

## **LIVE TEACHING DEVELOPMENT TEAM PRIZE 2013**

### **Development of a Virtual Veterinary Stethoscope Annual Progress Report**

#### **Project Overview**

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This project received a LIVE Teaching Award in 2013 to develop a virtual stethoscope to provide an innovative and interactive tool to help students appreciate clinical approaches to the auscultation of the dog. The project set out to expand the current limited library of heart sounds in conjunction with existing RVC electronic case-based teaching for students on clinical rotations.

The expanded heart sounds library will be used to adapt and extend a Virtual Stethoscope already developed within the college to provide an innovative and interactive tool to help students gain familiarity with normal and abnormal heart sounds, challenging them to refine their diagnostic skills without compromising the safety of real patients. This will also be used to enable preclinical students to develop their skills in auscultation of normal heart sounds at an early stage.

#### **Project Aims**

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The project aims are:

1. to record heart sounds from clinical patients seen by the Cardiology Service of the Queen Mother Hospital for Animals (QMHA)
2. to integrate these sounds in an interactive tool (the 'Virtual Stethoscope') developed by the Project Team
3. to employ the Virtual Stethoscope in a range of applications, including online auscultation tutorials, auscultation self-assessment exercises, and as part of the diagnostic data for 'virtual patients'
4. to evaluate the impact of the Virtual Stethoscope by soliciting feedback and monitoring usage by clinical rotation students

#### **Achievements to Date**

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The project started as planned in the autumn of 2013. The following has been achieved to date:

1. Purchase of two Littmann electronic stethoscopes to be used by clinicians and students of the Cardiology Service in the QMHA to record the heart sounds of canine and feline patients.
2. Restoration of a malfunctioning Meditron digital stethoscope.
3. Configuring a laptop to record heart sounds using the StethAssist™ software, and Meditron Analyzer software.
4. Creating a dedicated environment on the RVC's Asset Bank where heart sounds can be uploaded and tagged for later integration into the virtual stethoscope.

5. Initial comparative studies of digital recordings using two Littman stethoscopes and the older Meditron digital stethoscope to determine which system captures the optimal recordings in terms of quality and sound recognition.
6. Documenting recording procedures for use by clinicians and students to ensure consistency (see Appendix).
7. Initial research on user interfaces for the digital publishing environment and virtual stethoscope.

## Interim Results

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Data acquisition has been unexpectedly difficult with the new Littmann stethoscopes. Although the sound quality of recorded heart sounds is good with play-back through the stethoscope as a listening device, downloading the sound results in degradation of the sound quality. Direct discussions with Littmann have been unrewarding, and their recommendation is that we use only the stethoscopes for audio play-back. Downloadable sound files of adequate sound quality are essential for use in a virtual environment, and although adjusting the sound frequency of downloaded .wav files has helped to some extent, the sound quality has been disappointingly inadequate.

We resorted to restoring a 10 year old Meditron digital device (thanks to the expertise of Brian Cox), and Brian has also rebuilt a laptop to enable operation of both the Meditron software and Littmann software, with the aim of running a head-to-head trial between the two systems to determine the optimum system. Preliminary recordings using both systems on each case showed that the Meditron results are far superior, and we are now using solely the Meditron stethoscope.

Data acquisition using the Meditron is now well underway, with a streamlined system in place for sound recording in the Cardiology Clinic by students under the supervision of Julia Sargent and Anne Kurosawa.

## Planned Development

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The remaining project developments comprise:

### **1. *Collect a bank of over 100 normal and abnormal heart sounds***

- Julia Sargent and Anne Kurosawa (SCTs) to oversee heart sound recording by students
- Upload high quality recordings to the Asset Bank repository
- Ensure quality and consistency of metadata to enable retrieval

*Capture and store over 100 normal and 100 abnormal recordings by end of project*

### **2. *Create an interactive user Virtual Stethoscope interface for students***

- Develop prototype user interface to pilot with students

- Complete programming of beta application for evaluation
- Populate application with recordings from repository
- Integrate self-assessment and tutorial features into application

*Completion of new interface for student use by September 2015*

### **3. Evaluate and document project**

- Collect student feedback from rotations
- Prepare peer reviewed paper for publication (JVME?)
- Submit a poster to the Association of Medical Education in Europe conference
- Produce final project report

*Estimated project completion date December 2015*

## **Timescale**

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Because of the unexpected delays associated with capturing high quality recordings, we are currently at least 6 months behind schedule. In addition, one of the key members of the project team, Chris Trace, left the RVC in 2013 and no immediate replacement was identified to take his place.

The project team have now been able to identify a suitable technical approach to recording which will be evaluated by the end of September. In addition, the inclusion of Kieran Borgeat, Julia Sargent and Anne Kurosawa in the project team is likely to make a significant impact on use of the system by students on rotations.

In a mid term planning meeting on the 20<sup>th</sup> August 2014, the team agreed that it was still feasible to complete the project though on a less ambitious scale than originally anticipated. It is proposed to request a 6 month extension to the original project time scale.

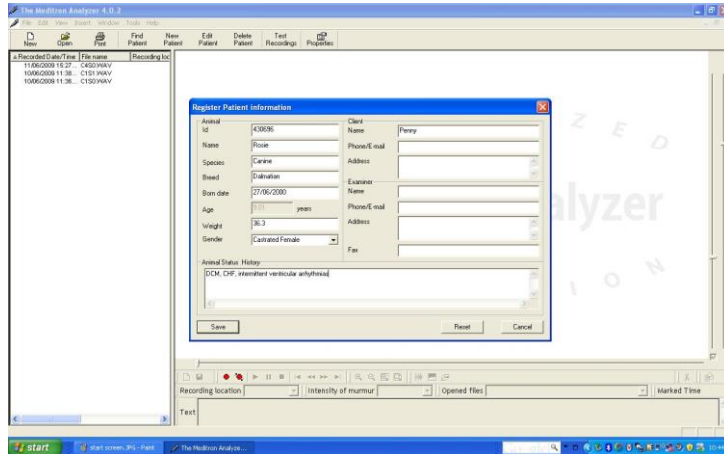
## **Project Team**

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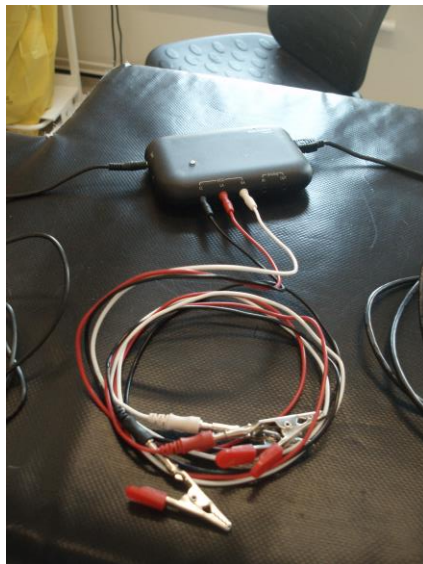
Virginia Luis Fuentes	Project lead and clinical coordinator
Chris Trace	Project management and coordinator (now left the RVC)
Sonya Powney	Coding and instructional design
Adrian Boswood	BVetMed Cardiovascular Strand Leader
Brian Cox	Technical specialist with expertise in editing audio
Kieran Borgeat	Visiting Lecturer in Veterinary Cardiology
Anne Kurosawa	Veterinary cardiologist-in-training
Julia Sargent	Veterinary cardiologist-in-training
Andy Gibson	Veterinary practitioner
Paul Crawford	Veterinary practitioner
Nick Short	Head of eMedia Unit

# Meditron Heart Sound Capture Instructions

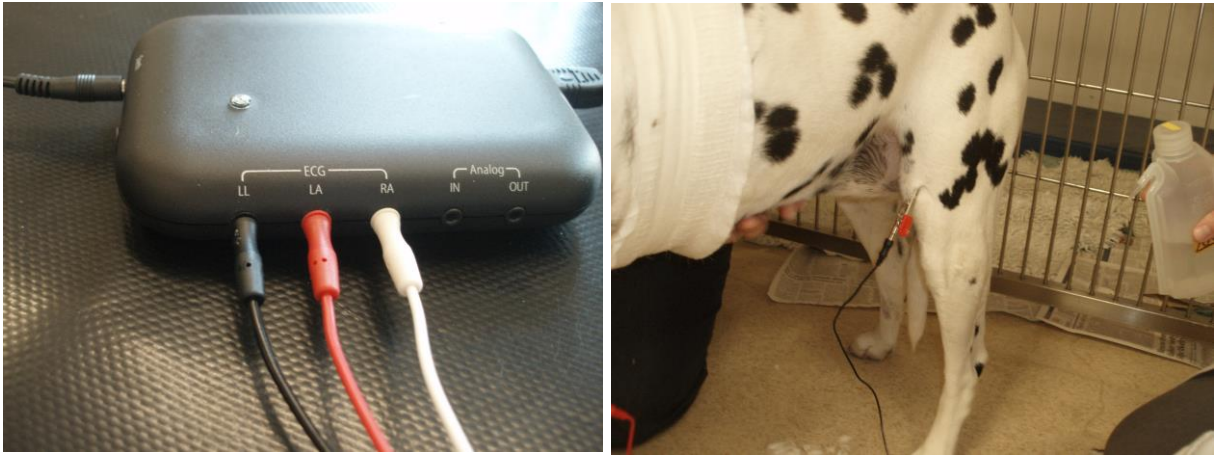
1. Select 'Meditron Analyzer' on the Desktop



2. Enter patient details (see above)
3. Attach connector to laptop



4. Attach ECG cables to patient (LA=left forelimb; RA=right forelimb; LL=left hindlimb) ensuring good contact with ECG gel or spirit



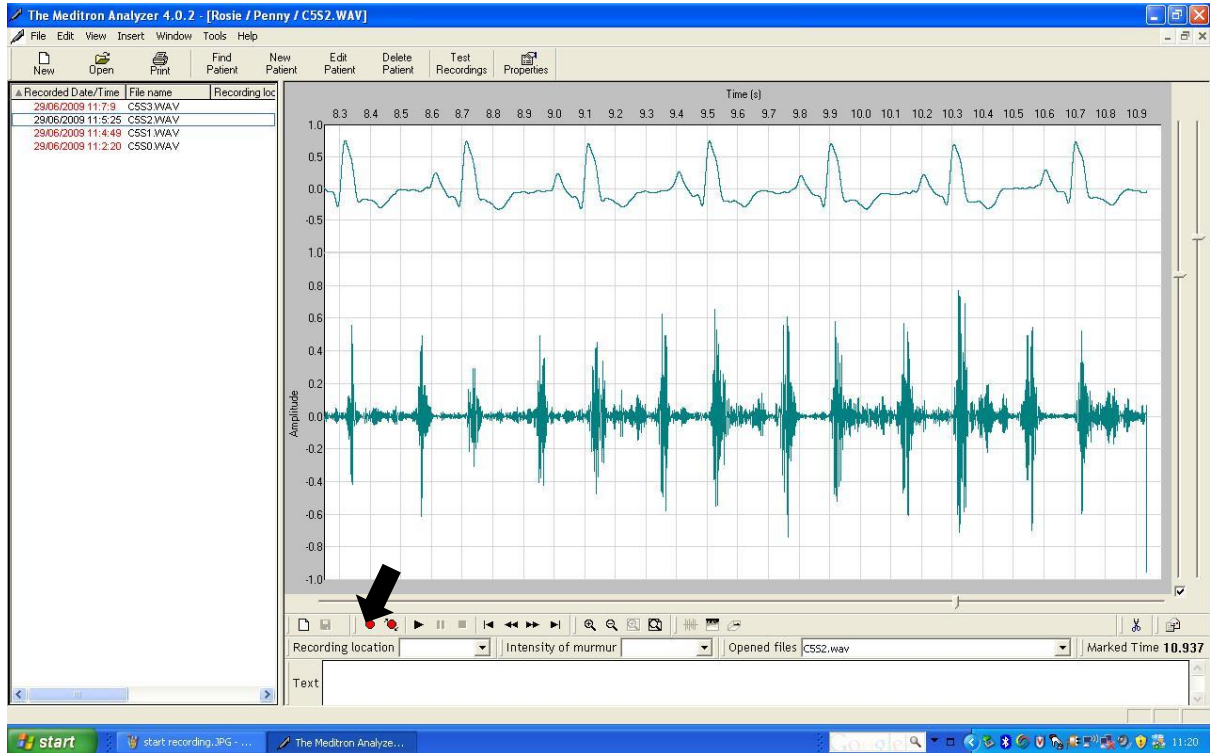
5. Attach connector to stethoscope



6. Apply ultrasound gel and switch on (the heart symbol)




7. Click record symbol (red circle) on the Meditron software






# Littman Heart Sound Capture Instructions

## 1. How to capture heart sounds using the electronic stethoscope




a) Turn on the stethoscope





d) Select an empty track and press 'M' to start recording  
e) Position the stethoscope on the animal  
f) Press 'M' again to stop recording (only the last 30 seconds will be captured)

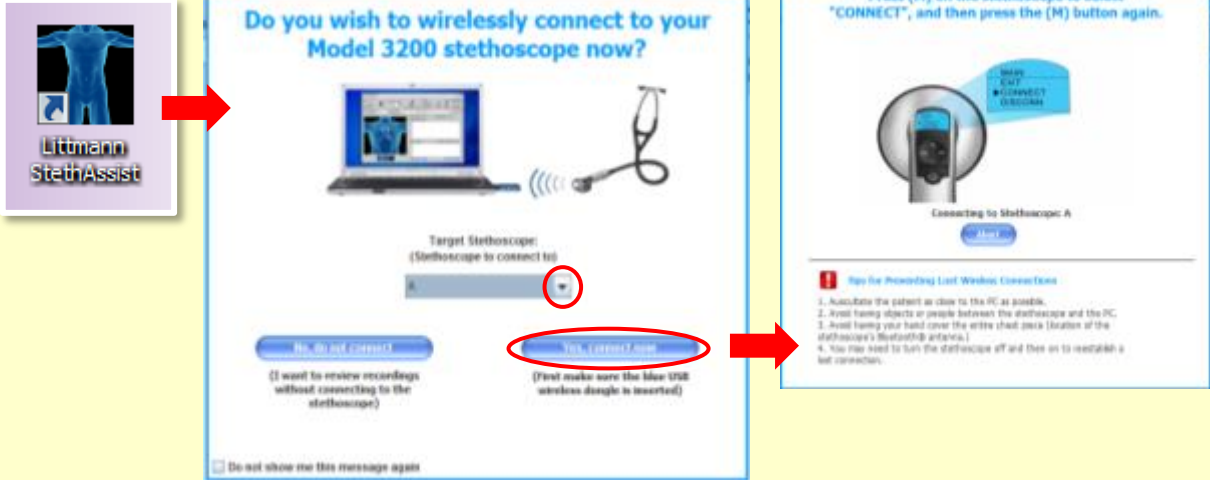


g) Review by selecting 'Play' in the 'RECORD' menu  
h) DELETE if quality not suitable.  
i) To record the name of the case press 'M' whilst the arrow is at 'COMMENT'  
j) Hold the chest piece 10cm from mouth and speak clearly and slowly. Say the name of the dog or cat clearly into the diaphragm



## 2. How to Connect to PC


Once a clear track has been recorded you should off load it to the PC.



The screenshot shows the 'Littmann StethAssist' application window. The main text asks: 'Do you wish to wirelessly connect to your Model 3200 stethoscope now?'. Below this, there is a 'Target Stethoscope' dropdown menu with 'A' selected. Two buttons are visible: 'No, do not connect!' and 'Yes, connect now!'. The 'Yes, connect now!' button is circled in red. A red arrow points from the 'Littmann StethAssist' icon to the software window. Another red arrow points from the 'Yes, connect now!' button to a second screenshot on the right. This second screenshot shows the stethoscope's display with the 'CONNECT' option selected and the 'M' button highlighted. Below the stethoscope image, there is a list of steps for ensuring a successful connection.

a) Open the 'Littman' program on the middle PC in the cardio suite

b) Select which stethoscope (A or B) you would like to offload audio files from and click "Yes, connect now"



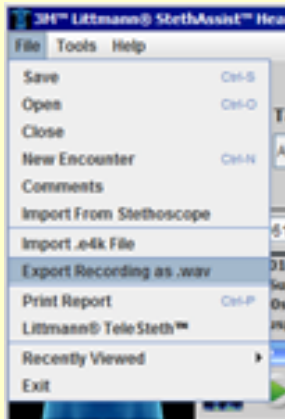
The three images show the Littmann Model 3200 stethoscope from different angles. The first image shows the 'M' button circled in red with a red arrow pointing to it. The second image shows the 'M' button circled in red. The third image shows the power button circled in red.

a) Turn on the stethoscope, press 'M' to access the menu

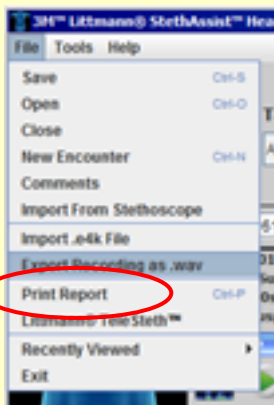
b) Select 'CONNECT' and press 'M' to activate the Bluetooth signal



### 3. How to import Tracks onto the PC



- a) Go to '**File**' – '**Import from stethoscope**'
- b) Enter patient ID (Case number) and name
- c) Ensure the Import from stethoscope onboard memory remains selected
- d) Click OK
- e) If import does not start automatically select '**PLAY**' to play the track you want to import



- c) The phonogram will be displayed. You can review the track again by pressing the green play button. This will play back through stethoscope.  
To playback using the PC speakers or headphones select '**Play to PC**'
- d) Go to '**File**' – '**Comments**'
- e) Add comments which should follow the agreed format – see below – which will be used to develop tags and identify the contents of the sound file.