

# Magnetic Resonance Imaging Principles and Applications

## 核磁共振影像原理及應用

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Lecture Time: Thursday 09:00~12:00  
Classroom: BMES R501  
Office Hour: Tuesday 10:00~12:00 (appointment via E-mail)  
Course No.: 11110BMES546700

### 1. Prerequisites

General physics

### 2. Text books/Optional References

- (1) Lecture slides: eeclass
- (2) Robert W. Brown, Yu-Chung N. Cheng, Michael, R. Thompson, Ramesh, Venkatesan, Magnetic Resonance Imaging: Physical Principles and Sequence Design, 2<sup>nd</sup> edition, 2014, Wiley Blackwell.

### 3. Course Objectives

- (1) Develop basic concepts and important applications of MRI
- (2) Develop problem-solving and critical thinking skills
- (3) Learn to integrate and apply various concepts to a single problem

### 4. Topic

- (1) NMR signal
- (2) Spatial encoding
- (3) Hardware
- (4) Image quality and contrast
- (5) MRI pulse sequence and k-space
- (6) Fast scan
- (7) Parallel imaging
- (8) MRI artifacts
- (9) fMRI
- (10) MR angiography
- (11) Phase contrast MRI
- (12) Diffusion imaging
- (13) Perfusion imaging

### 5. Evaluation

#### (1) Quiz: 70%

- Quiz1: 35%, Quiz2: 35%
- You can bring a handwriting A4-size note (double-side)

#### (2) Final report: 25%

- 2~3 persons/group
- Journal paper (1 major paper + 2 references)
  - targeting journal : Nature, Science, or their series (published year : after **2019**)
  - topic : new knowledge relevant to MRI
- Abstract (4%): Two-page A4
  - (1) Title, authorship, journal, volume, page, year
  - (2) Chinese/English, 12-size, single space

(3) Organized descriptions of the major paper

(4) Describe the relevance of this paper to our lecture ( $\leq$  600 words)

- Midterm report (6%)

- Four-page A4 (Chinese/English, 12-size, single space, figures allowed)

- Organized and detailed descriptions of 1 major paper + 2 references.

- Figures and Tables are allowed.

- Final presentation (15%): hardcopy of slides, final report

- 15 min presentation + 5 min Q&A

- Final report: Six-page A4 (Chinese/English, 12-size, single space, figures allowed)

- 15% (Presentation + Final report)

**(3) Course Participation: 5%**

Website for paper survey: <http://www.nature.com/siteindex/index.html>;

<http://www.sciencemag.org/>; <http://www.ncbi.nlm.nih.gov/sites/entrez>