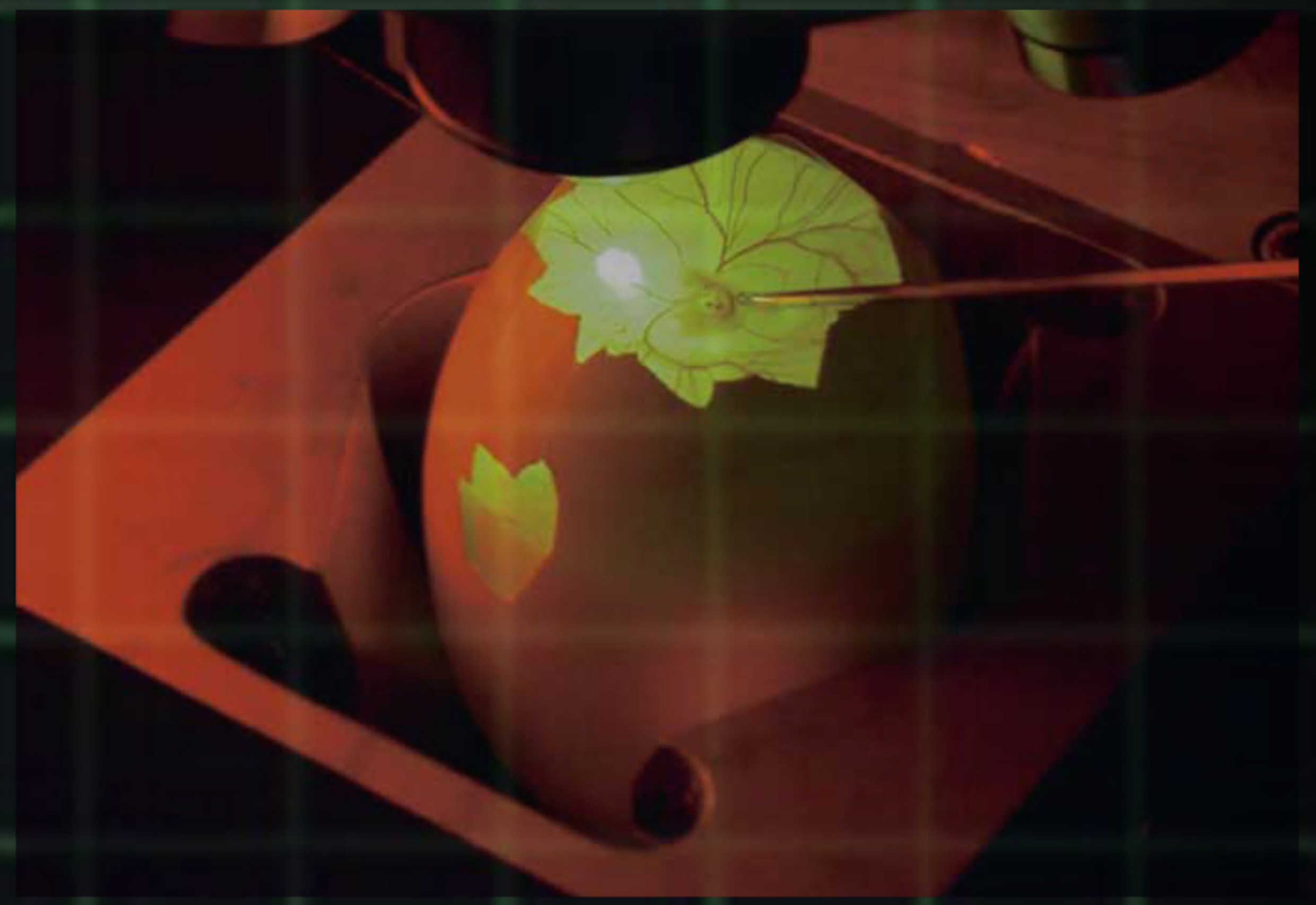


# Measuring chicken-embryo heart rates by ECG

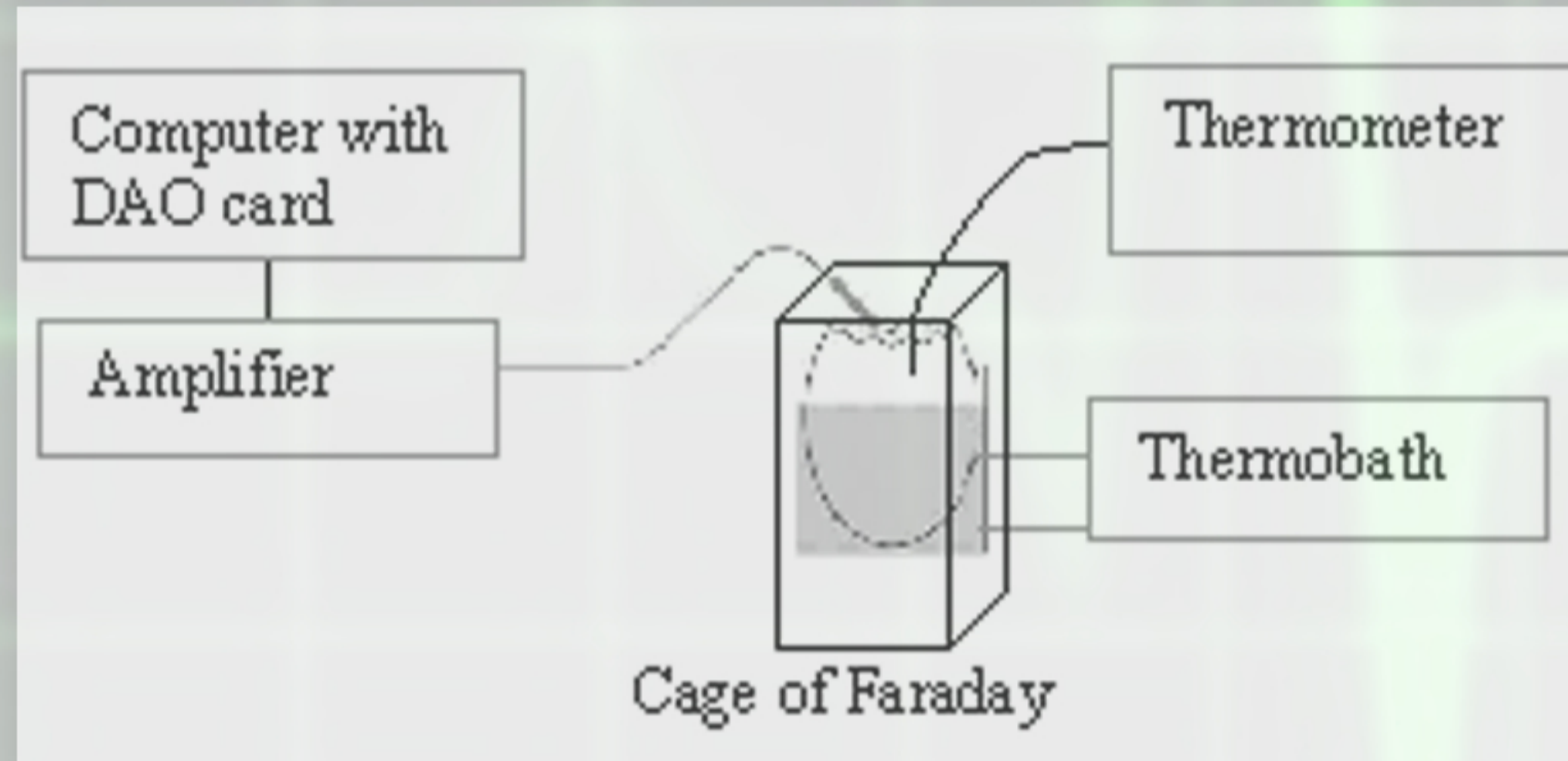
## Introduction

- Design an ECG set-up to facilitate the measurements of embryonic heart rate of a 3 day old chicken embryo
- Investigate the disturbances in measuring the ECG
- Develop an optimal method to avoid the disturbances



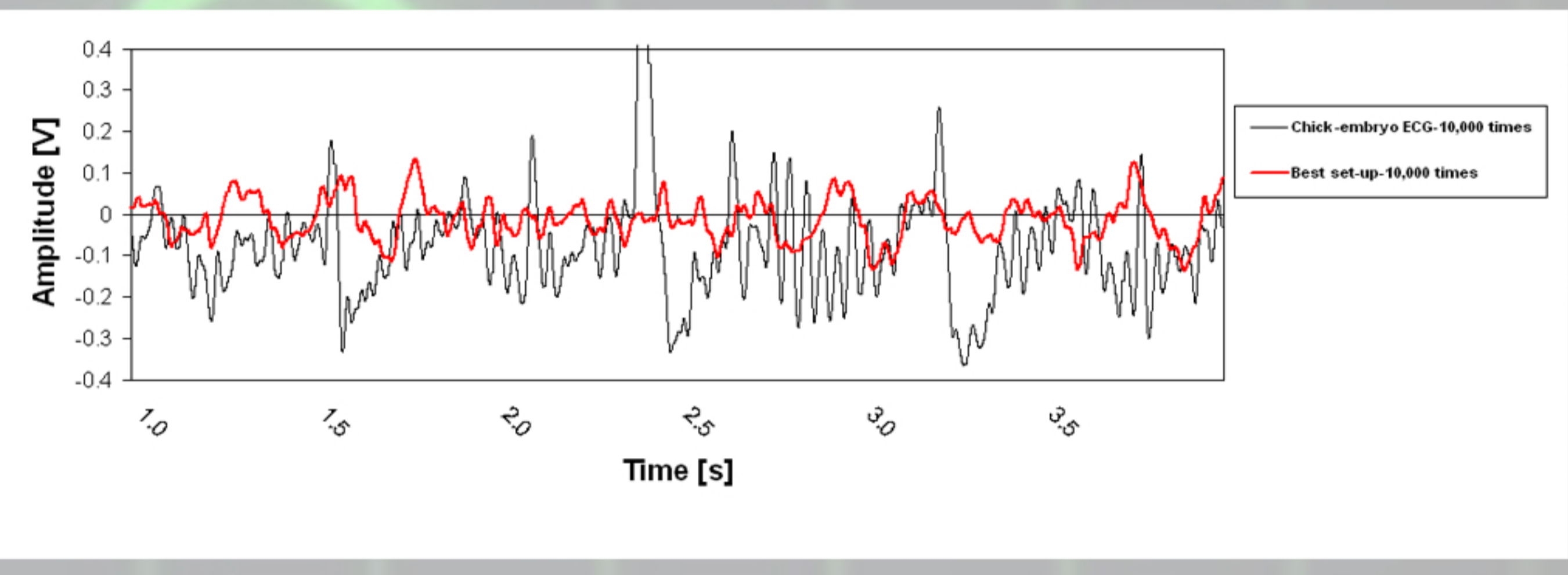
## Methods

The setup consists of an amplifier, thin coax-cables, an adjustable thermobath, a thermometer and a computer with a DAQ card (Data Acquisition card). The signals were digitally filtered using the LabView 8.0 program. Through iteration a "best setup" was designed with a reasonable signal to noise ratio. Then five experiments were performed to gauge the contribution of the noise factors and to measure the amplitude of the chick-embryo's ECG. Two performed experiences shown clearly the signal to noise ratio and are illustrated here.



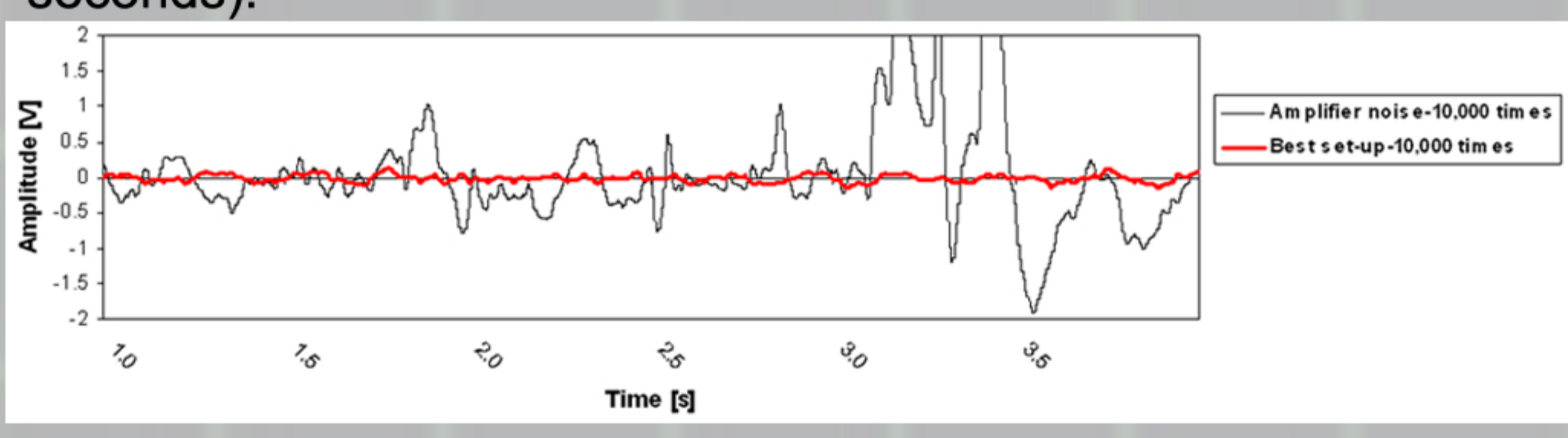
## Results

Chick-Embryo ECG – Using Faraday cage, single grounding and no looped shielding, a 10,000 times amplified signal was obtained as shown below. Experiment uses the same setup as in the measurement of the amplifier noise, but with a live embryo instead of a salt-solution. The ECG is not very clear, but its amplitude is estimated to be 0,000 02V



## Results

Amplifier Noise – Using Faraday cage, single grounding via DAQ and no looped shielding, a 10,000 times amplified signal is shown below. Looping the shielding of the electrodes results in a ten-fold noise decrease from 0.000 1V to 0.000 01V. Randomly there are even larger noise amplitudes (time: 3 to 3.5 seconds).



## Discussion and Recommendations

The last experiment with the chick-embryo shows the ECG to be of very small amplitude, only two times the amplitude of the noise as the noise cancelling methods were useful. What remains is a 4Hz component in all measurements. Our experiments reveal it to be a grounding issue or a mechanical disturbance. The best noise reduction was achieved by improving grounding conditions, therefore a clean grounding channel connected close to the amplifier and an ungrounded laptop running on batteries should decrease noise amplitudes even further. When powering the amplifier with batteries the 50Hz electrical grid disturbance can be avoided. Using hard-wired filters allows for continuously measuring the heart rate instead of digitally filtered batches. This set-up can be easily used in conjunction with a PIV set-up to provide data about the chicks blood pumping cycle. Using a set-up as described above should provide a signal with minimized noise and a clear chicken-embryo ECG.



Sara Bahramali  
 Hans Hertzberger  
 Jurjen van Royen  
 Marianne Visser