

**Location:** Queen's University

**Responsibility:** Principal Investigators (PI), Research Staff, Veterinary Staff

**Purpose:** The purpose of this Standard Operating Procedure (SOP) is to describe basic cardiac and reproductive ultrasound processes for rodents.

1. **Introduction and Definitions:** 'Ultrasound' refers to sound waves with a frequency too high for humans to hear. In general, ultrasound used clinically is in the range 1-18 MHz; however, rodent machines operate at a much higher frequency to get far better resolution (typically 40-70MHz). Ultrasound images (sonograms) are made by sending a pulse of ultrasound into tissue using an ultrasound transducer. The sound waves hit a boundary between tissues (e.g. between fluid and soft tissue, soft tissue and bone) and are reflected back to the probe and relayed on to the machine, or travel further until they reach another boundary and get reflected. The machine calculates the distance from the probe to the tissue or organ (boundaries) using the speed of sound in tissue (5,005 ft/s or 1,540 m/s) and the time of the each echo's return (usually on the order of millionths of a second). The machine displays the distances and intensities of the echoes on the screen, forming a two dimensional image. Many different types of images can be formed using ultrasound. The most well-known type is a B-mode image, which displays the acoustic impedance of a two-dimensional cross-section of tissue. Other types of images can display blood flow, motion of tissue over time, the location of blood, the presence of specific molecules, the stiffness of tissue,
-

## 2. Materials:

Various transducer probes - probe that sends and receives the sound waves  
Central processing unit (CPU) - computer that does all of the calculations and contains the electrical power supplies for itself and the transducer probe  
Transducer pulse controls - changes the amplitude, frequency and duration of the pulses emitted from the transducer probe  
Display - displays the image from the ultrasound data processed by the CPU  
Keyboard/cursor - inputs data and takes measurements from the display  
Disk storage device (hard, floppy, CD) - stores the acquired images  
Printer  
Isoflurane and vaporiser  
Heating blanket or discs  
Eye lubricant  
Sterile swabs  
Adhesive tape  
Sterile needles  
Sterile syringes  
Lactated Ringer's solution or sodium chloride  
Depilatory cream (Nair)  
Ultrasound conducting gel (Ecogel)  
Rectal thermometer and lubricant (petroleum jelly)  
Recovery cage

## 3. Procedures:

Before beginning, turn on the ultrasound system and computer as well as the handling platform (ensure the correct platform is in place, e.g. mouse versus rat). Set-up the study parameters on the computer and ensure your desired transducer is in the active port.

Turn on oxygen gas and isoflurane. For induction in an adult mouse or rat use 4% isoflurane in oxygen until the animal has lost its righting reflex, then transfer to the pre-warmed handling platform and the nose-cone. Make sure the flow of 0.612 792 reW\*Q.00000912 0.612 792 reW\*BT/F2 I

---



**REPRODUCTIVE SCANNING:**

Umbilical artery Doppler can be performed on pregnant mice and rats from gestation day 10 onwards. When visualized, the animals abdomen/pelvis the umbilical cord can then be seen connected the crescent-shaped placenta to the fetus. Colour Doppler then can be applied to differentiate between umbilical artery and vein. Ensure the direction of blood flow aligns with the Doppler angle and is at least  $60^\circ$  (the lower the better). Fetal heart rate can then be determined from the umbilical artery PW Doppler cine loop. Spiral arteries and maternal channels are measureable in the mesometrial triangle and placenta, respectively, in rat only. The vessels are not visible enough in mouse to measure blood flow.

---