

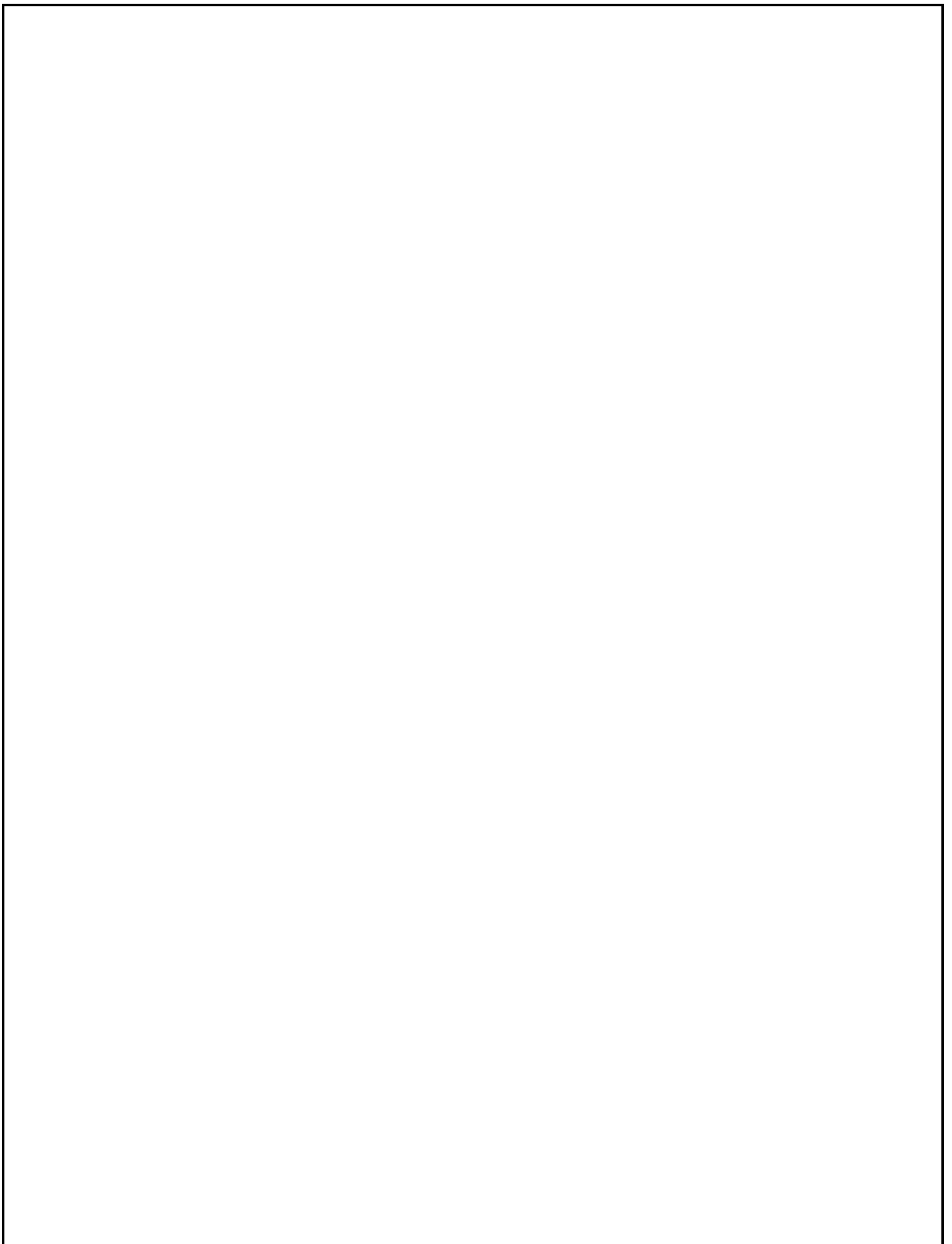
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News: Magnetic Resonance Imaging (MRI)

- Recently, Magnetic Resonance Imaging (MRI) has been a topic of discussion as an indispensable tool for non-invasive exploration inside the human body.

Magnetic Resonance Imaging (MRI)

- Magnetic Resonance Imaging (MRI) is a **non-invasive diagnostic procedure used to obtain images of soft tissues within the body.**
- Soft tissue is **any tissue that hasn't become harder through calcification.** Calcification of soft tissue is a condition **where calcium salts accumulate in soft tissue, causing it to harden.**
- It is **widely utilised for imaging various body parts such as the brain, cardiovascular system, spinal cord, joints, muscles, liver, and arteries.**
- Unlike **X-rays, which use radiation, MRI scans leverage powerful magnets and radio waves to create detailed images of soft tissues within the body.**
- Professor **Paul C. Lauterbur and Peter Mansfield** won the 2003 Nobel Prize in **Physiology or Medicine** for their innovative research which resulted in the **invention of MRI.**



Working Principle of MRI

- **Hydrogen Atom Utilisation:** An MRI procedure utilises hydrogen atoms present in the body part being scanned.
- **MRI Machine Components:** The MRI machine consists of four essential components, including a superconducting magnet, a radiofrequency pulse emitter, and a detector.
- **Magnetic Field Application:** The superconducting magnet produces a strong and stable magnetic field around the body, causing the hydrogen atoms' spin axes to align either parallel or antiparallel to the field.
- **Radiofrequency Pulse Emission:** A radiofrequency pulse is emitted into the body part under the scanner, exciting only the small population of unmatched hydrogen atoms.
- **Signal Detection and Image Formation:** The emitted energy from the excited atoms is detected by a receiver and converted into signals.
- These signals are then used by a computer to create two–or three–dimensional images of the scanned body part.

Importance of MRI

- MRI plays a crucial role in observing and treating cancers like prostate and rectal cancer, as well as tracking neurological conditions including Alzheimer's, dementia, epilepsy, and stroke.
- Additionally, researchers use MRI scans to study changes in blood flow, aiding in understanding brain activity, known as functional MRI.

Advantages of MRI

- **High Precision:** MRI machines scan specific body portions with gradient magnets.
- **Safety:** MRI scans pose no long-term harm, and magnetic field effects are well-studied.
- **Early Disease Detection:** MRI aids early detection of diseases like cancer and multiple sclerosis.
- **Minimally Invasive Procedure:** MRI is safe and comfortable, unlike surgery, benefiting children and the elderly.

Disadvantages of MRI

- **Cost:** MRI machines are expensive to purchase and maintain, leading to high diagnostic costs for patients.

- **Discomfort and Claustrophobia:** Patients must lie still for extended periods inside the MRI machine, which can be uncomfortable, especially for claustrophobic individuals.
- **Limited Imaging Capability:** MRI struggles to image certain tissues like bone, air, and some types of implants effectively due to their physical properties.
- **Strong Magnetic Fields:** The powerful magnetic fields used in MRI can pose potential risks for patients with certain medical implants (e.g., pacemakers) or metallic objects lodged in their bodies.