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ALL-IN-ONE
REGISTRY REVIEW

DIGITAL STUDY GUIDE



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MRI ALL-IN-ONE REGISTRY REVIEW

Josh Van Den Bossche
B.S., R.T. (R)(MR)



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MRI All-In-One Registry Review

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Preface

Welcome to *MRI All-In-One Registry Review*, a comprehensive study guide designed to help you prepare for the MRI registry examination. As a former student, I understand how overwhelming the preparation process can be. The sheer volume of information to learn can feel daunting, and finding the right resources is often a challenge.

That is why I created this study guide – to relieve some of the stress associated with MRI registry exam preparation. *MRI All-In-One Registry Review* aims to compile the relevant information needed to prepare for the MRI registry examination all-in-one place. It follows a clear and organized outline format, enabling learners to focus on studying rather than searching for information through multiple resources. Additionally, the guide aims to break down difficult concepts into smaller, easier-to-understand descriptions, making even the most complex topics more accessible.

Within this study guide, you will find a wealth of highly relevant knowledge and information acquired throughout my college education, registry preparation, imaging experience, and extensive research. The guide includes a detailed outline review and multiple tables containing important numbers, regulations, equations, and parameters. The tables are located throughout the guide and compiled again at the end to facilitate easy absorption of information. Additionally, the study guide includes limited access to an online bonus area containing an extensive database of practice questions, exams, and labeled anatomy images.

Whether you are a new student or nearing graduation, MRI All-In-One Registry Review can be an invaluable resource as you prepare for the MRI registry examination. I hope this study guide helps you achieve your goals and succeed in your career as an MRI technologist. Happy scanning!

Josh J. Van Den Bossche

How To Use This Study Guide

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Step 1: Read a Section of the Study Guide - While reading, place highlights and sticky notes throughout the text. When highlighting, consider using a different approach than with a textbook. Typically, highlights in lengthy textbooks mark valuable information to make studying more manageable. However, since this guide is already condensed to essential information, it is recommended to focus on highlighting details that are harder to remember and that may require additional effort to retain.

Step 2: Complete Each Section's Online Practice Questions - After reading a section of the study guide and placing highlights and sticky notes, log in to the bonus members' area at www.mriallinone.com to take the section's online practice quiz.

Step 3: Track Each Section's Progress - After reading a section of the study guide and completing the section's online practice questions, it is recommended to track progress using the progress tracker log at the end of each section of the guide. Simply click a progress tracking checkbox or enter an online quiz score to track progress after completing each section of the guide.

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1. PATIENT CARE PRINCIPLES

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1. LEGAL AND ETHICAL CONSIDERATIONS IN MRI

In the field of magnetic resonance imaging, mastering legal and ethical principles can be paramount for delivering exceptional patient care and upholding the highest professional standards. This section delves into the nuances of these principles, concentrating on two key topics: Patient Rights and Legal Issues in Healthcare. A general understanding of these topics can help future technologists prepare for exam questions regarding the legal and ethical aspects of the healthcare environment and the complex challenges that can emerge during practice.

A. Patient Rights - In healthcare, patient rights generally refer to the fundamental entitlements and protections granted to individuals seeking or receiving medical care. These rights often aim to ensure that patients are treated with dignity, respect, and autonomy, and that their medical decisions are informed and based on consent. Key aspects of patient rights can include the right to access healthcare services, the right to privacy and confidentiality, the right to receive accurate and comprehensive information about treatments, the right to make informed choices about one's care, the right to refuse treatment, and the right to be free from discrimination, among other things. Patient rights often serve as the foundation for ethical healthcare practices and help maintain trust between patients and healthcare providers. The following topics explore various dimensions of patient rights. It is important to note that this information is for general educational and informational purposes, and the descriptions and concepts related to patient rights can vary based on multiple factors, such as by jurisdiction or in specific contexts.

- **Patient Autonomy** - A fundamental principle in healthcare, emphasizing the right of patients to make independent decisions about their medical treatment without undue influence from healthcare providers. This concept is rooted in the belief that individuals should have the authority to make decisions regarding their health and are best positioned to evaluate their health needs and preferences. Patient autonomy respects patients' ability to understand their medical condition, assess the treatment options presented, and make choices that align with their personal values, beliefs, and desired health outcomes. It is a critical aspect of patient-centered care, helping ensure that medical decisions are not solely in the hands of healthcare professionals but are made collaboratively, honoring the patient's perspective and choice.
- **Informed Consent** - In general, informed consent is a voluntary agreement in which a patient grants permission to perform a medical procedure or receive treatment. Informed consent is usually required



before medical procedures and often involves the patient receiving comprehensive information about suggested procedures or treatments. The information typically encompasses aspects such as the potential risks and benefits of the procedure or treatment, available alternatives, and the risks associated with declining the procedure or treatment. Ultimately, the informed consent process can help maintain and uphold the principle of patient autonomy, allowing patients to make informed decisions about their medical care without undue influence from their healthcare provider. The following includes common types of informed consent.

- **Implied Consent** - A type of consent that is not directly granted by a person but is typically inferred from a person's actions and the facts and circumstances of a particular situation or, in some cases, by an unconscious person's silence or inaction. (e.g., when a patient lies on the MRI table for an exam, this may be considered implied consent.)
- **Oral Consent** - A type of consent that is typically spoken, often for less invasive interactions where written consent may not be necessary. (e.g., when asking to touch and position a patient during an MRI examination, this may be considered oral consent.)
- **Written Consent** - A type of consent that is typically documented in writing. Written consent is often required for invasive procedures or treatments with substantial risks. This form of consent is usually obtained by the physician performing the procedure or treatment or another qualified healthcare provider knowledgeable about the procedure or treatment.
- **Confidentiality in Healthcare (Privacy)** - In general, confidentiality involves safeguarding information and keeping things private through multiple relationships, whether employee-patient, employee-employer, or employee-employee. Confidentiality in healthcare typically refers to professionals' ethical and legal obligation to protect patients' privacy. The following includes topics regarding confidentiality within the healthcare environment.
 - **Health Insurance Portability and Accountability Act (HIPAA)** - A legal act that aims to enhance the efficiency of electronic healthcare transactions while safeguarding the privacy, security, and accessibility of personal health information. HIPAA primarily focuses on maintaining the confidentiality, integrity, and availability of individually identifiable health data by implementing strict guidelines for healthcare providers, insurers, and related entities. The legislation ultimately helps to foster trust in the healthcare system and ensure the responsible handling of sensitive patient information. For a more in-depth review of the Health Insurance Portability and Accountability Act of 1996, please refer to its official documentation [\[1\]](#).
 - **Physical Privacy** - This generally refers to confidentiality aiming to preserve a patient's physical privacy during medical procedures or interactions. Healthcare professionals, including technologists, commonly aim to keep patients appropriately covered, helping to ensure their dignity and modesty remain intact. This approach not only demonstrates respect for the patient's personal boundaries but may help to establish trust and maintain a comfortable environment for both patients and healthcare providers.

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11. SAFETY PRINCIPLES

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1. SCREENING AND SAFETY IN MRI

In the field of magnetic resonance imaging, maintaining rigorous screening and safety protocols can be vital for protecting patients and healthcare professionals. This section explores common practices employed during the MRI screening process and fundamental principles of MRI safety, focusing on four key aspects: MRI Screening and Education, Electromagnetic Field Safety Considerations, Equipment and Device Safety, and The MRI Environment. A general understanding of these topics can help future technologists prepare for exam questions regarding the screening and education of patients, the safety implications of MRI exams, the proper operation of MRI equipment, and the creation of a secure MRI environment.

A. MRI Screening and Education - Screening is often considered a vital step in the MRI process, generally involving the assessment of all individuals (including patients, personnel, and non-personnel) before entering the MRI environment. The purpose of screening is typically to identify potential hazards or contraindications that could pose risks during MRI procedures. Patient screening often includes verifying and assessing implants, ferrous foreign bodies, medical conditions, prior diagnostic or surgical procedures, and externally applied items and devices. Proper screening generally requires thorough education and training for MRI personnel, which often includes Level 1 and Level 2 designations. The following includes topics related to MRI screening and education. It is important to note that this information is for general educational and informational purposes, serving as an aid for those preparing for the MRI registry exam. Since MRI safety guidelines and information may differ based on various factors, consulting with qualified professionals, adhering to established protocols and guidelines, and referring to manufacturer recommendations are essential for ensuring accurate and safe practices.

- **Biomedical Implants** - During the screening process, identifying and documenting all implanted biomedical devices can be essential to help ensure patient safety. This process typically includes verifying

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|||. IMAGE FORMATION PRINCIPLES

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PART 1: ESSENTIALS OF IMAGE CREATION

1. INSTRUMENTATION IN MRI

In the field of magnetic resonance imaging, a comprehensive understanding of the instrumentation involved can be vital for optimizing image quality and ensuring proper operation. This section will explore the essential components and instrumentation of an MRI system. Typically, the order of the instrumentation that composes the MRI scanner's gantry from inside to outside is as follows: 1. Radiofrequency (RF) coils; 2. Gradient coils; 3. Shim coils; and 4. Primary magnet. We will begin discussing these components by delving into the intricacies of MRI instrumentation, focusing on four key aspects: Electromagnetism, The Static Magnetic System, The Radiofrequency System, and The Gradient System. A general understanding of these topics can help future technologists prepare for exam questions regarding the underlying principles and systems of MRI.

A. Electromagnetism - A force that governs the interactions between electric charges and magnetic fields and one of the four fundamental forces in nature (electromagnetism, gravity, weak forces, and strong forces). Electromagnetism plays a crucial role in MRI technology, as it governs both the use of magnetic fields and radiofrequency (RF) electromagnetic waves. The interaction of these energy fields allows for the excitation of protons in the body, enabling the generation of MR images. The following includes topics regarding electromagnetism in MRI.

- **Faraday's Law** - Also referred to as the "law of electromagnetic induction," Faraday's law is a fundamental law of electromagnetism that governs the generation of electromotive force (EMF) and induced currents in conductors exposed to changing magnetic fields. This principle is crucial in understanding the magnetic characteristics and components of MRI scanners, such as the rapid gradient applications where alternating gradient magnetic fields can induce currents in the body. Faraday's law states that three conditions must be present for electromagnetic induction to occur: a conductor, a magnetic field, and relative motion between them (or a change in the magnetic field over time). The following includes factors that influence the strength of the induced current in accordance with Faraday's law.
 - **Magnetic Field Strength** - The intensity of the magnetic field interacting with the conductor directly impacts the induced current. As field strength increases, the current generated within



the conductor generally increases.

- **Speed of Motion** - This factor pertains to the relative velocity between the magnet and the conductor. When the speed of motion increases, the induced current within the conductor generally increases.
- **Angle of Interaction** - This variable refers to the angle between the magnetic field and the conductor. When the interaction between a magnetic field and the surface of a conductor approaches 90 degrees (perpendicular), the induced current within the conductor is generally maximized.
- **Number of Coil Windings** - The number of windings in a conductive coil exposed to a magnetic field affects the induced current. As the number of windings increases, more flux linkages occur between the conductive coil and the magnetic lines of flux generated by the magnet, generally leading to a higher induced current within the conductive coil.
- **Lenz's Law** - An important law in electromagnetism and electromagnetic induction. Lenz's law states that an electromagnetically induced current within a conductor creates a magnetic field opposing the original magnetic field that caused the induction. These induced currents, commonly known as eddy currents, affect MRI systems, particularly gradient and radiofrequency (RF) coils, generally causing heating and energy loss and preventing the total efficacy of these components. Common techniques to minimize eddy currents include using low-conductivity materials, implementing shielding methods, and employing advanced coil designs.

B. The Static Magnetic System - The static magnetic system is an essential component of MRI system instrumentation, boasting unique characteristics across different MRI scanners. The static magnetic field (also known as B_0) utilized in MRI creates a large, stable field that extends throughout the patient's body. This magnetic field is constant and responsible for aligning the magnetic moments of the hydrogen protons in the body. The static (or primary) magnet is typically located within the fourth layer of instrumentation inside the MRI system's gantry (from inside to outside). The following includes topics regarding the static magnetic system.

- **Types of Static Magnets** - The three primary static magnets employed in MRI systems are superconductive electromagnets, resistive electromagnets, and permanent magnets. The following includes details and characteristics regarding these magnet types.
 - **Superconductive Electromagnet** - These specialized electromagnets are constructed using superconducting materials, such as a combination of niobium and titanium. When cooled below their critical temperature, typically around 4 K (Kelvin) or lower, their electrical resistance becomes virtually zero, allowing them to maintain a high current without additional power input. This property makes them capable of producing strong and stable magnetic fields. As a result, superconductive electromagnets are among the most powerful magnets available, with magnetic field strengths generally ranging between 1.5-3 tesla (T) for clinical systems and up to 7T or higher for research systems. Superconductive electromagnets also provide a high level of

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IV. PROCEDURES AND ANATOMY

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1. INTRODUCTION TO MRI PROCEDURES

In the field of magnetic resonance imaging, understanding certain foundational aspects of MRI procedures can be essential to the success and diagnostic accuracy of MRI exams. This section delves into some of the fundamental components of MRI procedures, focusing on three key aspects: Imaging Planes in MRI, Imaging Considerations in MRI, and Patient Setup and Positioning. A general understanding of these topics can help future technologists prepare for exam questions regarding the foundational components of MRI procedures.

A. Imaging Planes in MRI - The human body is traditionally described using anatomical planes such as sagittal, coronal, and axial. In MRI, these anatomical planes are used to capture detailed slices of the body. Understanding these planes is essential for accurate MRI assessment, image interpretation, and scan planning. Although MRI imaging planes often align with standard anatomical divisions, they can also be adjusted or angled to emphasize specific structures or pathologies. Each plane provides different perspectives, which makes certain orientations more suitable depending on the clinical focus. The following includes details regarding the primary anatomic planes and the oblique plane utilized in MRI, as well as some common imaging planes utilized to improve the visualization of certain anatomical structures and pathologies.

- **Axial (or Transverse) Plane** - The plane that divides the body into superior (top) and inferior (bottom) portions. In MRI scans, axial images provide cross-sectional views of the body, enabling horizontal visualization and assessment of structures from top to bottom. Clinically, axial slices are typically viewed from the patient's feet upward, with the patient's left side appearing on the viewer's right.
- **Coronal Plane** - The plane that divides the body into anterior (front) and posterior (back) portions. In MRI scans, coronal images provide frontal views of the body, enabling vertical visualization and assessment of structures from front to back. Clinically, coronal slices are typically viewed as though facing the patient, so the patient's left side appears on the viewer's right. The term "midcoronal" identifies a plane that divides the body into equal anterior and posterior halves, passing directly through the body's midline.
- **Sagittal Plane** - The plane that divides the body into left and right portions. In MRI scans, sagittal images provide side views of the body, enabling vertical visualization and assessment of structures from left to right. The term "midsagittal" refers to a plane that divides the body into equal left and right halves, passing directly through the body's midline.



- Oblique Plane** - This plane is oriented at an angle and is not parallel to any primary anatomical plane. In MRI, oblique slices can be angled and tailored to a specific structure or pathology when the standard planes do not optimally display the anatomy of interest. Examples include angling slices to better visualize blood vessels, the spine, or cardiac structures.
- Common Imaging Planes for Structures and Pathologies** - Certain planes are often better suited for viewing specific anatomical structures and pathologies. Generally, sagittal planes align well with long, linear structures (e.g., tendons, ligaments, the spinal column); coronal planes excel at capturing side-to-side structures and facilitating bilateral comparisons (e.g., menisci, shoulder rotator cuff, or the hippocampus in the brain); and axial planes offer detailed cross-sectional views of complex joints and regions (e.g., nerve roots, spinal canal, or the wrist). The table below provides a generalized list of common plane choices for frequently evaluated structures and associated pathologies, but it is not exhaustive nor set in stone, as actual protocols often vary by facility and clinical needs. When reviewing these imaging planes, it may be helpful to avoid simply memorizing which plane is “best.” Instead, consider and imagine the three-dimensional orientation and shape of the structure in question, as well as how a particular imaging plane may demonstrate its critical anatomy and potential abnormalities. Understanding these underlying principles can enable one to potentially adapt them to a broader range of clinical situations. The following includes a table listing some common imaging planes for various structures and pathologies.

COMMON IMAGING PLANES FOR STRUCTURES & PATHOLOGIES		
Region	Key Planes	Enhanced View of Key Structures
Head/Brain	Axial	- General survey of overall brain structures (gray/white matter, ventricles, brainstem) - Stroke/hemorrhage detection - White matter lesions - IACs (when centered to area)
	Sagittal	- Midline structures visible in a single slice (e.g., corpus callosum, pituitary, brainstem) - Evaluation of ventricular shape and third ventricle
	Coronal	- Temporal lobe / hippocampus (e.g., epilepsy, hippocampal sclerosis) - Pituitary and parasellar region - IACs - Optic nerves and extraocular muscles
		- Height, alignment, and herniations of multiple discs in a single view

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2. SECTIONAL ANATOMY IN MRI

In the field of magnetic resonance imaging, a solid foundation in sectional anatomy can be crucial for accurate slice prescription and anatomy identification. Anatomy is a vast subject that relies heavily on imagery, extending well beyond the capabilities of a compact, on-the-go review. To keep this digital study guide concise and manageable, the hundreds of images necessary for this section are hosted within the online members' area at www.mriallinone.com. This section will focus on three key areas of anatomy: Head, Neck, and Spine; Body; and Musculoskeletal. The table below organizes key anatomical groupings for each area, such as the ventricles of the brain, major fissures, and components of the Circle of Willis, helping to illustrate spatial relationships and improve comprehension. A general understanding of these areas can help future technologists prepare for exam questions regarding the precise location, grouping, and appearance of anatomic structures within MR images displayed in various planes.

RELEVANT ANATOMICAL GROUPINGS	
Head, Neck, and Spine	
Major Brain Regions/Lobes	<ul style="list-style-type: none"> • Frontal Lobe - The anterior portion of the cerebrum. • Parietal Lobe - The superior lateral portion of the cerebrum. • Temporal Lobe - The inferior lateral portion of the cerebrum. • Occipital Lobe - The posterior portion of the cerebrum. • Cerebellum - A rounded structure located inferior to the cerebrum and posterior/superior to the brainstem.
Major Fissures of the Brain	<ul style="list-style-type: none"> • Lateral Fissure (Sylvian fissure) - Separates the temporal lobe from the frontal and parietal lobes. • Longitudinal Fissure - Separates the right and left cerebral hemispheres. • Transverse Fissure - Separates inferior cerebrum and the cerebellum.
Major Dural Folds of the Brain	<ul style="list-style-type: none"> • Falx Cerebri - A fold of dura mater that separates the right and left cerebral hemispheres and lies within the longitudinal fissure. • Falx Cerebelli - A fold of dura mater that partially separates the right and left cerebellar hemispheres. • Tentorium Cerebelli - A fold of dura mater that separates the cerebrum from the cerebellum and lies within the transverse fissure.
	<ul style="list-style-type: none"> • Lateral Ventricles - Paired, C-shaped cavities located in

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SECTION PROFICIENCY LOG

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BODY					
MSK					

REVIEW: Areas of Weakness

Use the following progress charts to pinpoint sections needing further study. The provided checkboxes align with those in the progress charts at the end of each study guide section. Upon completing a section and recording your proficiency in each section's corresponding chart, this master chart updates automatically, helping you quickly identify weaker areas after finishing the guide.

I. PATIENT CARE PRINCIPLES					
SECTION	POOR	FAIR	AVERAGE	GOOD	MASTERED
1. Legal and Ethical Considerations in MRI					
2. Interpersonal Communication in MRI					
3. Physical Assistance and Monitoring in MRI					
4. Medical Emergencies in MRI					
5. Infection Control in MRI					
6. Pharmacology in MRI					

II. SAFETY PRINCIPLES					
SECTION	POOR	FAIR	AVERAGE	GOOD	MASTERED
1. Screening and Safety in MRI					

III. IMAGE FORMATION PRINCIPLES: Part 1 - Essentials of Image Creation					
SECTION	POOR	FAIR	AVERAGE	GOOD	MASTERED
1. Instrumentation in MRI					
2. Fundamentals of MRI					



3. Imaging Artifacts in MRI					
4. Quality Control in MRI					
III. IMAGE FORMATION PRINCIPLES: Part 2 - Image Quality, Parameters, and Options					
SECTION	POOR	FAIR	AVERAGE	GOOD	MASTERED
1. Imaging Quality and Parameters in MRI					
2. Imaging Options in MRI					
III. IMAGE FORMATION PRINCIPLES: Part 3: Data Acquisition and Manipulation					
SECTION	POOR	FAIR	AVERAGE	GOOD	MASTERED
1. Pulse Sequences in MRI					
2. Special Pulse Sequences and Procedures in MRI					
3. Data Manipulation in MRI					

IV. PROCEDURES AND ANATOMY					
SECTION	POOR	FAIR	AVERAGE	GOOD	MASTERED
1. Introduction to MRI Procedures					
2(A). Sectional Anatomy - Head, Neck, and Spine					
2(B). Sectional Anatomy - Body					
2(C). Sectional Anatomy - MSK					



TABLES: Memorization

Use this section to quickly review the study guide's tables, which contain key information, numbers, and equations, before exam day. Some details, such as numbers and equations, are easily forgotten since their retention often depends more on memorization than comprehension. To aid recall, the guide's tables have been compiled here for easy reference and memorization before exam day.

TYPICAL ADULT VITAL SIGNS	
Heart Rate / Pulse Often measured via palpation or with electronic monitoring equipment.	~ 60-100 BPM (Beats per minute)
Blood Pressure Often measured with a sphygmomanometer.	Systolic: ~120 mmHg Diastolic: ~80 mmHg (Millimeters of mercury)
Respiratory Rate Often measured visually by counting or with electronic monitoring equipment.	~ 12-20 Breaths per minute
Temperature Often measured with a thermometer in various locations.	Oral: ~ 98.6° F Axillary: ~ 97.6° F Tympanic: ~ 97.6° F Rectal: ~ 99.6° F
ADDITIONAL: Blood Oxygen Saturation (SpO2) Often measured with a pulse oximeter. Notably, carbon dioxide (CO2) levels can be measured with a capnometer.	~ 95-100%
Please note that ranges can vary based on the patient's age, sex, health status, and other factors. Therefore, vital signs are often best interpreted in the context of the individual patient and in consultation with other healthcare professionals.	

TYPICAL ADULT ORG COMPRESSION TECHNIQUE

— END OF SECTION —
DEMO