



臺北醫學大學

TAIPEI MEDICAL UNIVERSITY

Technical Services of TMULAC animal MRI

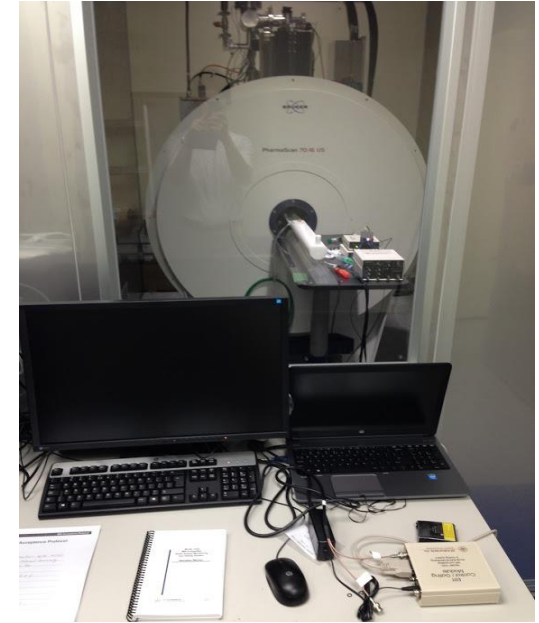
Technical Specialist : WU WEN CHI

2020. 12. 25

Bruker 7T PharmaScan



- **Gradient** : B-GA9S HP
 - (一) Inner Radius : 9 cm
 - (二) Gradient magnetic field : 380 mT/m
- **RF coil** :
 - (一) Rat Volume Coil (Inner Radius : 72 mm)
 - (二) Rat Surface Coil
 - (三) Mouse Volume Coil (Inner Radius : 40 mm)
 - (四) Mouse Surface Coil
- **Software** : ParaVision 6.0
- **Performance** :
 - (一) Physiological monitoring system : Breath Rate 、 Body Temperature 、 Pulse 、 BloodOxygen 、 ECG 。
 - (二) Analysis system : ParaVision 6.0
 - (三) Pulse Sequence : Cardiac Package, Diffusion Package, Angiography Package, Pulsed ASL Perfusion Package, fMRI and DCE Package, Short Echo Time Package, Relaxation Package, Spectroscopy Package
- **PC**
- **Animal Bed** : Rat Bed *1 、 mice Bed*1
- **Anesthesia system**
- **Water Bath**
- **UPS**



Imaging Procedure

1. Alignment & Precession

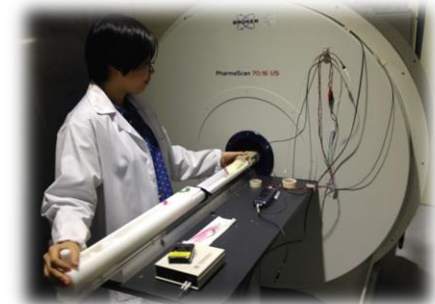
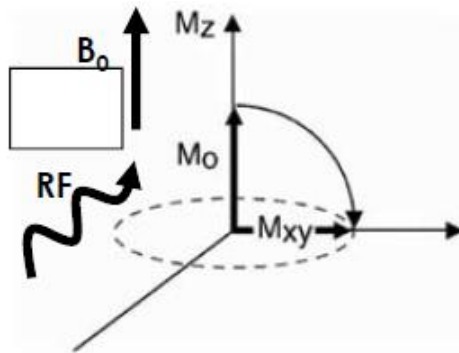
Put target to the high throughput magnetic field(B_0). Make proton precession in specific direction.

2. Resonance

Giving a RF pulse with best frequency and vertical to B_0 direction. Change the direction of proton precession.

3. MR signal & Relaxation time

After RF pulse, the proton precession recover to the direction as B_0 , and emit signal to make image.



The Pulse Sequence We Supply



- T1-GRE : T1 weighted Gradient Recalled Echo
 - T2-SE : T2 weighted fast spin echo
 - MRA : magnetic resonance angiogram
 - SWI : susceptibility weighted imaging
 - Resolution
 - Normal : 156um
 - High : 60~80um
-

Term



- **T1 Relaxation Time:**

The time that proton recover to longitudinal magnetization after RF pulse.

- **T2 Relaxation Time:**

The time that proton decay of transverse magnetization after RF pulse.

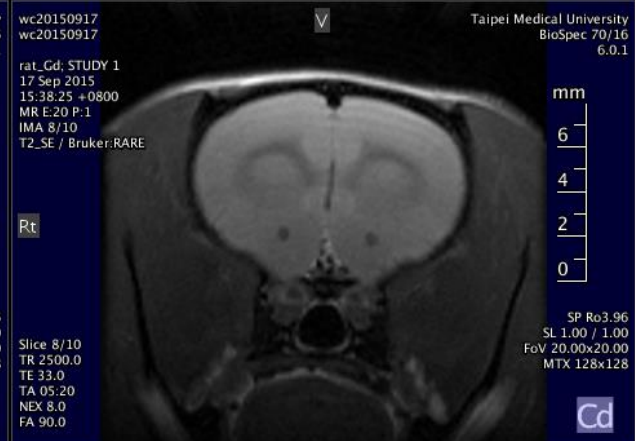
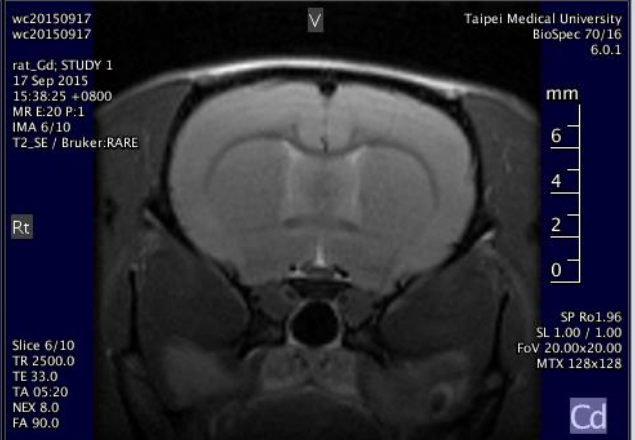
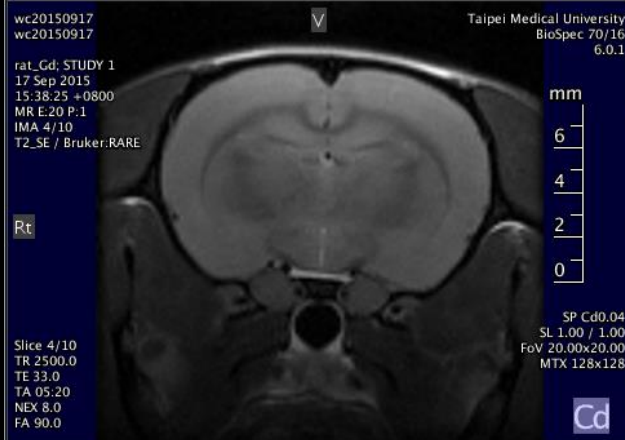
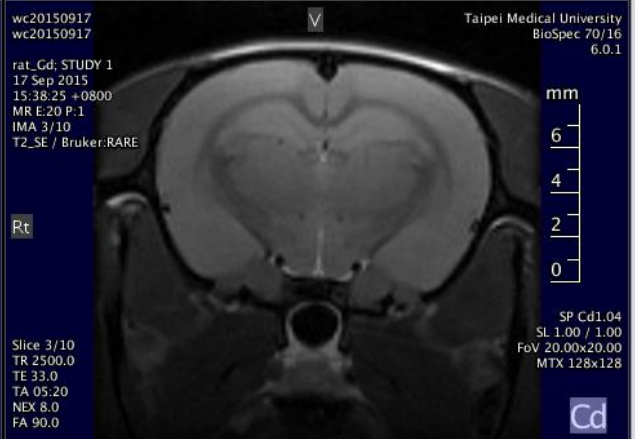
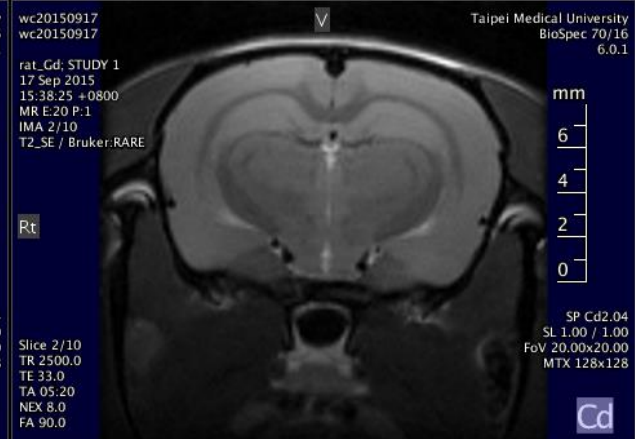
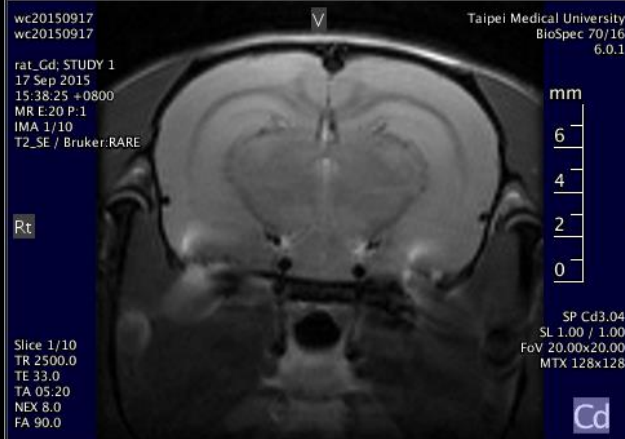
- T1 and T2 are inherent properties of specific tissue.

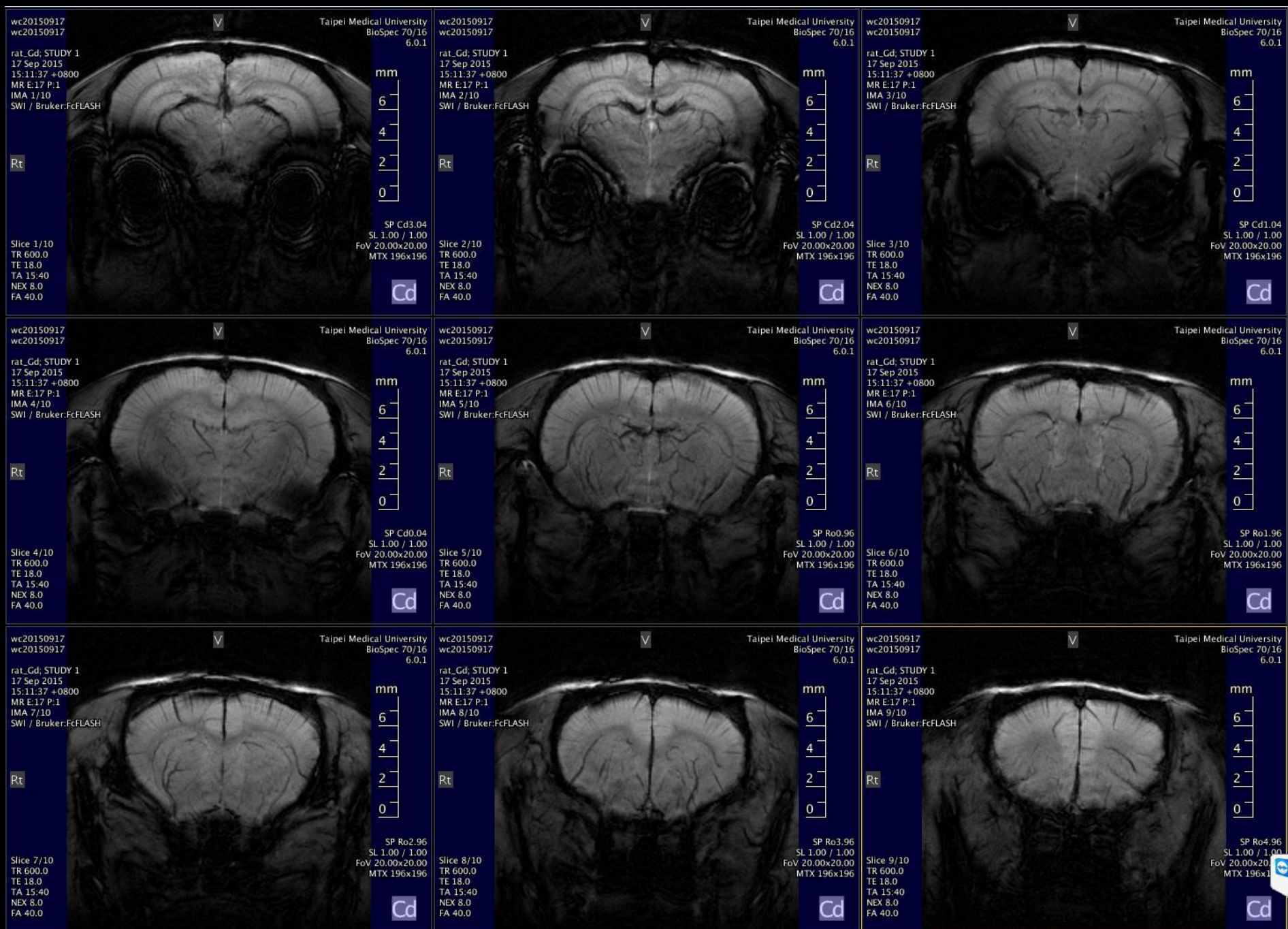
- T1W or T2W

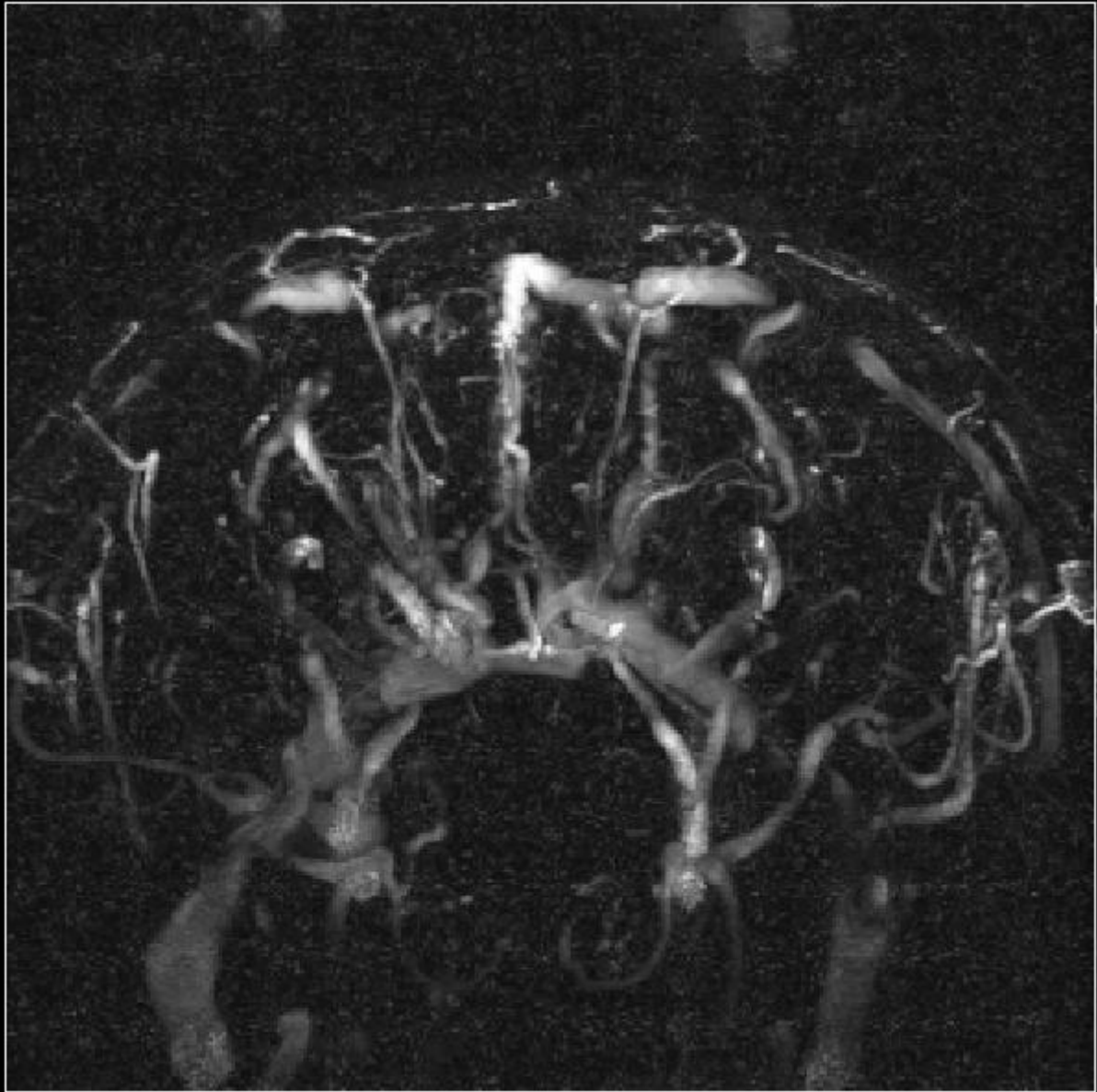
The imaging method that emphasize the different T1 or T2 among tissue that make different contrast.

Property of Pulse Sequence

1. Gradient Recalled Echo (GRE)
 - a. Saving time
 - b. To increase the effect of uneven magnetic susceptibility, suitable for hemorrhage
 - c. Serious artifact
 - d. Sensitive to uneven magnetic field
 2. Fast Spin Echo (SE)
 - a. Less artifact
 - b. Tolerate to uneven magnetic field
 3. MRA
Emphasize blood vessel
 4. SWI
 - a. To increase the effect of uneven magnetic susceptibility, suitable for hemorrhage
 - b. Serious artifact
-



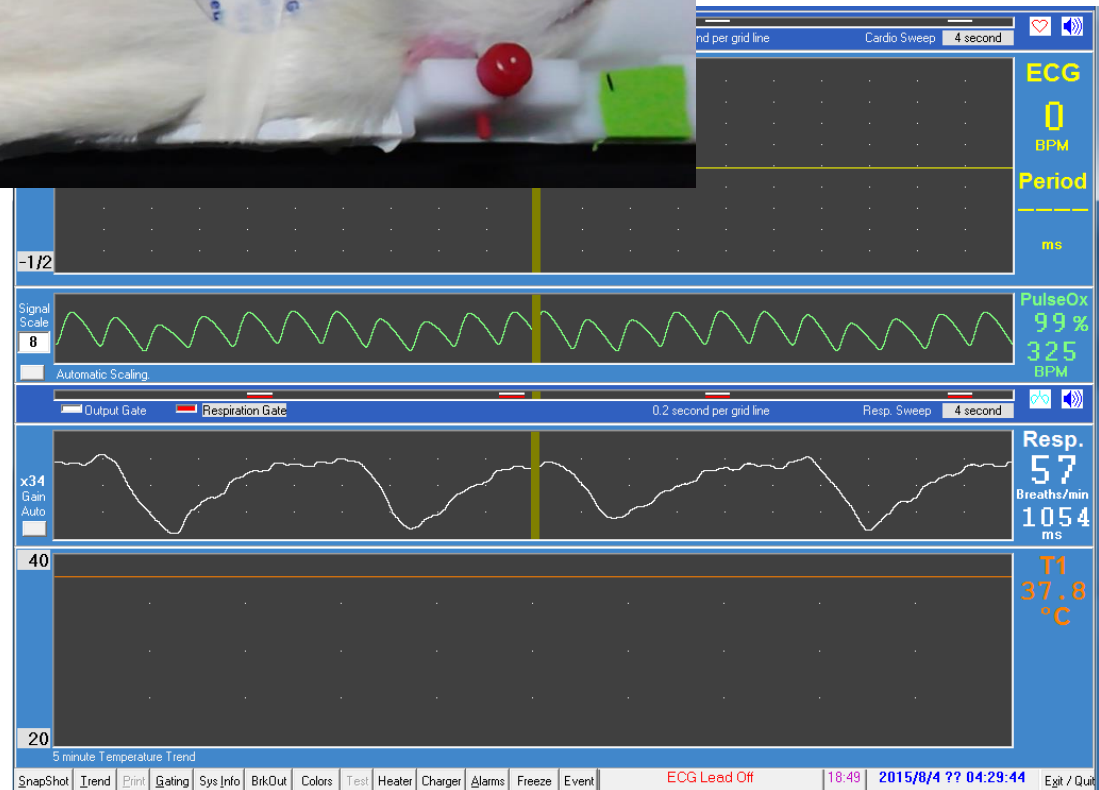




Physiological monitoring system



1. Pulse Oxygen
2. BPM
3. Respiration rate
4. Tempereration



Contrast Agent



蓋多維斯[®] 1.0 (Gadovist[®] 1.0)

蓋多維斯1.0(Gadovist 1.0) 產品資訊

產品中文名	蓋多維斯1.0
產品英文名	Gadovist 1.0
主成份	每毫升的注射液含1.0毫莫耳gadobutrol (相當於604.72毫克gadobutrol)
劑型	注射劑
許可證字號	衛署藥輸字第 023884 號 本藥限由醫師使用



適應症

顱部和脊髓磁振造影 (MRI) 增強作用、乳房磁振造影(MRI) 增強作用、腹部磁振造影(MRI)增強作用(肝臟)、骨盆磁振造影 (MRI)增強作用(前列腺和子宮)、後腹腔磁振造影(MRI)增強作用(腎臟)、肢端和肌肉骨骼系統磁振造影(MRI)增強作用、血管磁振造影增強作用(CE-MRA)

古爾貝特 業務:葉浚昌

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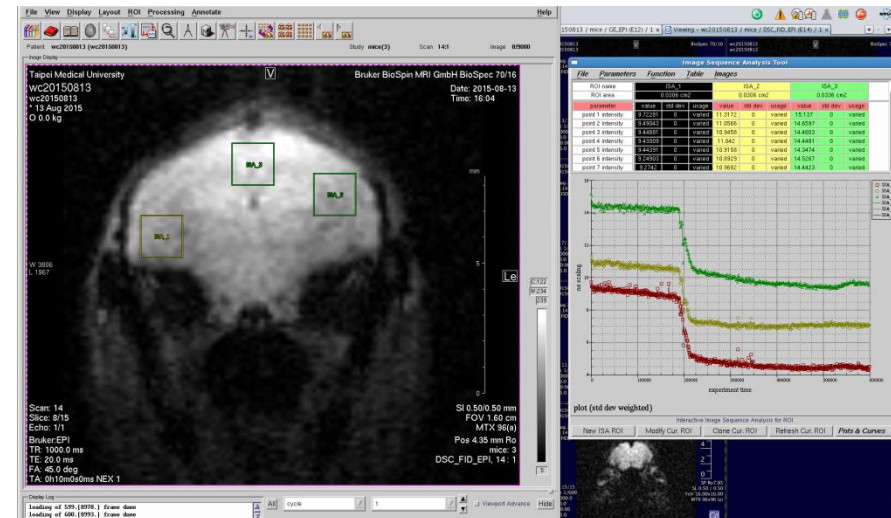
拜耳

業務:顏勝宏

0933018516

The Necessity of Contrast Agent

- More scan time
- Higher mortality rate
- BBB leakage



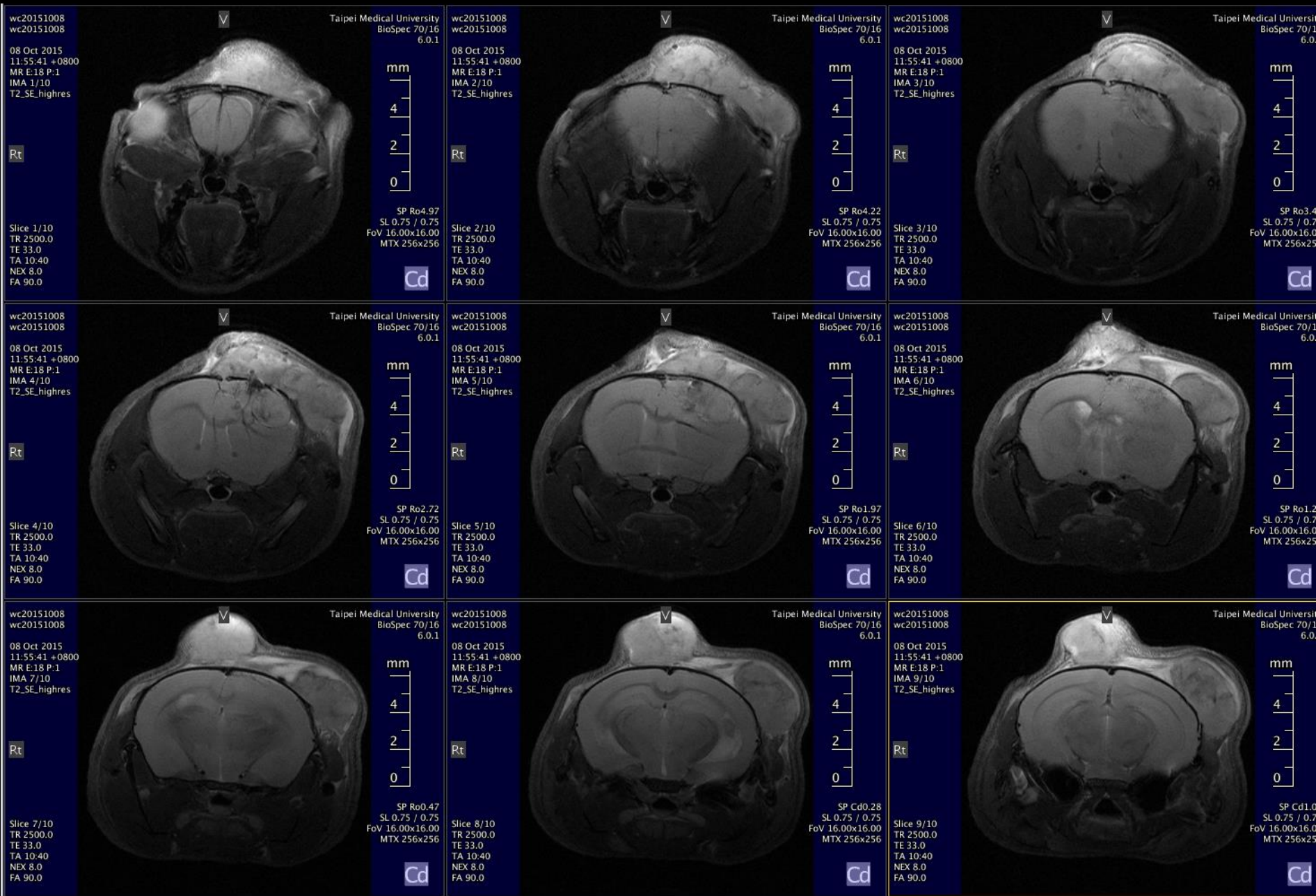
Application

- Morphology quantitative analysis
- Animal Neuroscience
- Tumor
- Adipose Tissue
- Hemodynamics
- Heart Function
- Kidney Function

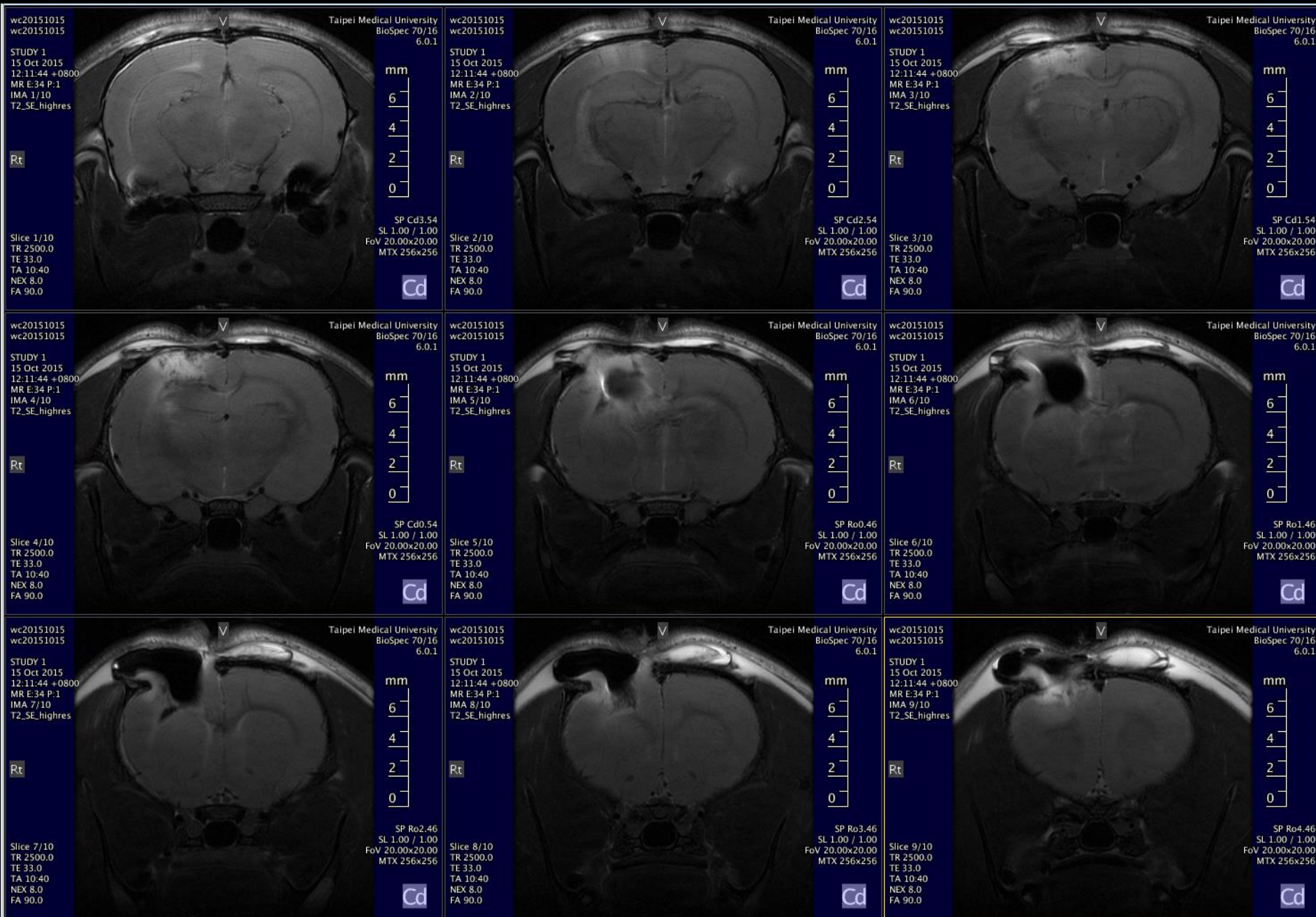


Image processing

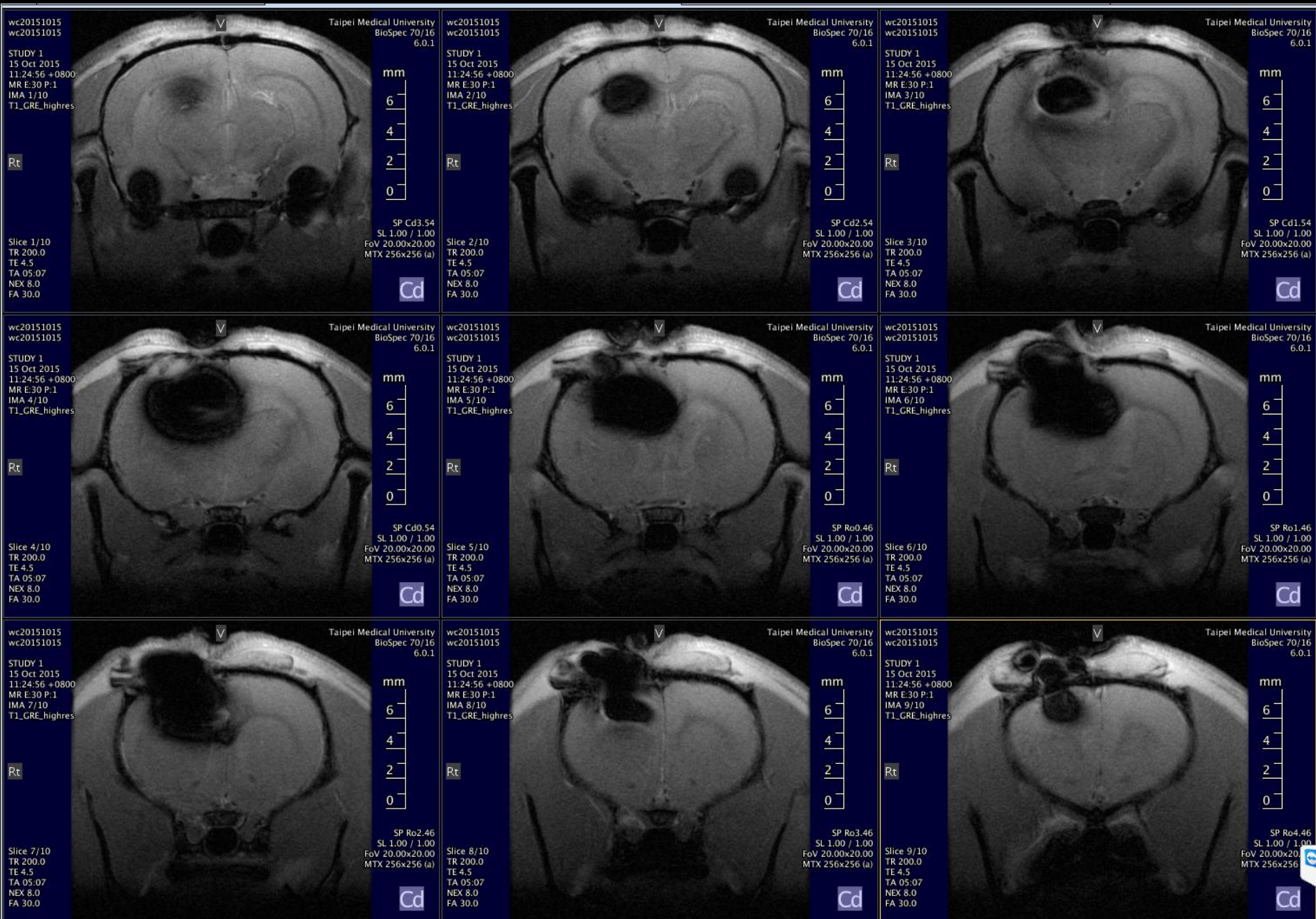
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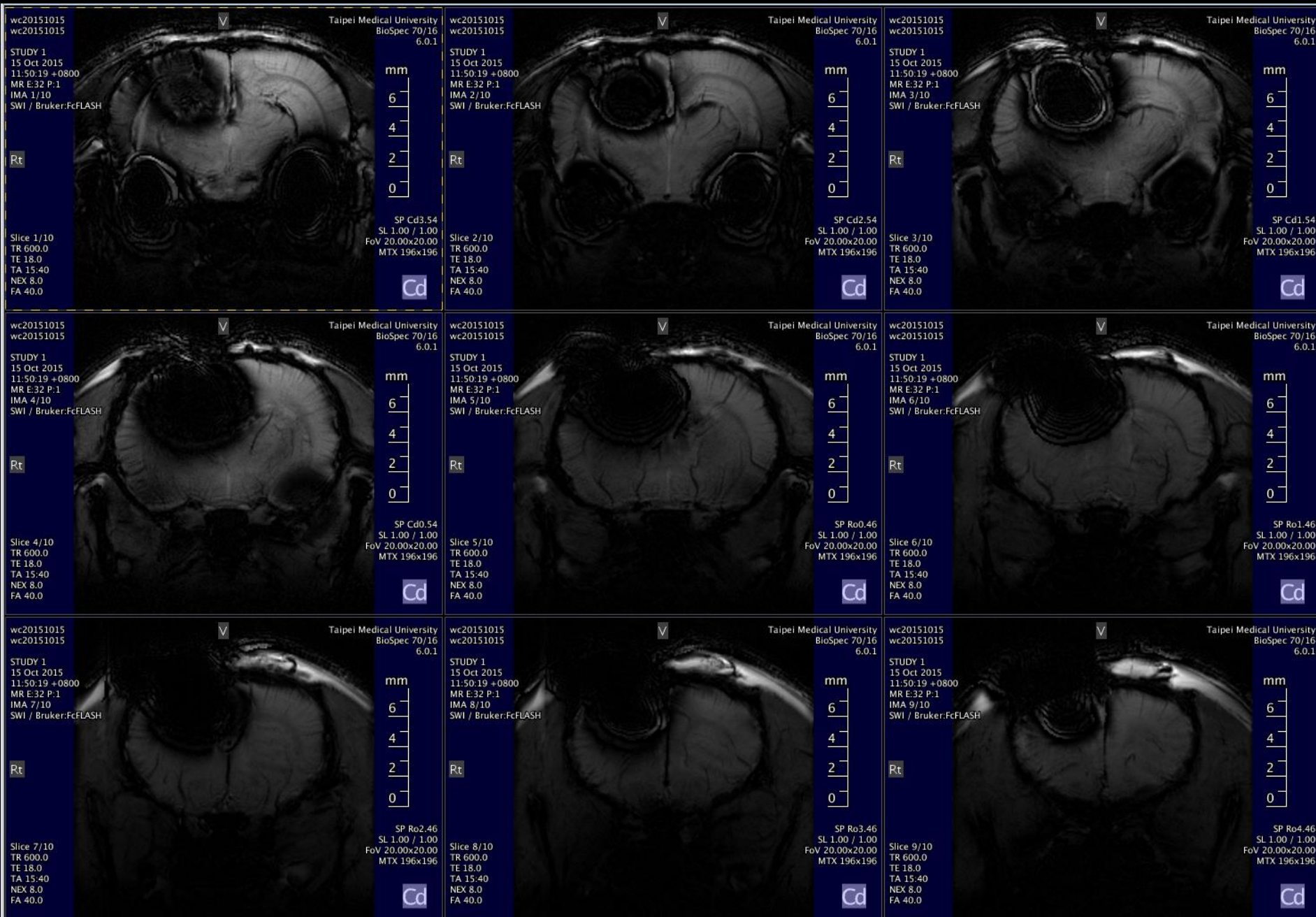
Null mice_Brain Tumor_T2

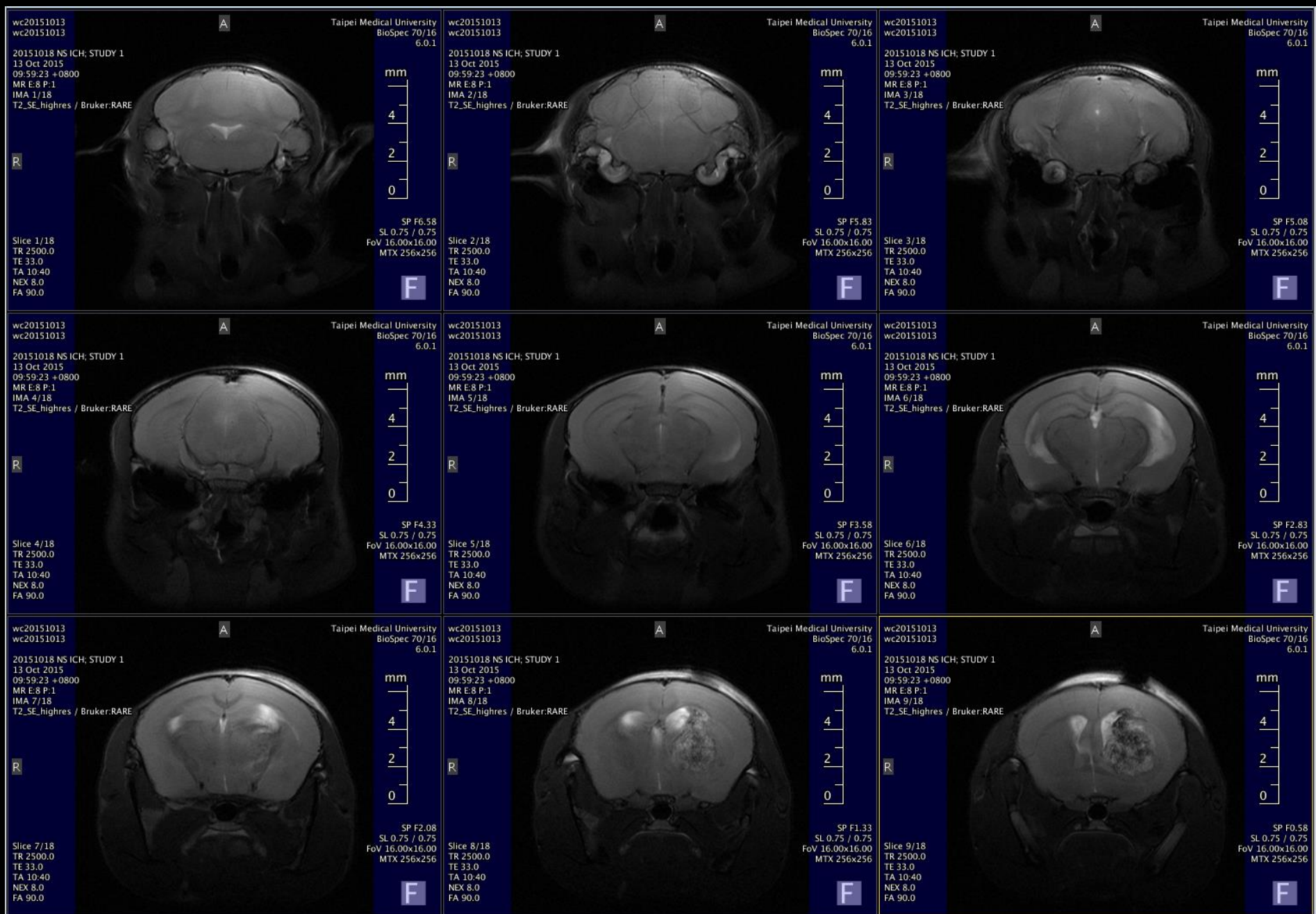


Rat_TBI_T2

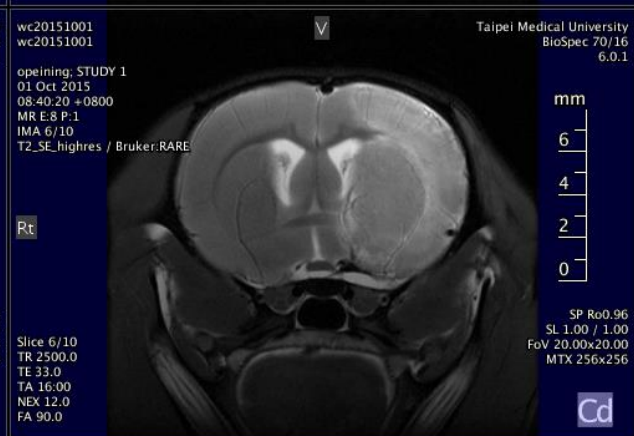
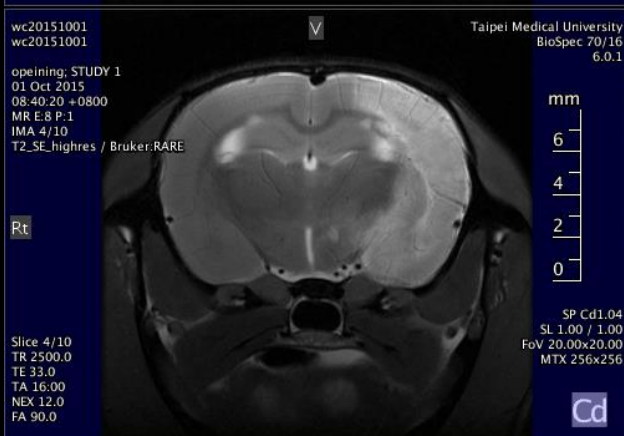
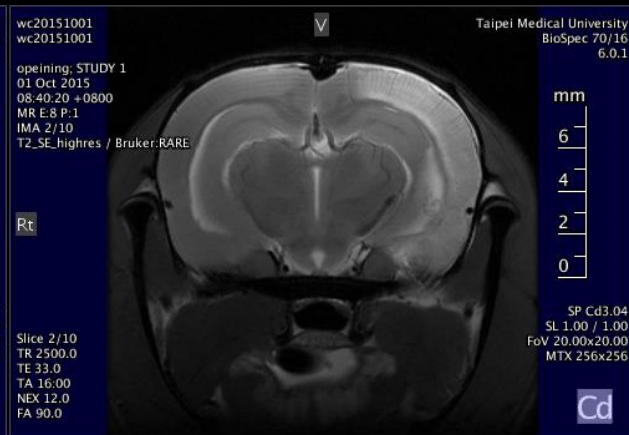


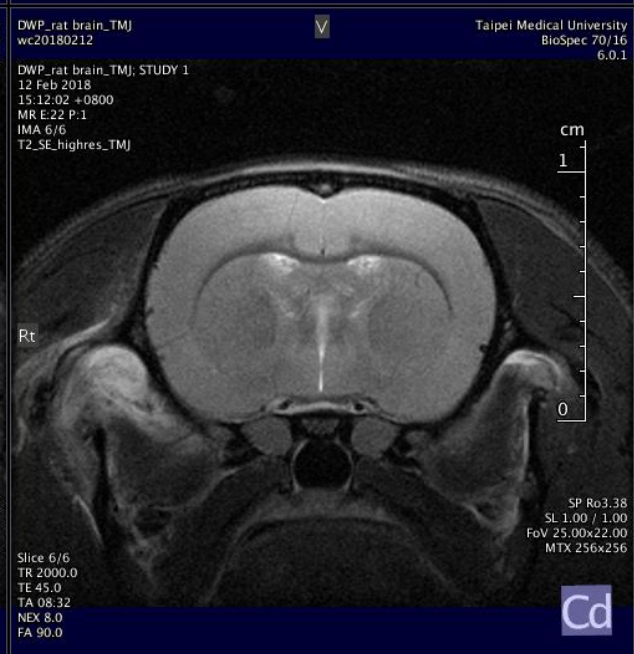
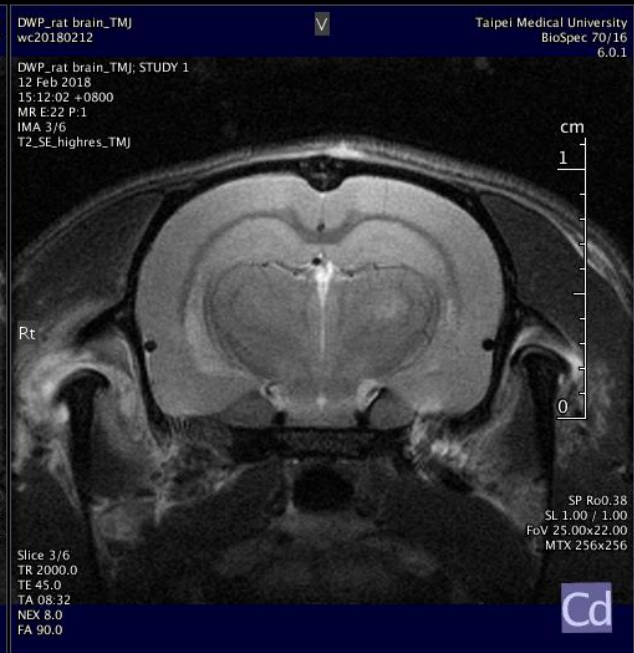
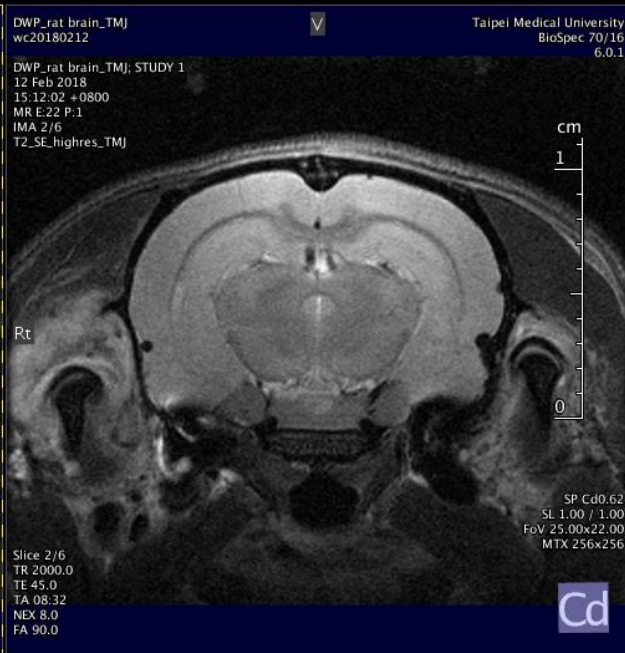
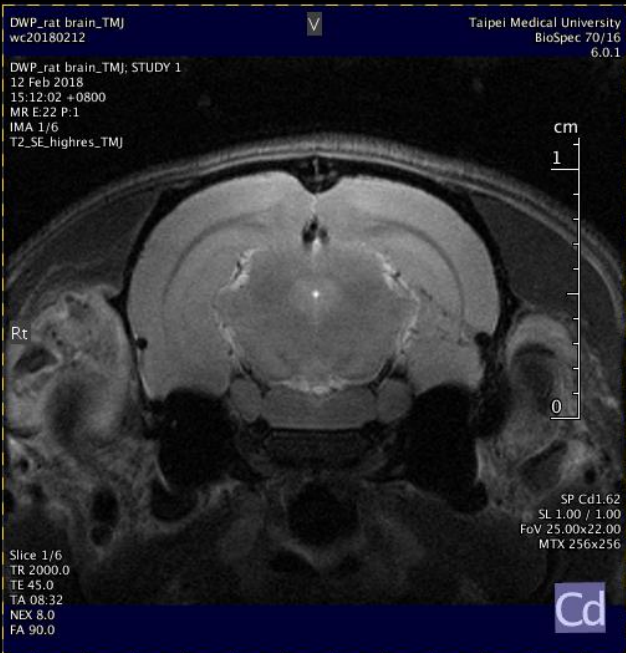
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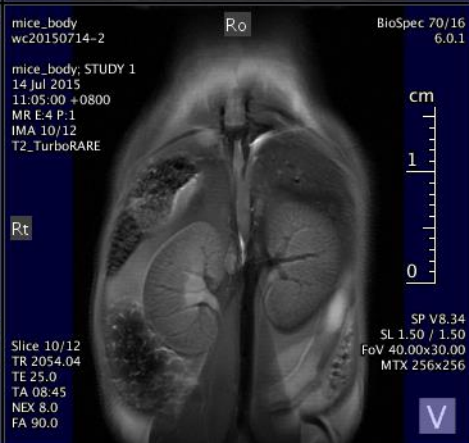
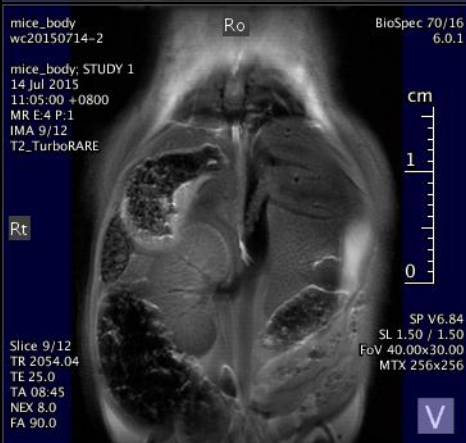
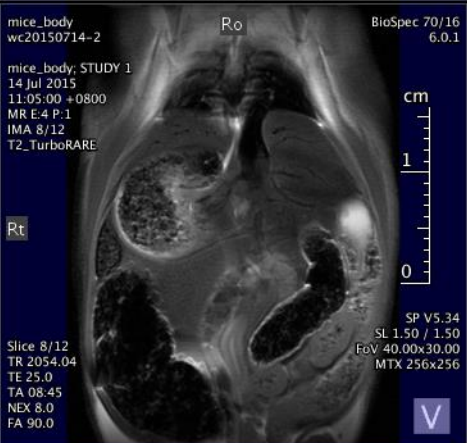
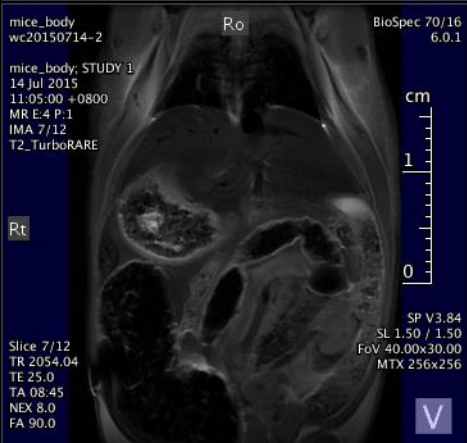
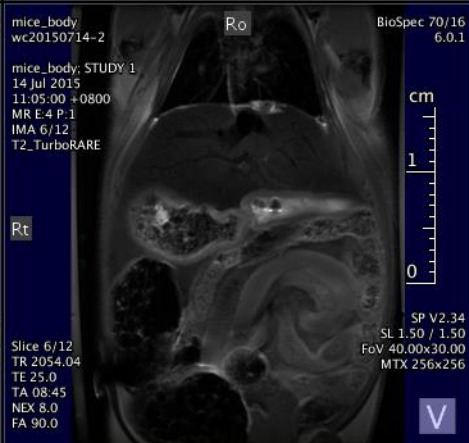
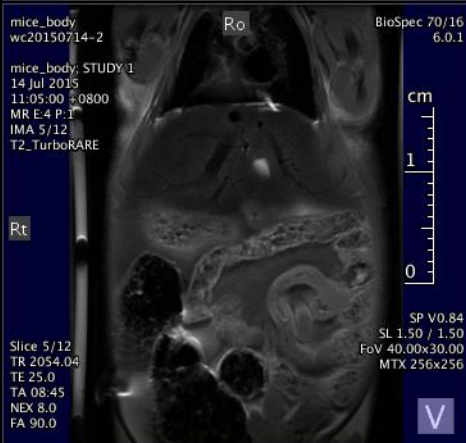
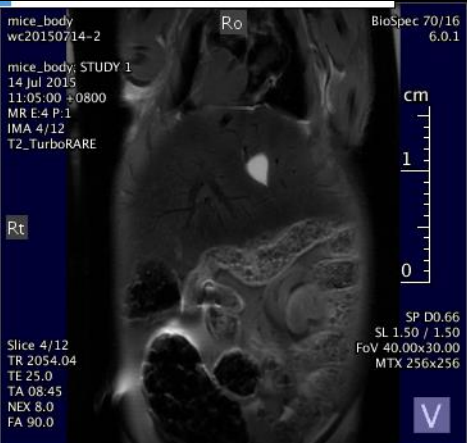
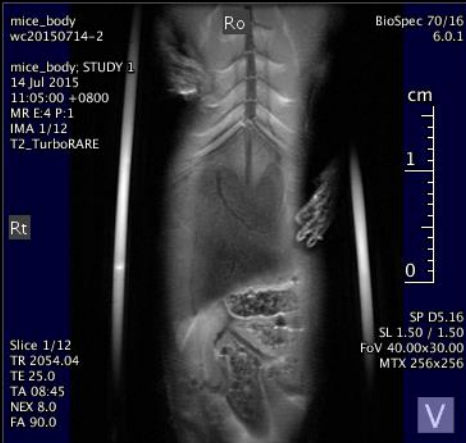


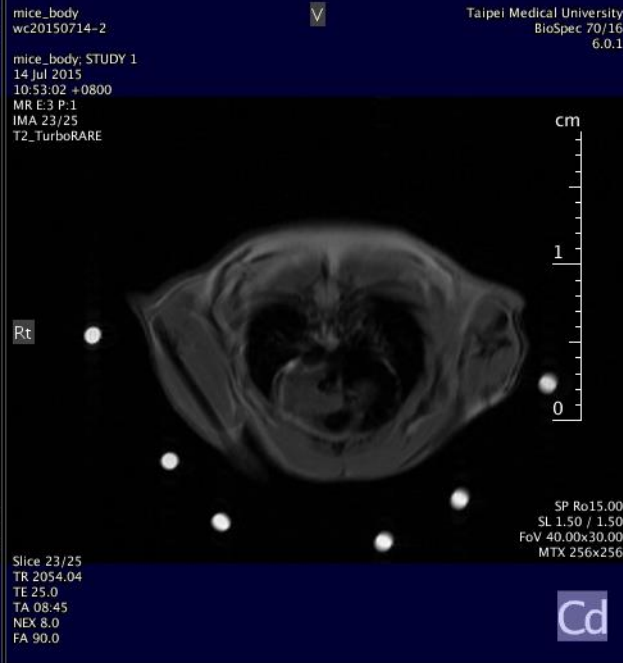
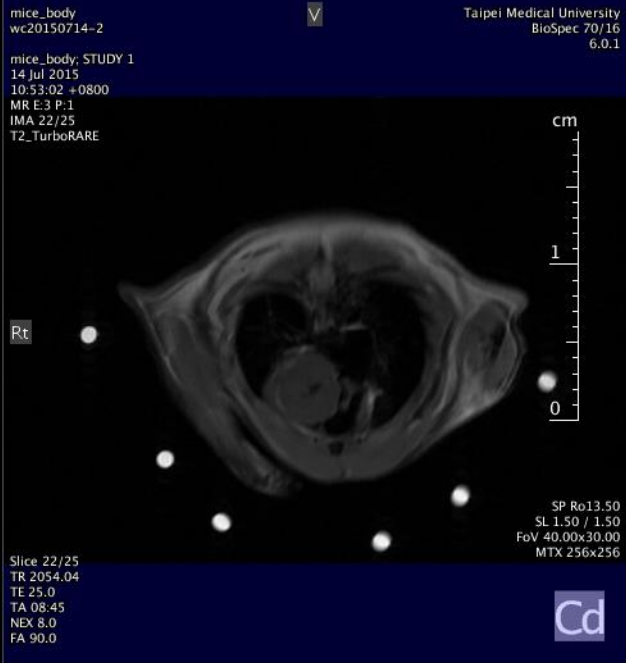
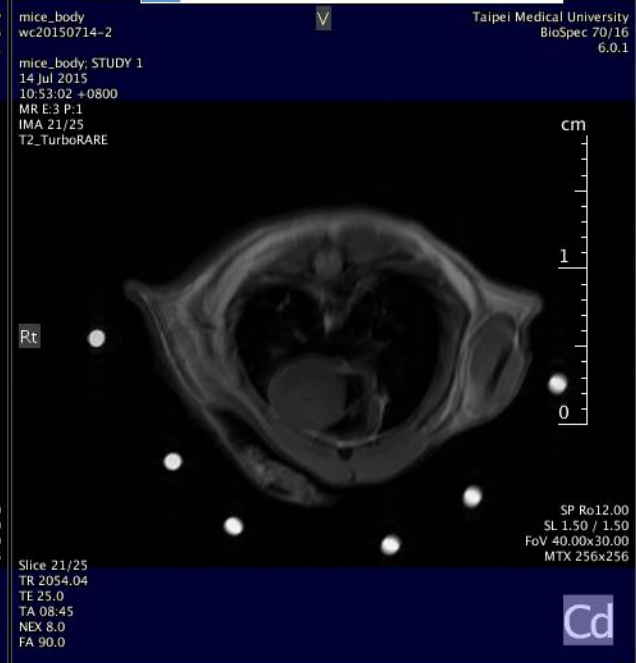


Mice_collagenase-induced ICH_T1









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wc20150714-2

Taipei Medical University
BioSpec 70/16
6.0.1

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MR E:3 P:1
IMA 13/25
T2_TurboRARE

cm

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Slice 13/25
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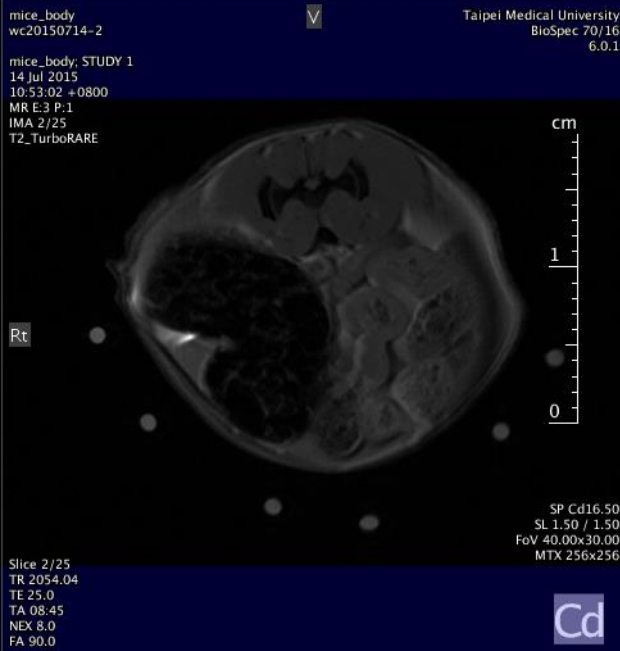
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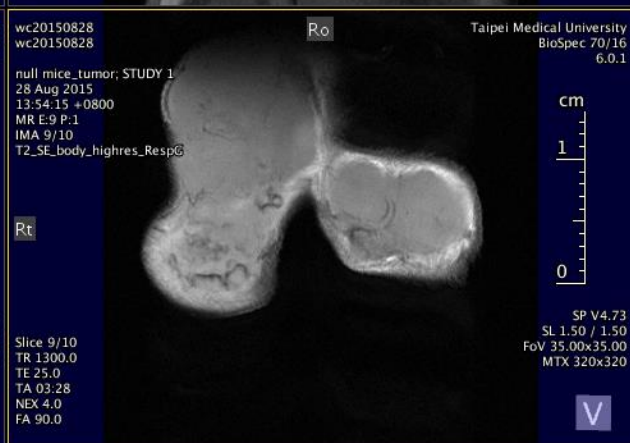
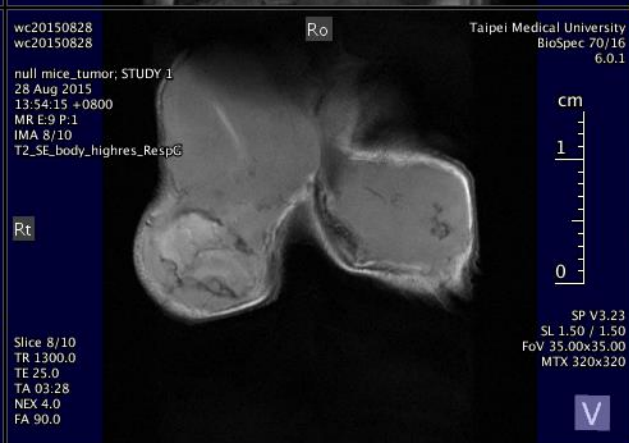
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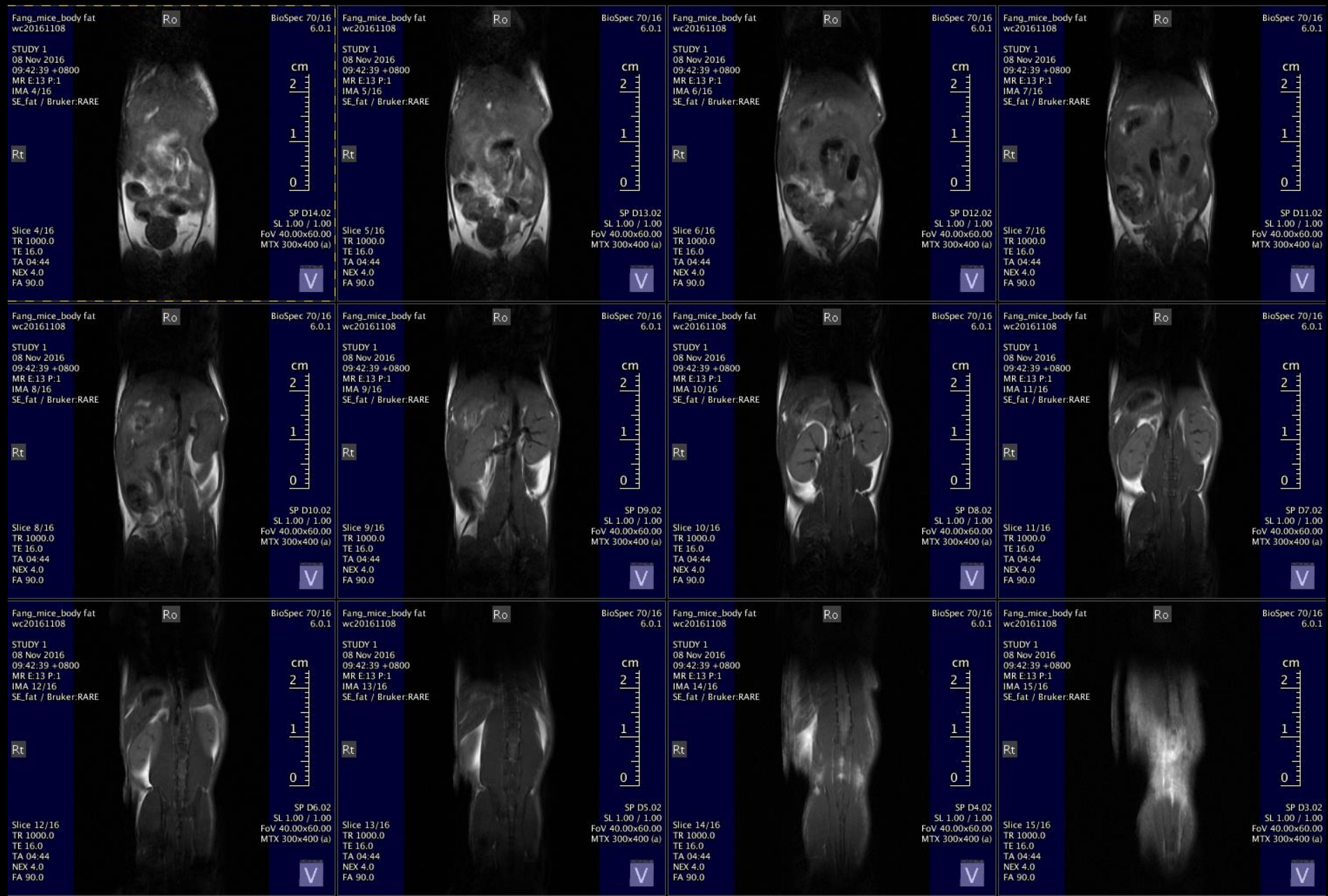
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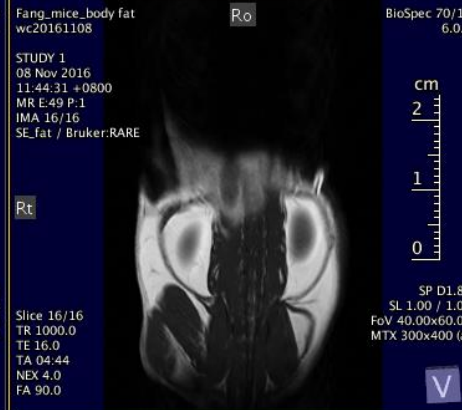
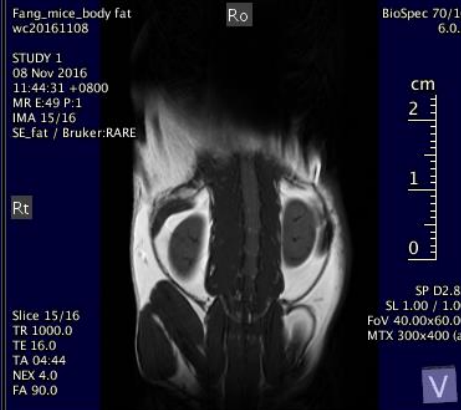
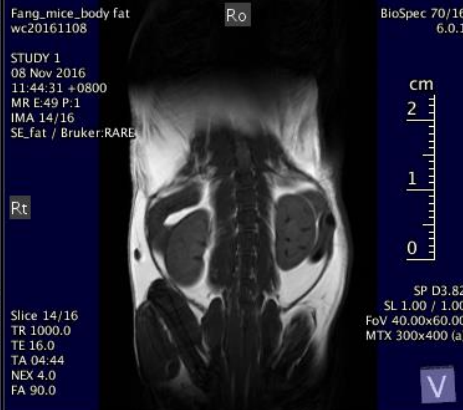
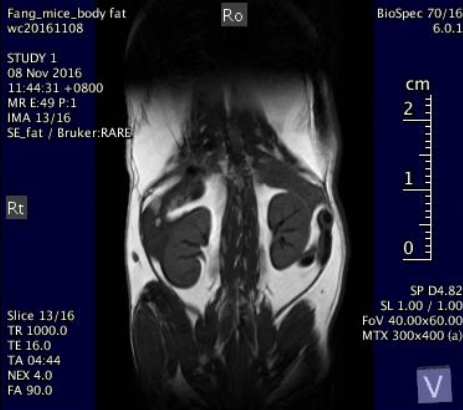
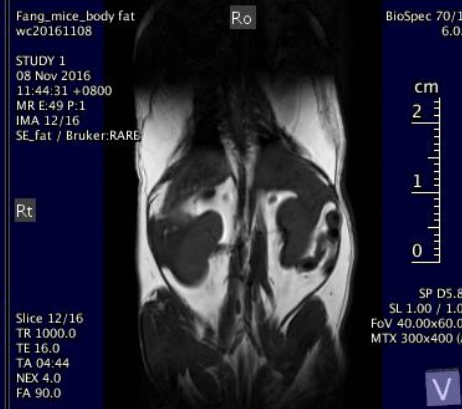
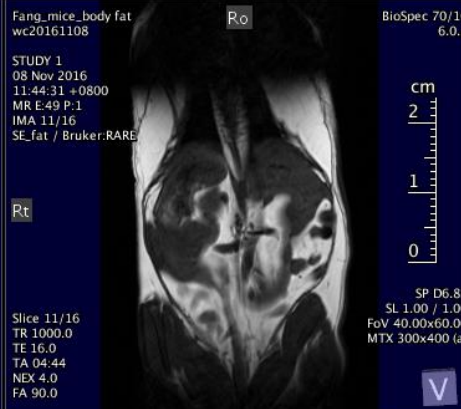
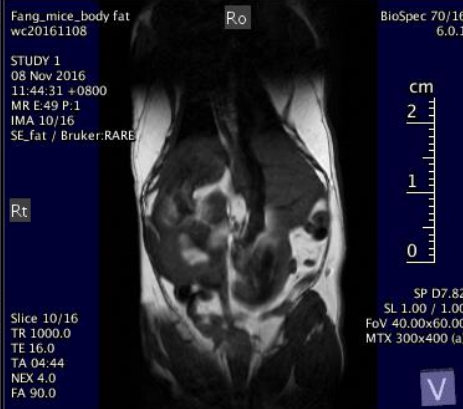
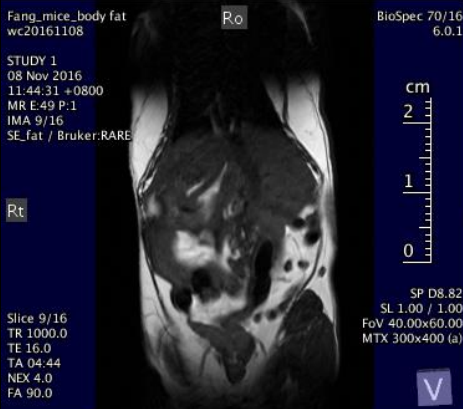
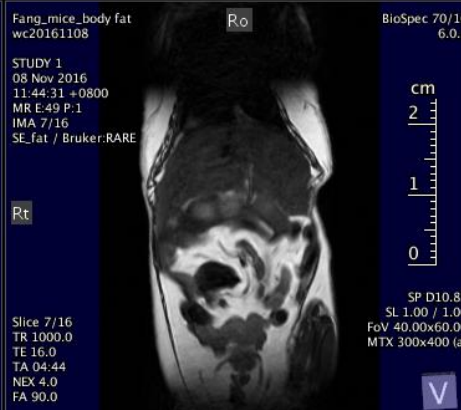
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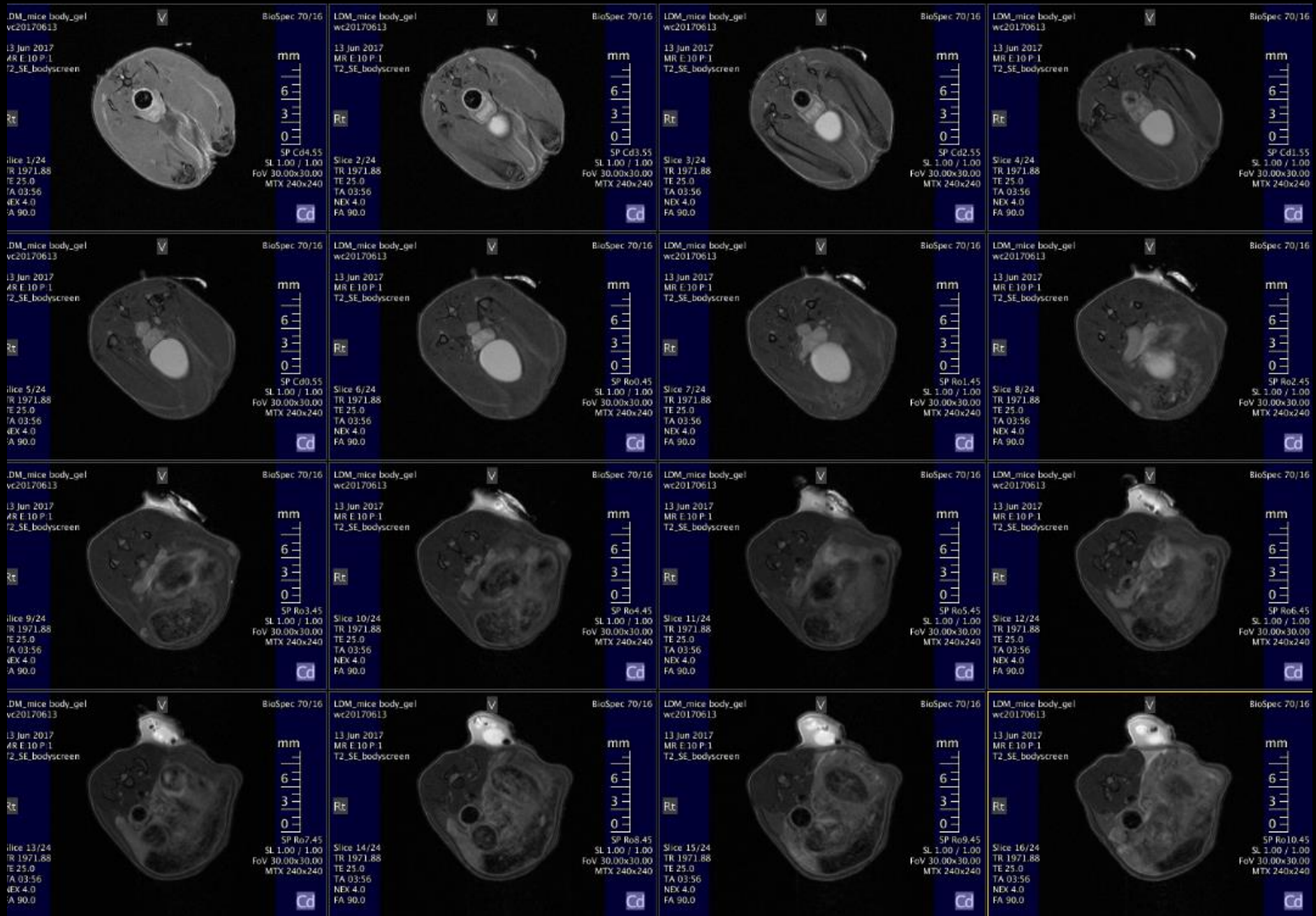
















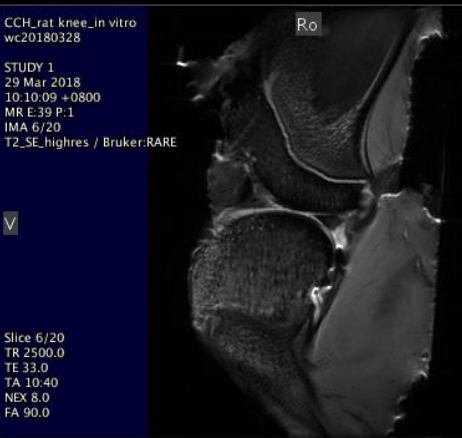
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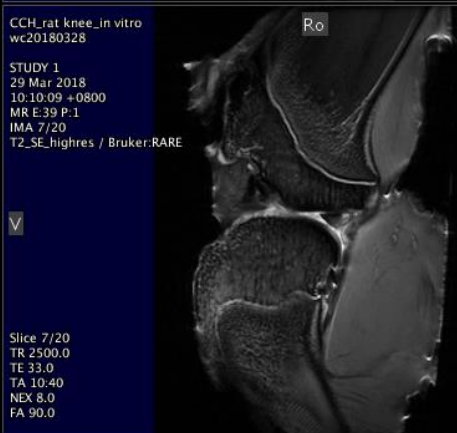
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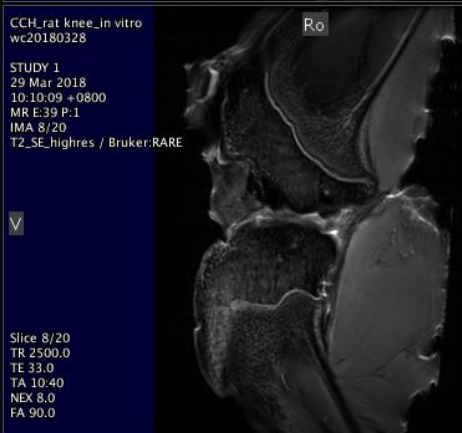
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Taipei Medical University
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6.0.1

SP Le2.98
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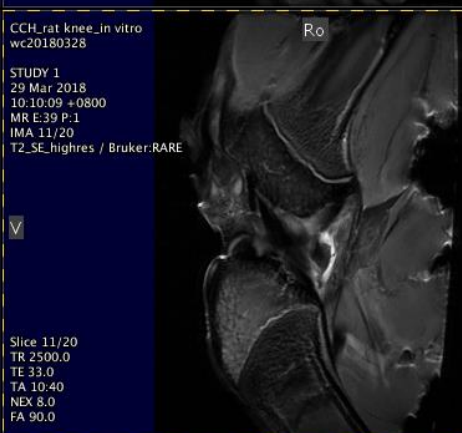
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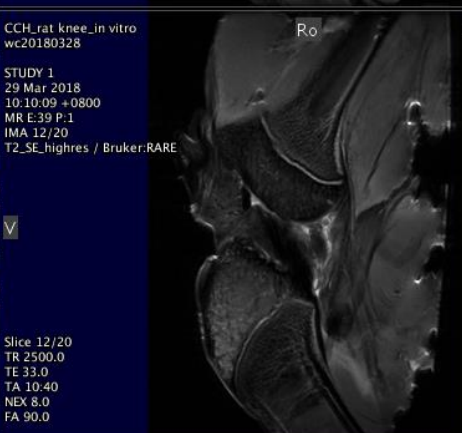
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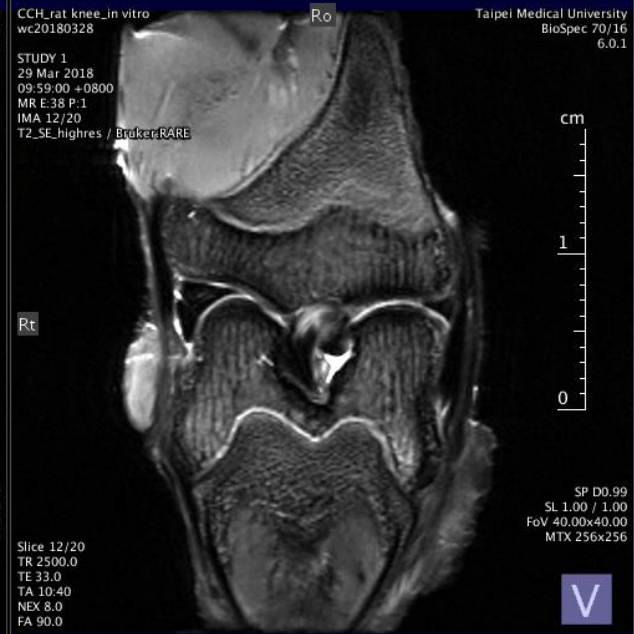
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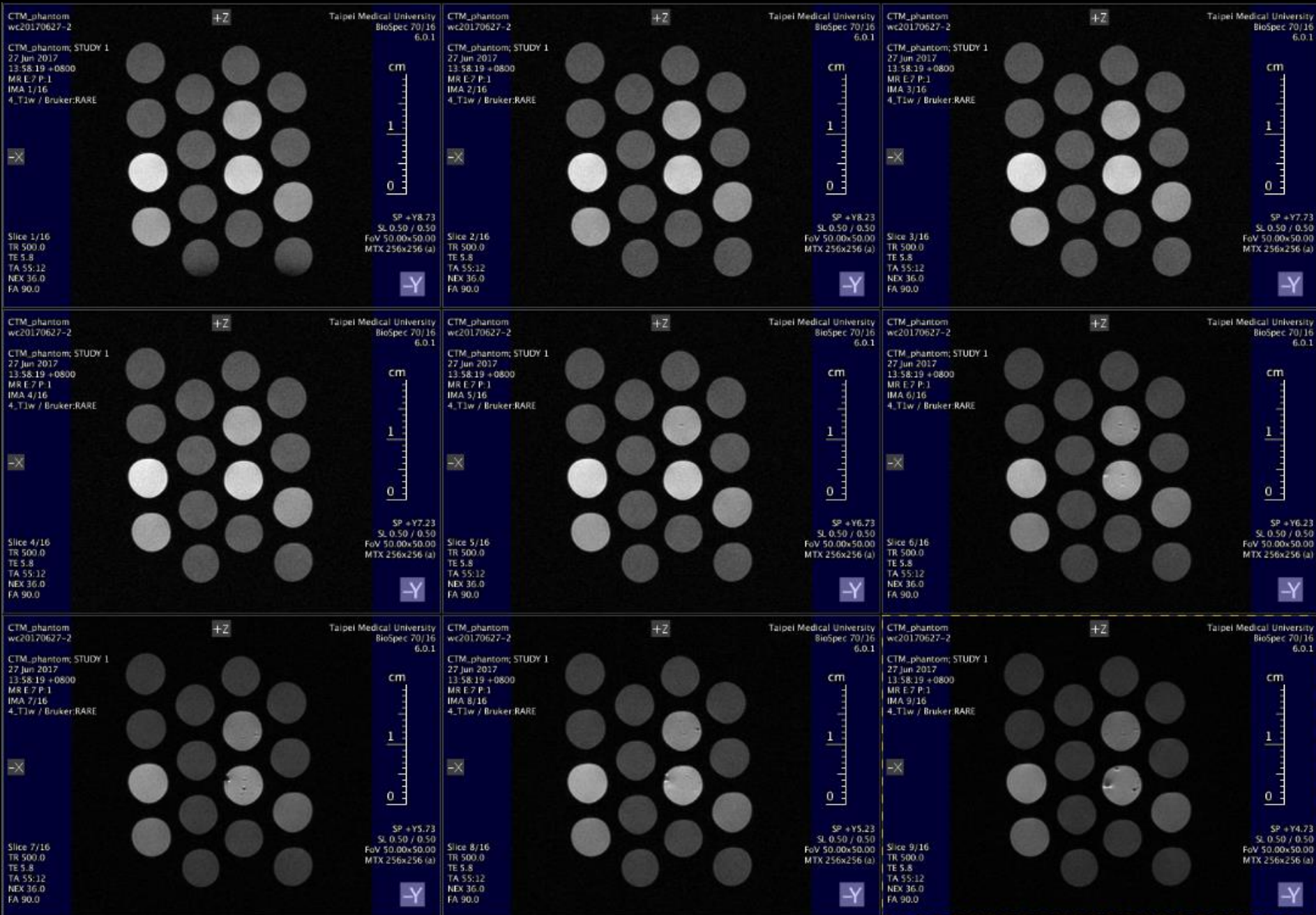
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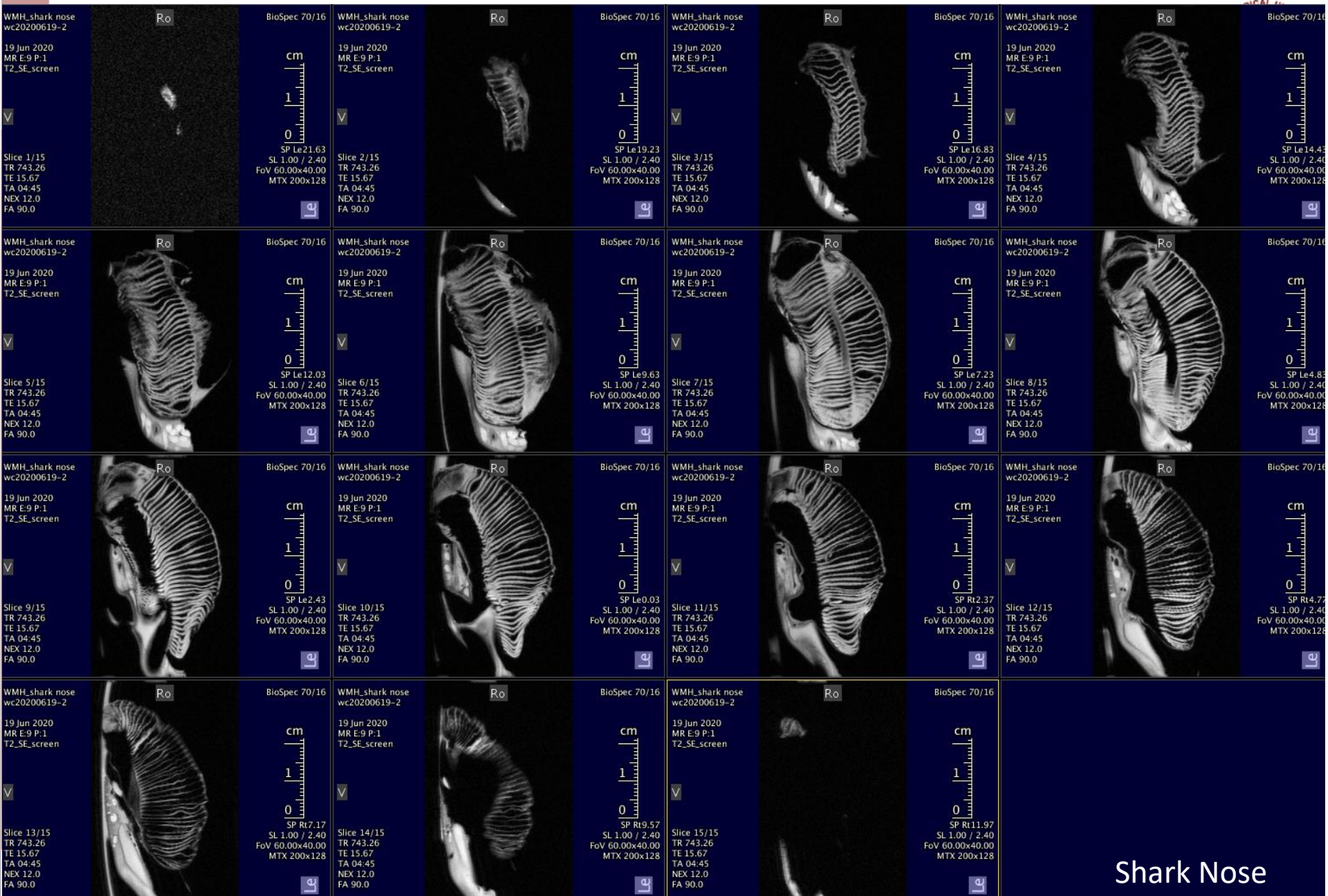
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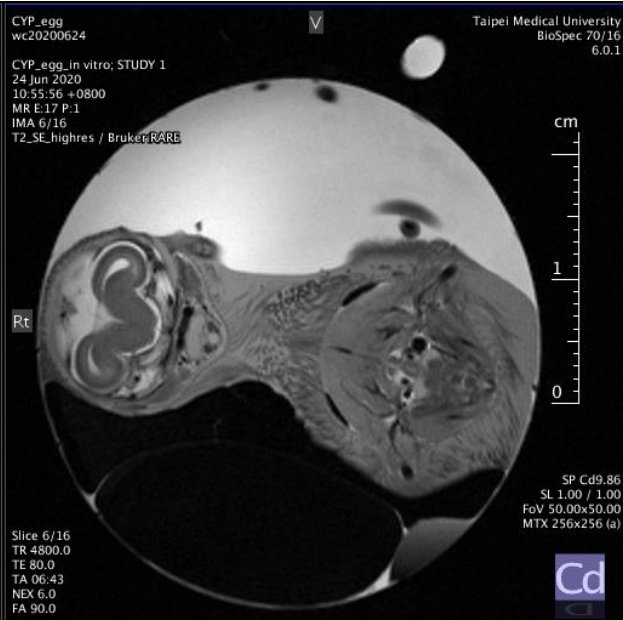




phantom



Shark Nose



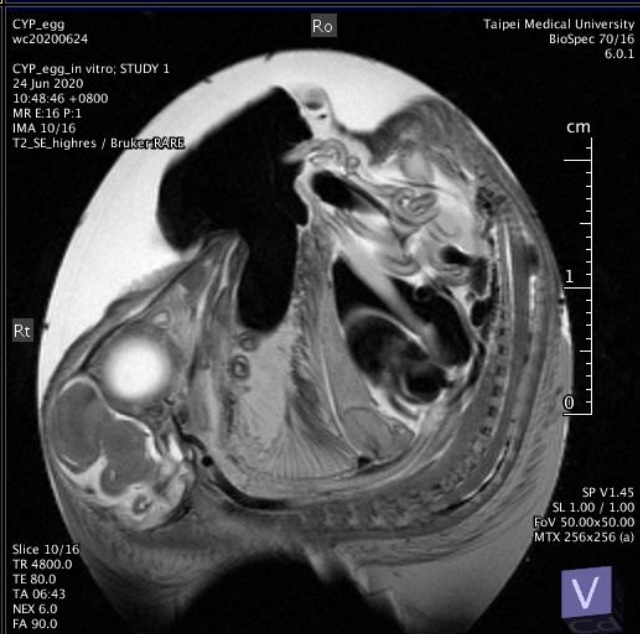
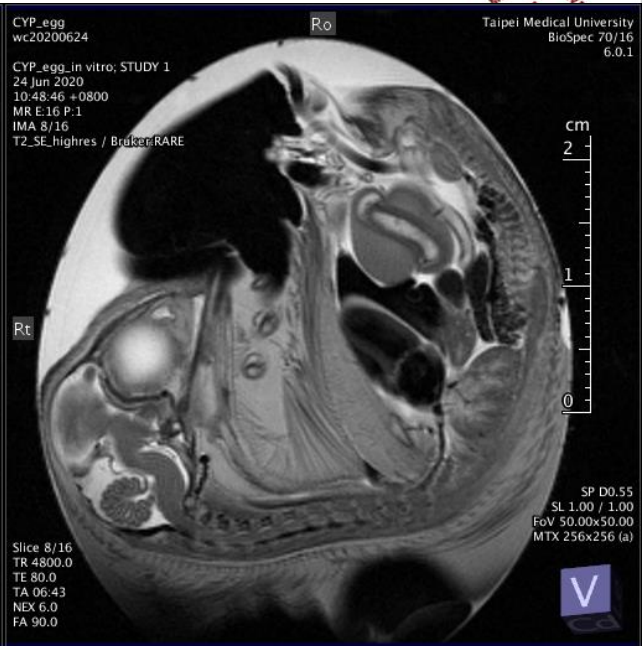
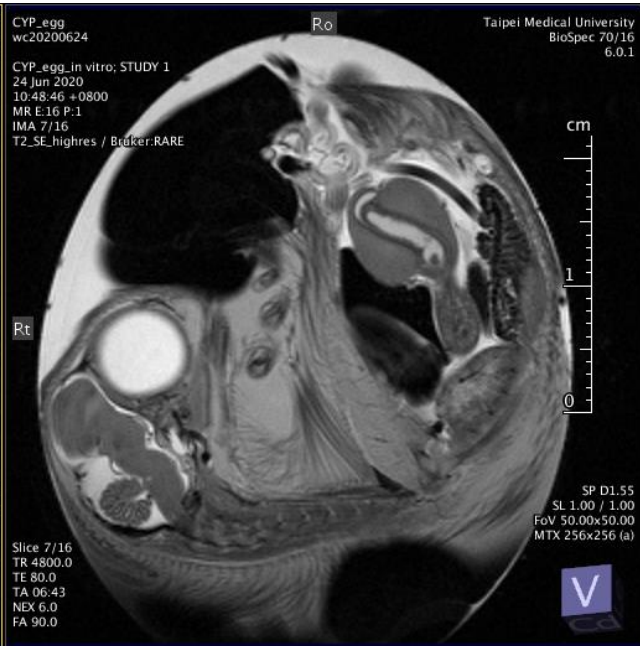
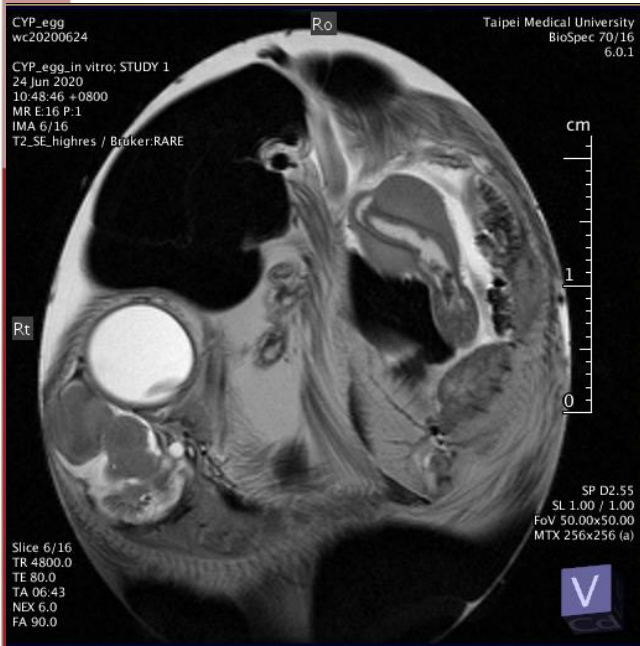


Image Processing



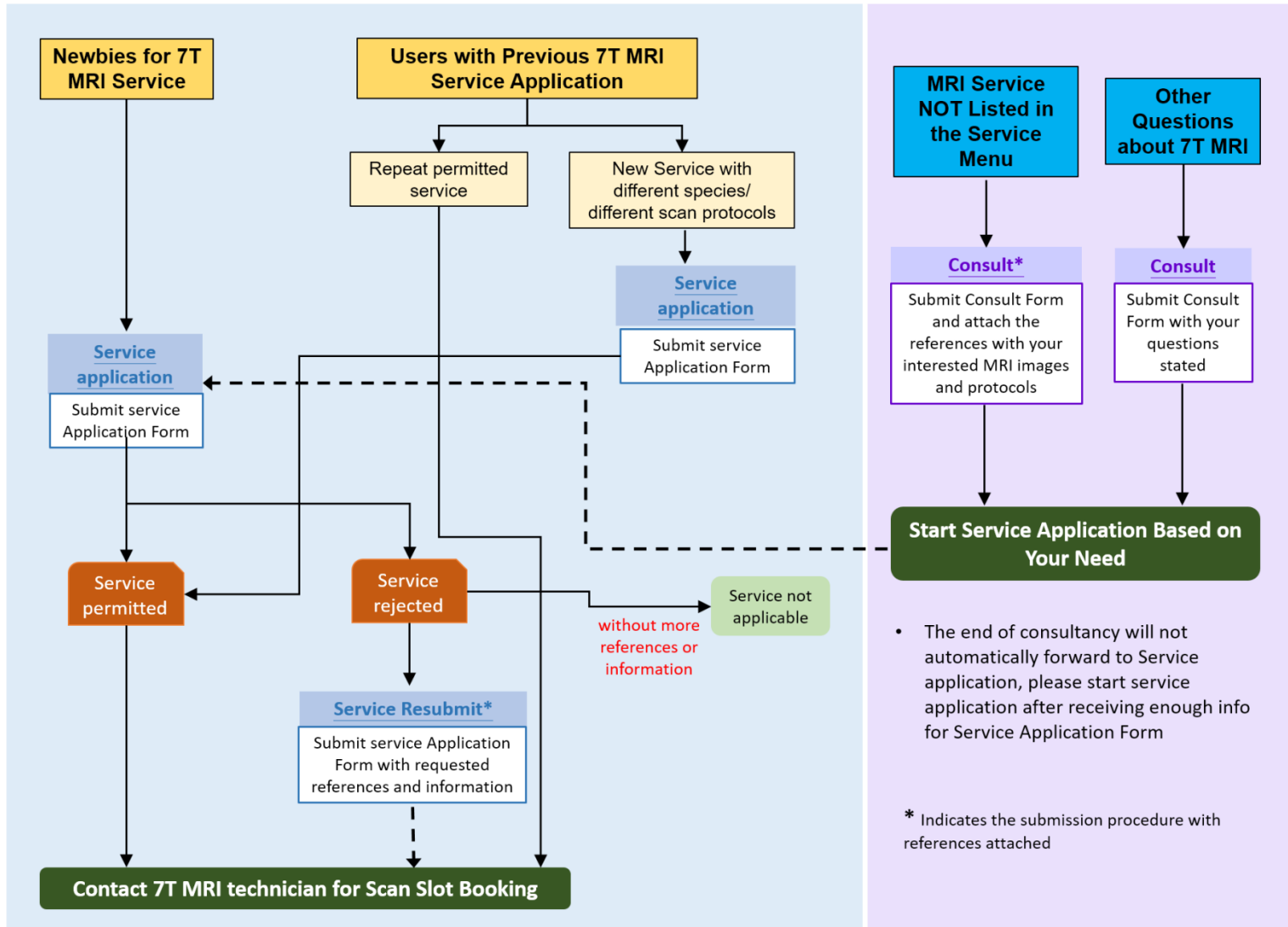
- DICOM import Image J
http://lac1.tmu.edu.tw/wp-content/uploads/2019/02/7TMRI-Image-Processing-guideline_Lu.pdf

E-mail: 7tamri@gmail.com

Service application process



7T MRI Service Application and Consultancy



- The end of consultancy will not automatically forward to Service application, please start service application after receiving enough info for Service Application Form

* Indicates the submission procedure with references attached

- 收費標準
- 儀器簡介
- 代操作服務
- 繳費方式
- 石蠟切片進度公告
- 小動物磁振造影服務



小動物磁振造影服務

儀器簡介

使用規範

本造影服務審查、諮詢與影像處理指引，由北醫神經醫學研究中心-神經影像團隊(原轉譯影像研究中心)協助提供。

送影排程、收費資訊請聯繫本動物中心技術人員，吳小姐(02-2736-1661分機7256)。

送件地點與聯絡方式

- ◆ 11031 臺北市吳興街252號(北醫附醫第二醫療大樓後側，原天空咖啡) 北醫神經醫學研究中心-神經影像團隊
- ◆ (02)2737-2181 分機 1133 翁廷璋小姐
- ◆ 文件Email 7tamri@gmail.com

LAC致謝範本

二月 2019

一	二	三	四	五	六	日
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

Consultation application form

諮詢編號: (由磁振影像研究中心填寫)

Consult v1.2
 9/1/2015 JK TIRC@TMU

台北醫學大學 7T 動物磁振造影 諮詢表格

7T MRI Consult

諮詢人資訊

諮詢日期 *	(系統自動帶出)
實驗單位 Institute/Lab/Company *	
計畫主持人/試驗負責人 ¹	
PI's Name *	
聯絡人 Contact *	
聯絡人電話 Phone number *	
聯絡人 e-mail *	
實驗物種 Species ¹	
實驗品系 Strain ¹	
動物數量 Number of Animals ¹	
預計造影起迄日期 Imaging Period ¹	

諮詢內容

諮詢問題類別 *	<input type="checkbox"/> 造影參數與流程 (parameter and sequence) [註] ¹ <input type="checkbox"/> 動物準備 (animals) ¹ <input type="checkbox"/> 掃描時間 (scan time) ¹ <input type="checkbox"/> 影像傳輸 (Image transfer) ¹ <input type="checkbox"/> 影像處理及分析 (Image processing & Analysis) ¹ <input type="checkbox"/> 預約流程 (reservation) ¹ <input type="checkbox"/> 掃描費諮詢 (scan fee) ¹ <input type="checkbox"/> 其他 (others) ¹
----------	---

[註] 如諮詢類別為造影參數與流程, 請檢附盡量而詳盡欲使用造影參數之參考文獻, 並將造影參數部分登錄於諮詢內容欄位中。¹

Consult v1.2
 9/1/2015 JK TIRC@TMU

諮詢內容 *

請條列欲諮詢之問題, 並盡可能明確描述內容。¹
 (篇幅不足, 請自行增頁)¹

計畫主持人/
試驗負責人簽章 *

收件人與日期 ¹

(由磁振影像研究中心填寫)¹

* 為必填項目

諮詢紀錄與審核 (由磁振影像研究中心填寫)¹

前期諮詢編號 ¹	(同一計畫主持人/試驗負責人簽章) ¹		
諮詢結果 ¹		承辦人簽章與日期 ¹	
審核人簽章與日期 ¹		轉譯影像研究中心 主管簽章與日期 ¹	

Service application form

申請編號:

Application From v1.8,
9/4/2015 JK TIRC@TMU.

台北醫學大學 7T 動物磁共振造影 申請單
7T MRI Application Form

申請日期 Application Date *		
實驗單位 Institute/Lab/Company *		
計畫主持人/試驗負責人 PI's Name *		
中文計畫/試驗名稱 *		
英文計畫/試驗名稱 Project Title *		
聯絡人 Contact *		
聯絡人電話 Phone number *		
聯絡人 e-mail *		
持有共儀器預約系統帳號 Account of equipment reservation at TMU Core Facility Center	<input type="checkbox"/> No <input type="checkbox"/> Yes, Account ID <input type="text"/>	
實驗物種 Species *	實驗品系 Strain *	
動物數量 Number of Animals *		
動物周齡 Age *	平均體重 Weight *	
預計造影起迄日期 Imaging Period *	/ / - / /	
重複性掃描 Longitudinal Scan *	<input type="checkbox"/> No <input type="checkbox"/> Yes 如有重複掃描需求，請明確於下方實驗設計中標示時間點，以利動物中心安排服務時間。	
造影需求時段 Preferred Scan Time *	<input type="checkbox"/> Mon <input type="checkbox"/> Tue <input type="checkbox"/> Wed <input type="checkbox"/> Thur <input type="checkbox"/> Fri <input type="checkbox"/> 9 AM-12 PM <input type="checkbox"/> 1 PM-3PM <input type="checkbox"/> 3PM-5PM	

- 大鼠體重限制：掃描腦部 < 400g, 掃描身體 < 220g

研究目的 Aims of the Study * (以100字為限)

磁共振造影實驗目標 Purpose of MR Imaging * (以100字為限)

實驗設計 Experimental Design * (以100字為限)

Application From v1.8,
9/4/2015 JK TIRC@TMU.

掃描服務選擇 Service Scans

請比對造影菜單，選擇以下掃描服務
若有自定義掃描參數，請請按網頁資訊。若無自定義掃描參數，將使用目前各服務已設定最佳化之掃描參數。

Rat Brain Service

T1-GRE T1-GRE-highres T2-SE T2-SE-highres
 T1-GRE+C T1-GRE+C-highres
 MRA MRA+C
 SWI

Mouse Brain Service

T1-GRE T1-GRE-highres T2-SE T2-SE-highres
 T1-GRE+C T1-GRE+C-highres

Rat Body Service

T1-GRE-body-RespG T1-GRE-body-RespG-highres
 T2-SE-body-RespG T2-SE-body-RespG-highres

Mouse Body Service

T1-GRE-body-RespG T1-GRE-body-RespG-highres
 T2-SE-body-RespG T2-SE-body-RespG-highres

*是否需要施打顯影劑? (藥品須自備, 技術人員施打費用 100 元/隻) 是 否

*風險說明及其他注意事項

同意
 在動物麻醉的過程中，接受動物可能因為吸收大量麻醉氣體、動物本身即屬於體質體質(如具有腫瘤之動物)或其他不可抗拒之因素，產生失溫、呼吸窘迫等異常狀況而導致動物在掃描過程中死亡。施打顯影劑後所產生之風險也等同於麻醉產生之風險。

同意
 需自行準備 Isoflurane 供掃描時使用。

同意
 需自行攜帶光碟片供技術人員將檔案燒錄後給予申請者。

Application Form v1.8,
9/4/2015 JK_TIRC@TMU.

計畫主持人/ 試驗負責人簽章*	收件人與日期 (由轉譯影像研究中心填寫)
--------------------	-------------------------

申請結果	
承辦人簽章與日期	
審核人簽章與日期	轉譯影像研究中心 主管簽章與日期

Application Form v1.8,
9/4/2015 JK_TIRC@TMU.

自定義掃描參數要求 Requested Scan Parameter*

如您對於已開放之結構性影像(如上頁所述)有特定參數需求,請檢附所需掃描資訊並附上參考文獻。

範例 Example

Scan Name	T2-weighted images	Correlated Service Scan	T2_SE
Reference	Shen et al., JCBFM 2014, 34:169.		
Scanner	7-T/40-cm magnet, a Biospec Bruker console.	Coil	A surface coil (2.3-cm ID)
Sequence	T2-weighted images	TR/ TE	2000/50(80)
FOV	2.56x2.56 cm	Matrix(MTX)	128x128
Slice number/ Thickness		Average(NEX)	8
Flip Angle(FA)	90	Repetition	08
其他other	Echo train length=8.		

Magnetic Resonance Imaging Experiments

Magnetic resonance imaging experiments were performed on a **7-T/40-cm magnet, a Biospec Bruker console** (Billerica, MA, USA), and a 40-G/cm gradient insert (ID = 12 cm, 120- μ s rise time). **A surface coil (2.3-cm ID)** was used for brain imaging and a neck coil for perfusion labeling.^{14,15} Coil-to-coil electromagnetic interaction was actively decoupled.

T₁, T₁-weighted images were acquired using single-shot inversion-recovery gradient-echo echo-planar image sequence with six different inversion delay times (0.025, 0.5, 1, 2, 4, and 8 seconds), matrix = 96 × 96 (reconstructed to 128 × 128), FOV = 2.56 × 2.56 cm, TR = 12 seconds (90° flip angle), and 4 signal averages.

T₂, T₂-weighted images were acquired using fast spin-echo pulse sequence with two effective echo times (50 and 80 milliseconds), TR = 2 seconds (90° flip angle), matrix = 128 × 128, FOV = 2.56 × 2.56 cm, echo train length 8, and eight signal averages.

Scan Name*	Correlated Service Scan*
Reference*	
Scanner*	Coil*
Sequence*	TR/ TE*
FOV*	Matrix(MTX)*
Slice number/ Thickness	Average(NEX)*
Flip Angle(FA)	Repetition
其他other	

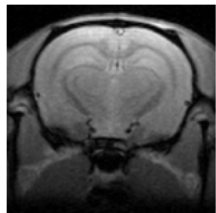
- 請務必填寫必填欄位(*), 避免遺件或延誤審查時間。
- 不同掃描項目, 需各自附上至少一篇參考文獻以及相關資訊。
- 如需多項自定義掃描參數, 請自行複製表格。
- 因實驗需求相異, 我們將依據設備硬體與軟體考量, 斟酌修改掃描參數, 惟無法確保修改後之影像品質, 請由各計畫主持人/試驗負責人自行考量。

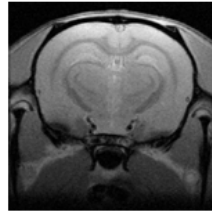
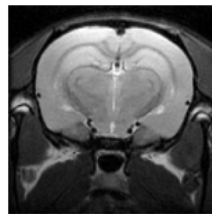
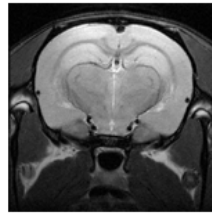
Imaging Menu Legend



台北醫學大學 7T 動物磁振造影 服務內容 7T MRI Service Scan

Rat Brain 造影選單

造影程序 (in-plane resolution in μm)	掃描 時間	顯 影 劑	範例影像	相關應用
T2-SE-Screen # 初篩 T2權重影像	10 min		NA	General Adjustment and localizer
T1-GRE * T1權重影像 (156 μm)	3 min			Gross anatomy, hematoma

T1-GRE-highres T1權重高解析影像 (78 μm)	8 min			Gross anatomy, hematoma
T2-SE * T2權重影像 (156 μm)	6 min			Gross anatomy, edema, stroke lesion
T2-SE-highres T2權重高解析影像 (78 μm)	16 min			Gross anatomy, edema, stroke lesion



Precautions

- **Imaging Object :**

1. Rat and mice living in the TMULAC 1F and 3F

<Weight limit of rat>

Brain imaging : under 400g

Body imaging : under 300g

2. Specimen or phantom ◦

- **Scan Time:**

Mon. to Fri./ 9:00 AM to 12:00 PM、13:00 PM to 17:00 PM

Cancelling or reducing scan time at least **one day earlier**.

If **no show** or **late for more than 15min.**, LAC will charge as Original booking time.

- The data will be burned to CD, please bring a blank CD to LAC when scanning.

Precautions-in vivo



1. **Risk of death at your own risk**, The scanning process doesn't need to fully involved.
 2. Please bring **Isoflurane** and **blank CD** every time.
 3. Prepare the contrast agent yourself if need.
(fee of injection : **100NT/animal**)
 4. Do **not** implant any **metal** in animal (like **ear tag** or **leather nail**)
-

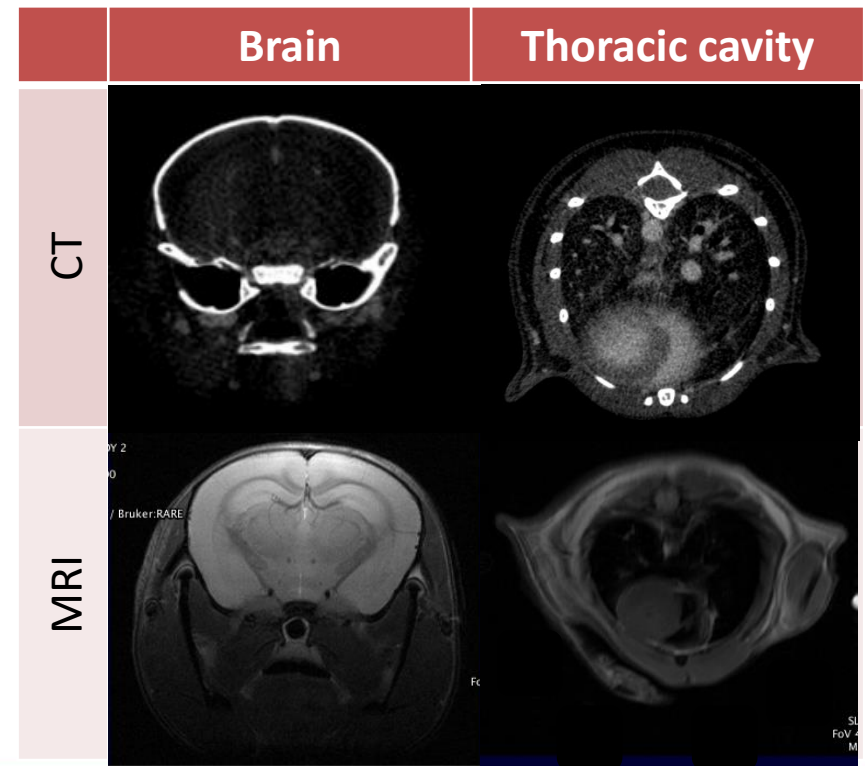
Price list



	TMU	Not TMU
Fee for scan	1200NT/hour	1200NT/hour
Fee for injection	100NT/animal	

Q&A

1. Control image provide
2. Check in first or MRI booking first
3. Other pulse sequence out of service list ?
4. CT or MRI ?
5. Image analysis



CT or MRI ?

- CT
 - Hard Tissue : Bone, Tooth
 - Bad magnetic susceptibility : Lung
 - MRI
 - Soft Tissue : Brain, Cerebellum, Heart, Liver, Kidney
 - Circulation System
-

Please Contact :

1. aMRI consulting and application

TMU Neuroscience Research Center- NeuroImaging Group

Dr. Kuo: e-mail: 7tamri@gmail.com

2. Scan time booking

TMU laboratory animal center

Miss Wu : #7256



Thanks for your Attention
