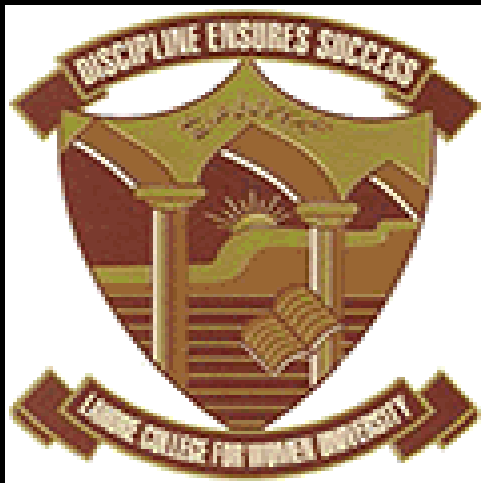


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Subject: Nanotechnology &
Nanostructures (Lecture # 17 (2))
Prof .Dr. Zohra Nazir Kayani

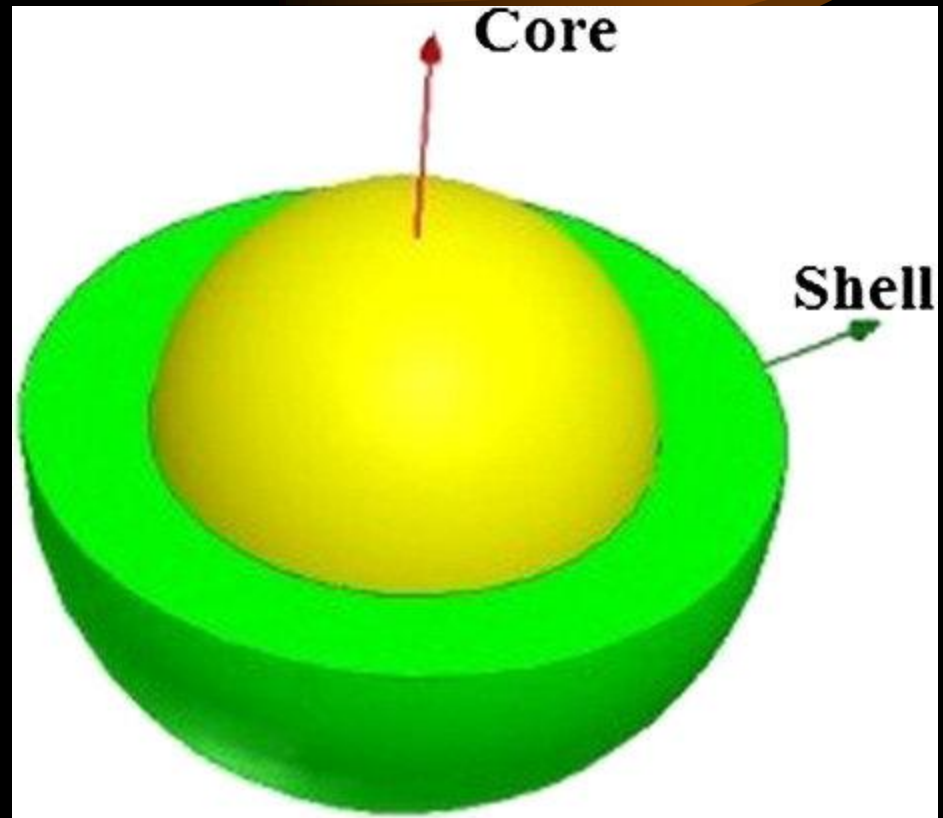
Physics Department
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Lecture # 17
Part(2)

Core/Shell Nanoparticles

- The core/shell means a structure comprising two materials for example a polymer and some metal, in which there is a core and the surrounding medium is shell.



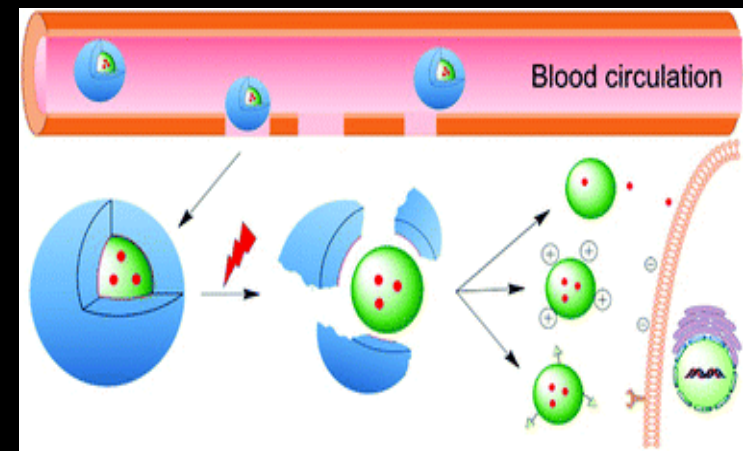
Applications

➤ Core/Shell nanoparticles are finding wide spread applications in all fields. Things such as cabinet and car doors contain nanoparticles which improve their durability.

➤ At a large scale the industries that make most use of these materials are the chemical, electronics, biomedical, civil and mechanical Industries.

➤ They are used as catalysts, modifiers, fillers, thermal and mechanical property enhancers, sensor material due to high sensitivity to slight changes in parameter.

➤ The diverse branches of the industry where nanoparticles are being recognized are bioimaging, drug delivery, biomarkers and transplants.





*Uses of magnetic **Core/Shell** nano particles*

- ❖ *In Bio Imaging*
- ❖ *In Drug Delivery*

Bioimaging

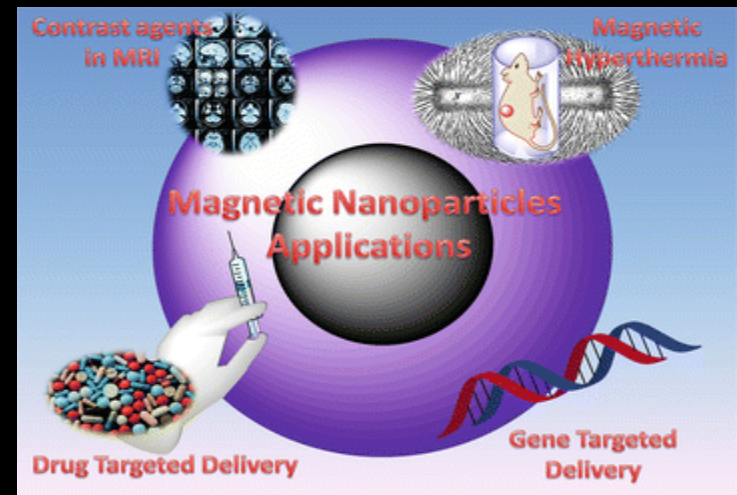
Biological imaging may refer to any imaging technique used in biology such as

- Cancer Imaging
- Inflammation Imaging
- Magnetic resonance Imaging (MRI)
- Ultrasound Imaging



Uses of magnetic nano particles


- The imaging modalities in which core/shell nanoparticles are used are MRI and luminescence.
- Magnetic nanoparticles iron oxide or cobalt core particles are used to enhance MRI images by improving contrast.
- Core/shell nanoparticles can enter the cells and they have better spin-lattice relaxation time. Thus the contrast is better. These particles are found to be biocompatible, so they seem very promising.



➤ Similarly particles that emit in the UV-visible range sometimes have low signal to noise ratio. But the composition and particle size can be varied to get appropriate emission and detection is also a lot easier.

➤ The luminescent particles are particles that fluoresce by absorbing light over in a wavelength range and emit in the visible or near-IR range.

➤ The nanoparticles with NIR region emission are still being worked on as the cells do not emit in the same range. Thus signal to noise ratio is high. Though they cannot be easily applied to in-depth live cell imaging, the application is not impossible.

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- The ranges of nanoparticles that are luminescent are semiconductor nanoparticles, lanthanide based nanoparticles, and gold coated silica nanoparticles and the like.
 - Multifunctional nanoparticles that have magnetic and luminescent properties can also be synthesized by choosing appropriate core and shell. This helps in obtaining clear 3D images.

Drug Delivery

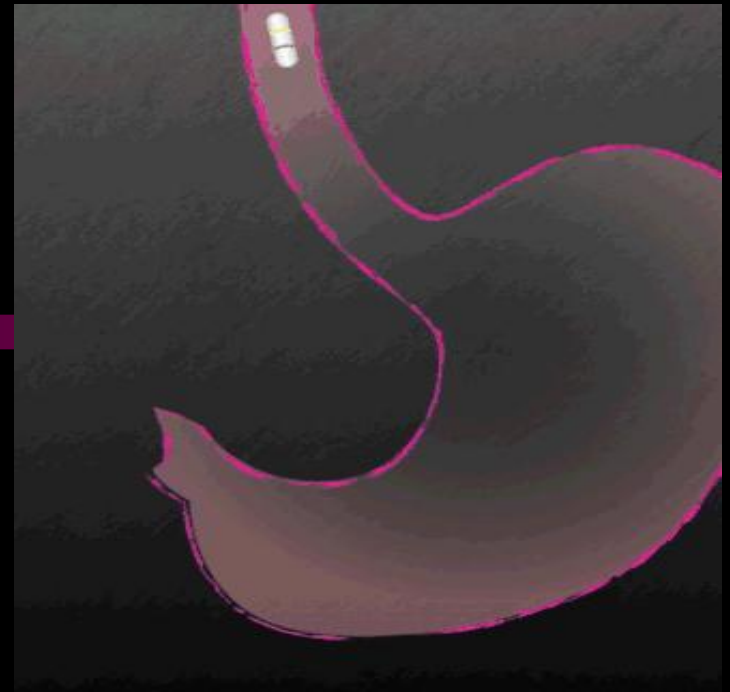
Drug delivery refers to approaches, formulations, technologies and systems for transporting a pharmaceutical compound in the body as needed to safely achieve its desired therapeutic effect.

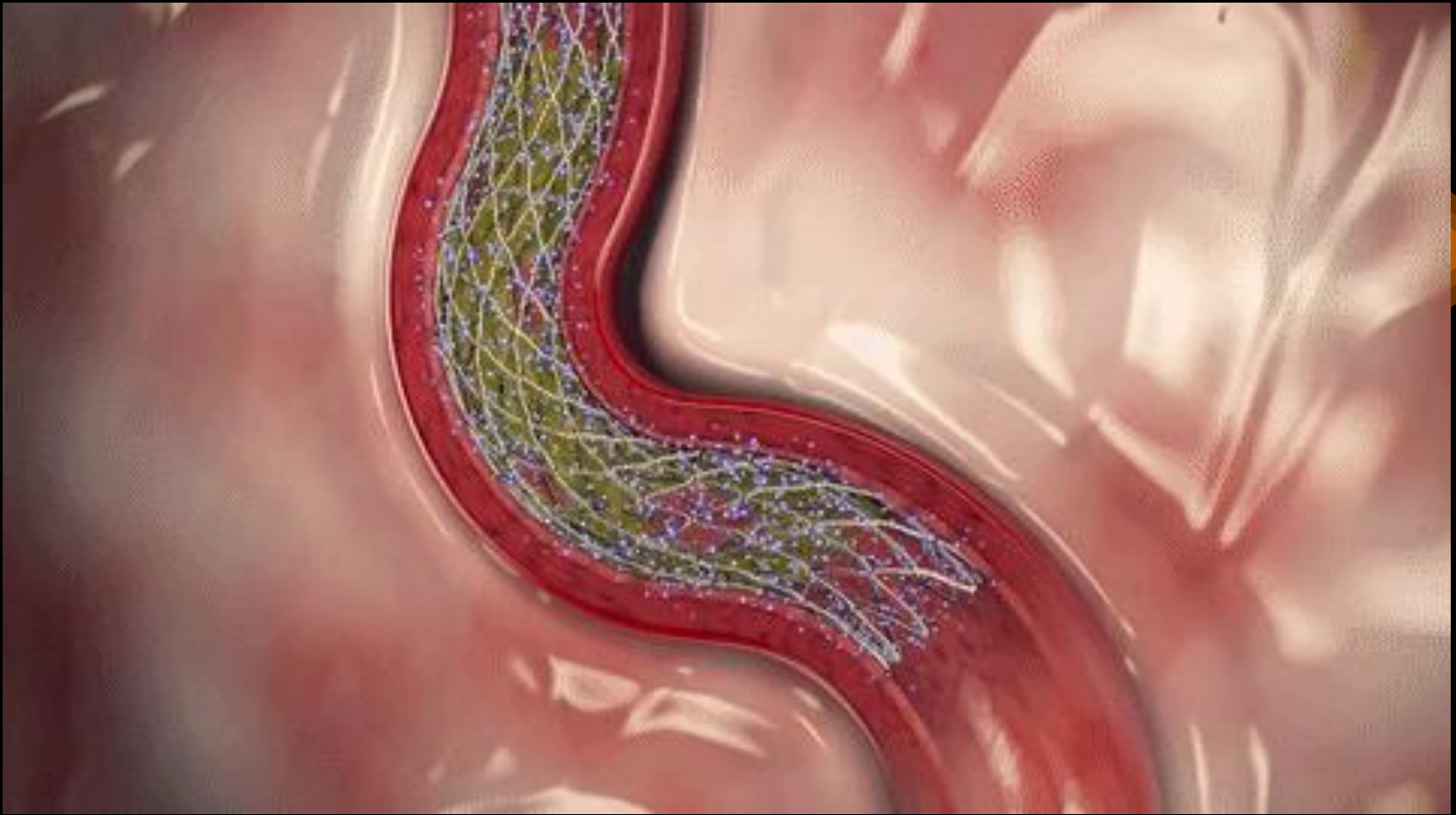


- Core/Shell structures serve a wide category of **drug delivery** application.

- The particles are biocompatible, have the ability to be conjugated to molecules without affecting the core and also can be used to encapsulate drugs.

- They can be structured so that they can be used for imaging and for drug delivery.





• **Drug eluting stents** made of nanocomposite material are being worked upon to reduce abrasion.

- The drugs can be targeted to specific locations by attaching biomolecules such as antibodies to the surface of nanoparticles.

- This is very useful when it comes to targeting tumor cells.

- Thermo sensitive and pH sensitive nanoparticles can be used for environment controlled delivery of drug from the particles.

- Bifunctional nanoparticles with a luminescent core and shell conjugated with a biomolecule/drug that can be used for targeting /drug delivery and imaging.

- Drug loaded contact lenses are an elucidation of how these materials can be used for encapsulating drugs.



Thank You