



This online training is required for any researchers or staff who wish to use the EchoMRI to measure the whole-body composition of awake small animals in the vivarium of Comparative Medicine.

Access to the EchoMRI requires a two-part training: This online component and a brief in-person component with a Preclinical Imaging staff member.

Overview

Scientific Background

Operating the Echo

Logging off and Saving Data

Echo Quiz

Overview

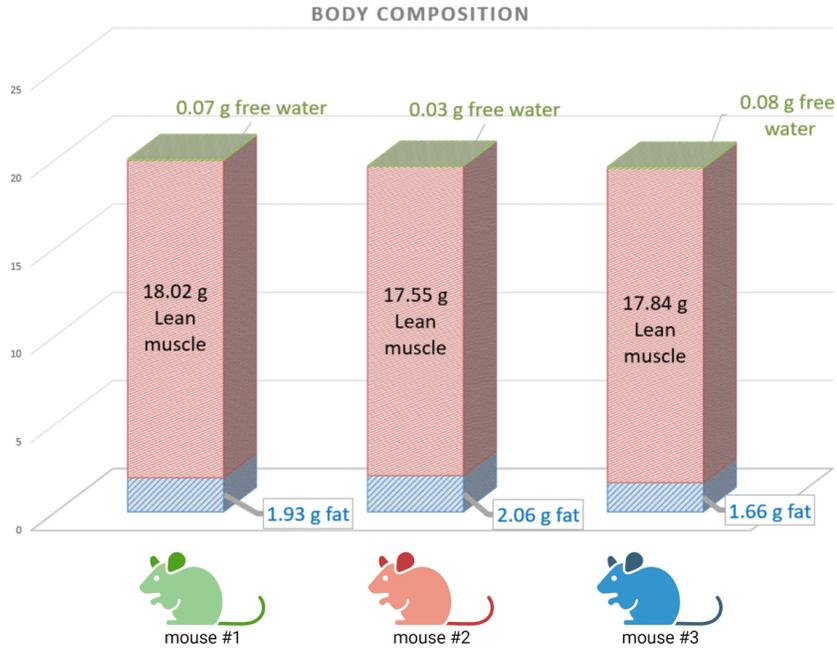
PI Preclinical Imaging

The EchoMRI performs whole body composition measurements of fat and water composition in live, awake small animals



Mouse body composition measurements that can be obtained via the EchoMRI

- Whole body composition measurements of fat and water composition in live, awake animals
- No need for anesthesia & no radiation or toxicity concerns
- Not a form of imaging, just whole-body measurements of fat tissue, lean tissue, free water & total water
- Soft tissue measurements only, does not account for bone weight



Example of some data that can be acquired using the EchoMRI

CONTINUE

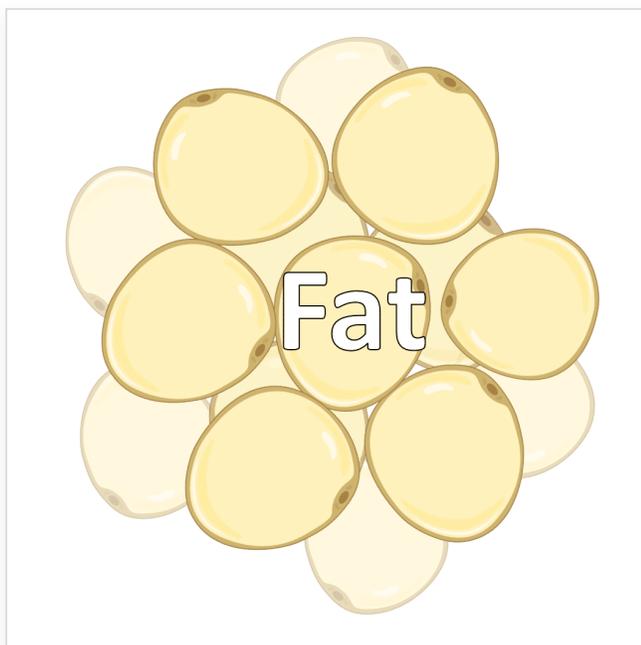
Scientific Background

PI Preclinical Imaging

The EchoMRI operates under the same principles that guide Nuclear Magnetic Resonance (NMR) spectroscopy and Magnetic Resonance Imaging (MRI). However it does NOT acquire images.

The EchoMRI acquires four principle measurements from the mouse (rather than images or a spectrum).

The Four Principal Measurements obtained with EchoMRI



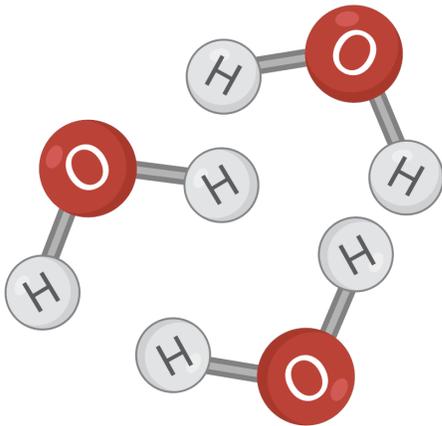
FAT: The mass of all the fat molecules in the body expressed as the equivalent weight of canola oil



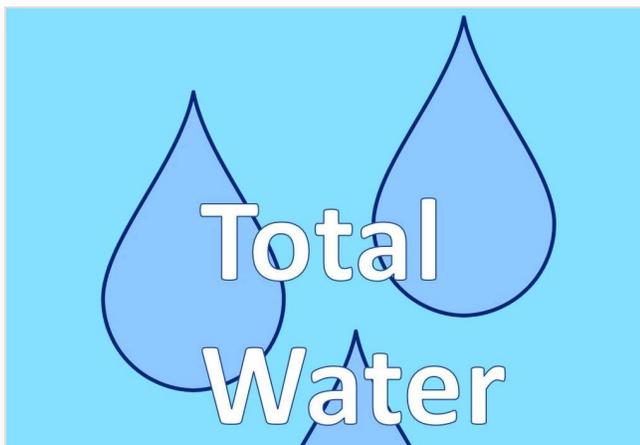


LEAN: Muscle tissue mass of all the body parts containing water, but excluding fat, bone minerals, and other substances like hair, claws, etc.

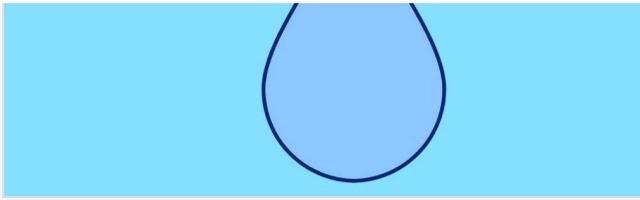
Free Water



FREE WATER: Contributions come mostly from the bladder. In experiments, for a limited time, water can be detected after it is injected into abdominal cavity of an animal, until it gets absorbed.



TOTAL WATER: Includes both the Free Water and the water contained in Lean Fat, which is all the water in the body. For normal animals, the hydration ratio (Total Water - Free Water) / Lean is



typically within a few percent of 80%.

How does the animal's weight compare with the sum of the above measured components?

$(\text{Weight}) = (\text{Lean}) + (\text{Fat}) + (\text{Free Water}) + (\text{Undetected substances}) + (\text{Systemic Errors})$

$(\text{Total Water}) = (\text{Free Water}) + (\text{Lean}_{[\text{water only}]})$

CONTINUE

Lesson 3 of 5

Operating the Echo

PI Preclinical Imaging

Set-up for Procedure

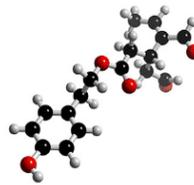
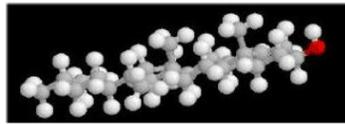
EchoMRI 2020 Body Composition Analyser

— □ ×

Folder ▾ System Test Repeat Scans Enter Template Review ▾ Help ▾



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
Scan: Primary Stage 2/2
Scan: Recovery 15 sec before Water Stage 1/1
Scan: Water Stage 1/1
Water Stage Completed
Completed scan 1/1
Scan ALL DONE

Mice ▾

Primary Accumulation 1 ▾

Water Stage Yes ▾

Step 1

iLab

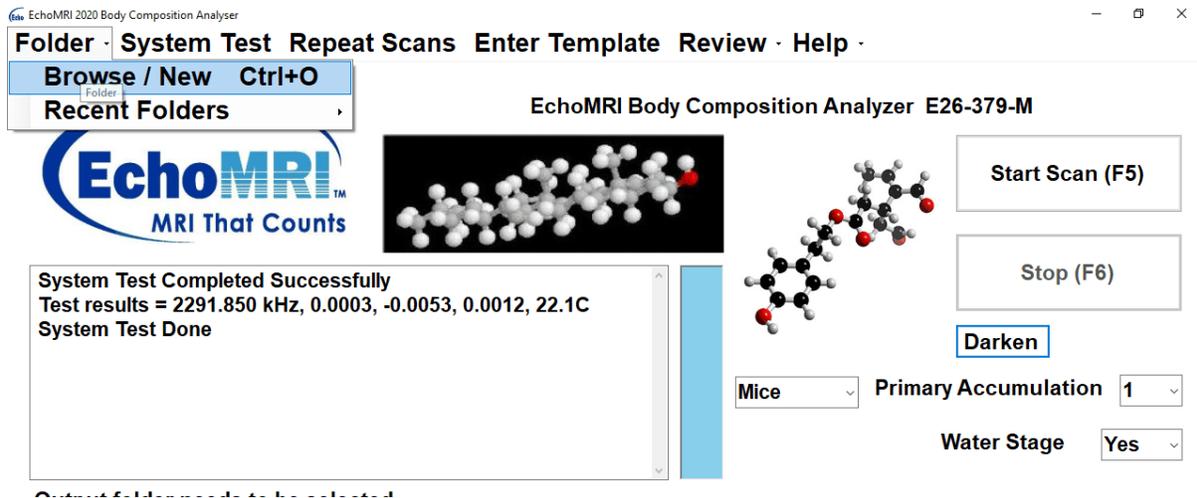


iLab

Reserve time in iLab and log in at the start of your session to turn the computer on.

Step 2

Computer configurations



- Wake up computer by pressing computer power button (I/O, top level) once.
- Open the EchoMRI software on the computer desktop.
- Set your data path in the software
 - click Folder>Browse/New
 - Follow the datapath format C:\Echo Scans**PI name****date**
 - New folders must be empty otherwise you will receive an error message. You may need to open File Explorer and make a new folder for today's date first before doing this.

Step 3

Canola Oil System Test



- Assemble canola oil system test sample as shown above
 - All materials are housed in the bottom drawer of the EchoMRI stand assembly. Use the canola oil vial labeled “35.1”.
- Place in machine with black arrow pointing towards back of machine.
- Click “System Test” in software (or “Alt + Y”)
 - After System test completes - if the Scan Stages Report window says “System Test Done” - proceed with experiment.
 - “System test failed”, two possible events have occurred:
 - A small deviation in allowed error was measured, which prompts a new Canola calibration to be started automatically.
 - A large deviation was measured and a warning message will display, prompting you to check that the sample was prepared properly. Verify that the machine has been on for more than >3 hours.

Step 4

Choosing the appropriate mouse holder



Weigh each mouse. Round the weight of the mouse to the nearest multiple of 10. Use this number to select the appropriate labeled sample holder from the white mesh cart.

For example, a 23 gram mouse should go into the sample holder labeled '20'.

Step 5

Be careful!



Echo Tubes are fragile. Please be careful when handling.

Summary

The system is now ready to measure the body composition of small animals!

Acquiring Animal Measurements





Unattach Velcro tab & remove clear inner tube

Put the mouse into the red tube and position it at the end by the air holes.
It is easiest to do this if the tube is held vertically while scruffing the mouse.



Reposition clear inner tube

Carefully put clear inner tube back, being very careful not to squish the mouse! Leave enough room for the mouse to turn around, but not enough so that it can run back and forth through the tube. Reattach the Velco strap to secure the placement of the clear tube.



Push red tube into chamber

The mouse-end of the tube goes in first.

The clear collar will bump up against the surface of the machine.

Be careful not to bump against the clear inner tube, as it can squish the mouse if pushed upon.



"Start Scan" (or F5) in software

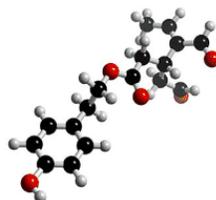
Input label, comments, and other identifiers like weight if necessary

See the next section for further data acquisition options!

Further Interface Options



EchoMRI Body Composition Analyzer E26-379-M



Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation

Water Stage

Output Folder = C:\EchoScans\Animal Imaging\20210928\

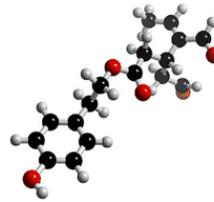
Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

Start Scan

Yields a prompt to input the mouse label, weight (in grams), and any other comments.



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Mice

Primary Accumulation +

Water Stage Yes

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Output Folder = C:\EchoScans\Animal Imaging\20210928\

Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

Primary Accumulation

How many measurements to take.

- "1" takes 1 measurement (default setting)
- "3" takes the same measurement 3 times in a row, then averages the results together



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation 1

Water Stage Yes

Output Folder = C:\EchoScans\Animal Imaging\20210928\

Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

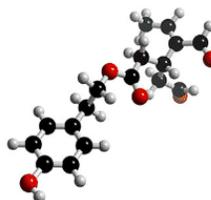
Data Table

Shows results from each scan.

This data can be exported to an excel sheet at end of experiment.



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Mice

Primary Accumulation 1

Water Stage Yes

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Output Folder = C:\EchoScans\Animal Imaging\20210928\

Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

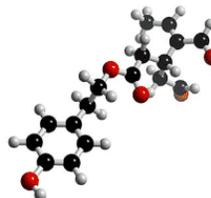
Water Stage

'Yes' is default setting and yields total water and free water measurements.

'No' will only collect Fat and Lean values.



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation 1

Water Stage Yes

Output Folder = C:\EchoScans\Animal Imaging\20210928\

Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

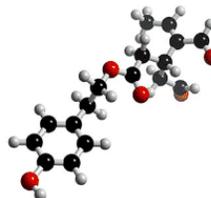
Repeat Scans

Automatically repeats any number of scans of the same sample without requiring re-input of sample information each time.

In comparison to “Primary Accumulation = 3”, Repeat Scans inserts automatic wait times between scans (at least 20 seconds between each scan) but you get each measurement individually rather than averaged together.



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation 1

Water Stage Yes

Output Folder = C:\EchoScans\Animal Imaging\20210928\

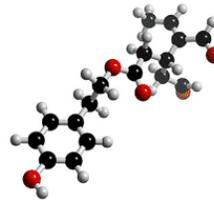
Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

Enter Template

Best for situations where many mice are being imaged on many different occasions.
 Saves settings so that labels don't need to be re-input every time.



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation 1

Water Stage Yes

Output Folder = C:\EchoScans\Animal Imaging\20210928\

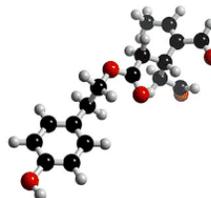
Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

Stop

Aborts a scan mid-acquisition



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1 +
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation 1

Water Stage Yes

Output Folder = C:\EchoScans\Animal Imaging\20210928\

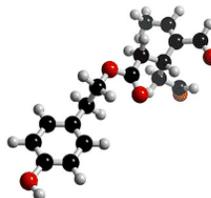
Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

Status Box

Yields what the status of a scan is as it is being acquired.



EchoMRI Body Composition Analyzer E26-379-M



Start Scan (F5)

Stop (F6)

Darken

Scan: Primary Stage 1/2
 Scan: Primary Stage 2/2
 Scan: Recovery 15 sec before Water Stage 1/1
 Scan: Water Stage 1/1
 Water Stage Completed
 Completed scan 1/1
 Scan ALL DONE

Mice

Primary Accumulation 1

Water Stage Yes

Output Folder = C:\EchoScans\Animal Imaging\20210928\

Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

Review

Options to save or export data, generate statistics, or edit data that has already been acquired.

CONTINUE

Lesson 4 of 5

Logging off and Saving Data

PI Preclinical Imaging

Saving Data & logging off

	A	B	C	D	E	F
1	RecNumb	Label	Fat	Lean	FreeWater	TotalWater
2		1 mouse1	1.93	18.02	0.07	15.57
3		2 mouse2	2.06	17.55	0.03	15.16
4		3 mouse3	1.66	17.84	0.08	15.78
5		4 mouse3	1.52	17.87	0.13	16.63
6		5 mouse3	1.54	18.44	0.16	16.23
7						
8						

This process will describe how to back up your data to the homelink network drive then log off from the computer

Step 1

Export data table

Folder · System Test Repeat Scans Enter Template Review · Help ·

EchoMRI Bod

EchoMRI
MRI That Counts

Scan: Primary Stage 1/2
Scan: Primary Stage 2/2
Scan: Recovery 15 sec before Water Stage 1/1
Scan: Water Stage 1/1
Water Stage Completed
Completed scan 1/1
Scan ALL DONE

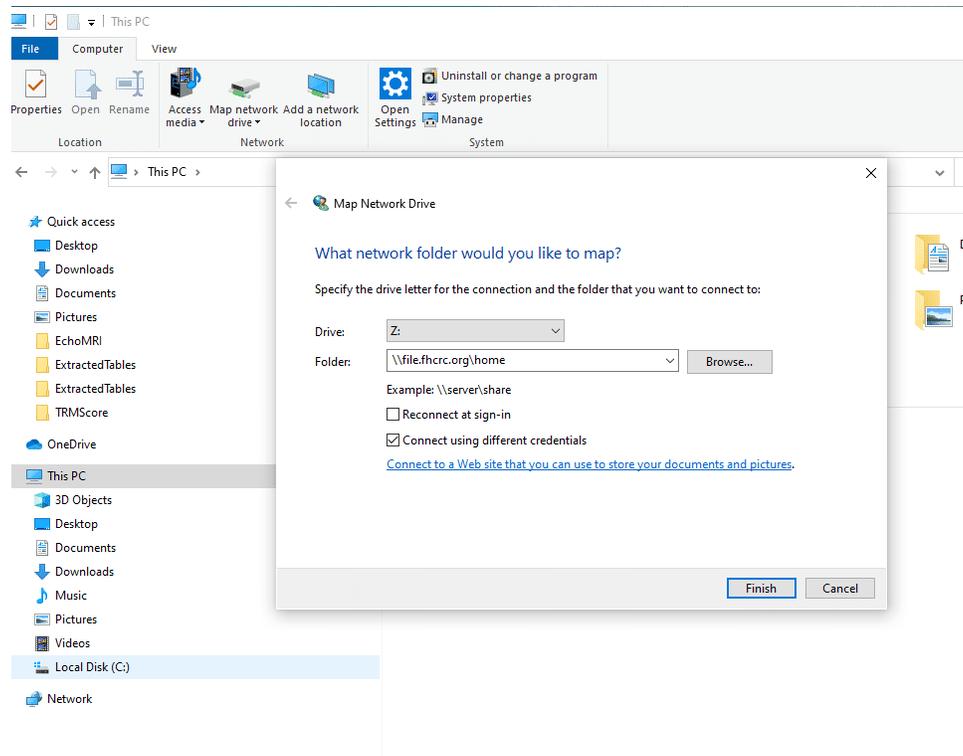
Output Folder = C:\EchoScans\Animal Imaging\20210928\

Num	Label	Fat (g)	Lean (g)	F.Water (g)	T.Water (g)	Time, Date; Duration (s); User	Acc	Weight	Comments
1	Tst	35.15	0.00	0.02	1.41	12:41:22; 28 Sep 2021; 67; ems	1		

1. Select the data you wish to save from the Scan Results table (click + shift on each entry)
2. Click Review>Extract Table OR press F8 and save to the desired file location
3. If desired, save statistics (mean and standard deviation values) via Review>Selected Statistics

Step 2

Transfer data onto homelink

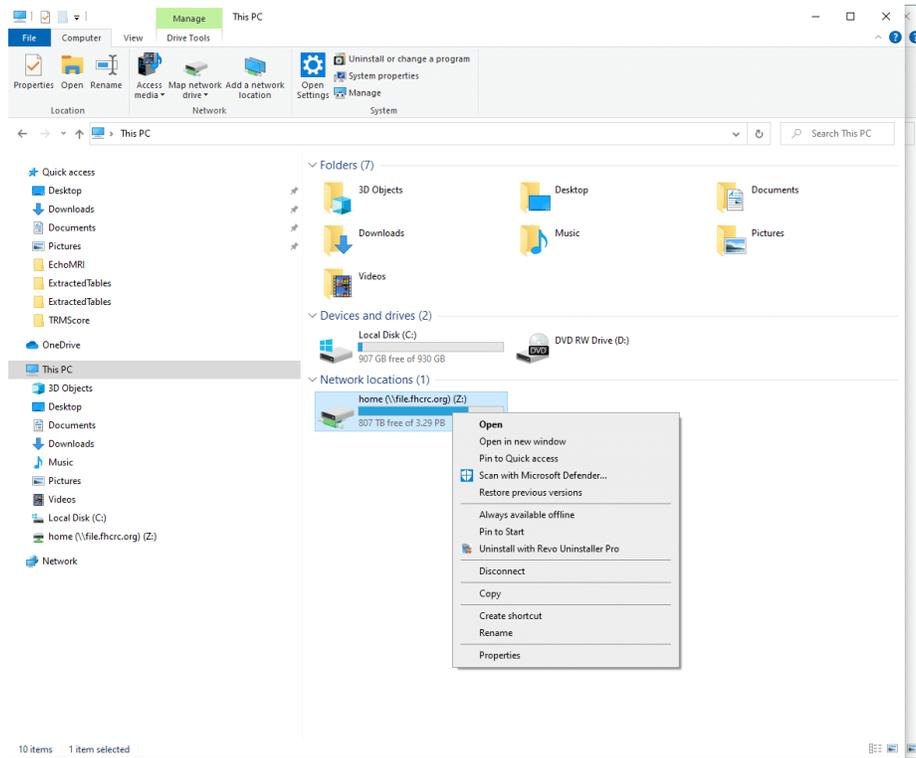


1. Open file explorer (the folder icon), go to “This PC”, click and select “Map network drive” from the banner on top.
2. Select “Drive: Z:” and input “\\file.fhcr.org\home”
3. Check “Connect using different credentials”.
4. Log in with your Hutch email address and password
 - a. it is very important that for the email address you put yourHutchUsername@**fhcr.org** , not @fredhutch.org!
5. Transfer data from the folder on computer to the selected folder in your home drive
6. When finished, right click on the mapped drive, and click disconnect.

7. When back at your personal work computer, back up the data from the Z: drive to an additional location.

Step 3

Close software, disconnect from network drive, and log out of iLab



- To close the software simply X out of the software
- Disconnect from your network drive by going to "This PC" and right clicking on the Z: drive. Then select 'Disconnect'.
- Log out of iLab so that you are not charged for more time.

Step 4

Clean up

- Clean the inner clear tube with T-Spray or LABSAN (no ethanol)
- Use long tube with paper towels and T-Spray or LABSAN to clean the inside of the red tube

Thank you for completing this module!



Please continue on to the quiz if you have not completed the in-person training yet.

We recommend revisiting this module whenever a refresher on how to use the Echo is needed!

i Please note you will not be able to use the EchoMRI until you have completed a brief in-person training. You should receive an email to schedule this soon, but feel free to contact preclinicalimaging@fredhutch.org with any questions.

Click below if you would like to save a PDF of this training for future reference or to print out for your records

 **echo-mri-instrument-online-training-4HeEF3Fq (1).pdf** 
9.5 MB

CONTINUE

Lesson 5 of 5

Echo Quiz

PI Preclinical Imaging

Complete the following quiz to complete the online-training portion of the EchoMRI training

Question

01/04

Why is this machine called an EchoMRI even though it does not take images?

- The EchoMRI operates upon the same principles that guide MRI and NMR spectroscopy
- The EchoMRI uses echolocation just like MRIs do
- It is called an MRI because it can take pictures of the mice

Question

02/04

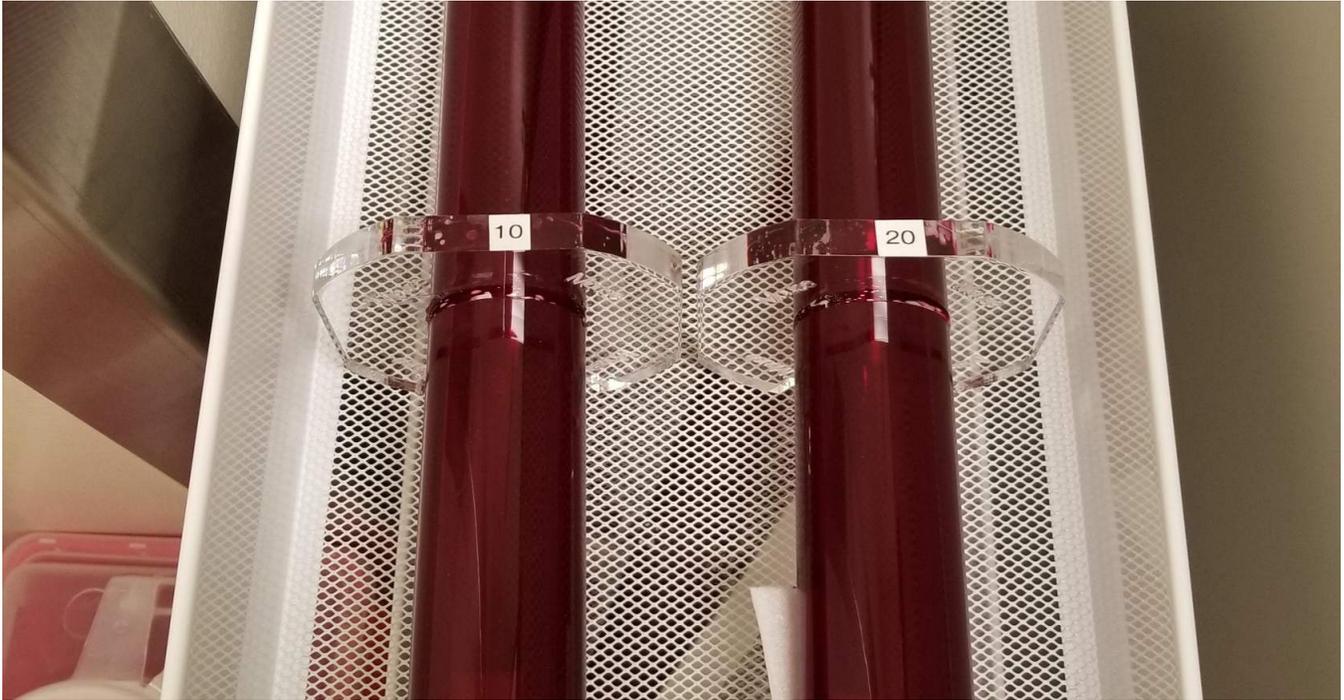
Why should you run a system test before taking any other measurements?

- To calibrate the EchoMRI and to make sure your animal measurements are accurate
- We don't need to do this, it adds unnecessary extra work
- Because we need to know the fat composition of canola oil

Question

03/04

What does the label on the red tubes indicate?



- The length of the tube
- The circumference of the magnet used to take the measurements
- The approximate weight (in grams) of the mouse that should be put inside the tube
- The approximate weight (in pounds) of the mouse that should be put inside the tube

Question

04/04

What do you need to do when you are finished using the EchoMRI? (Select all that apply)

- Thoroughly clean mouse housing tubes
- Alert Preclinical Imaging that you are done using the machine
- Export data table
- Alert Comparative Medicine that you are done using the machine
- Save data to Homelink then disconnect from network
- Log out of FOM