

# Applications of Nanomaterials – Carbon Nanotubes (CNTs)

Subject: Fundamentals of Nanotechnology and Nanoscience

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# Introduction to CNTs

- Hollow cylindrical structures made of carbon atoms.
- Discovered by Sumio Iijima in 1991.
- Formed by rolling a single layer of graphene into a tube.
- **Two main types:**
  - Single-Walled CNTs (SWCNTs)
  - Multi-Walled CNTs (MWCNTs)
- Known for high strength, light weight, and excellent electrical & thermal properties.

 3D model of Single-Walled and Multi-Walled Carbon Nanotubes



# What Makes CNTs Special?



## Unmatched Strength

100x stronger than steel but at only 1/6th of its weight.



## Superior Conductivity

High electrical & thermal conductivity, ideal for nano-electronics and heat removal.



## High Versatility

Large surface area, flexible, chemically stable, and can be functionalized for specific uses.



# Applications (Part 1)

## Electronics & Electrical

- ✓ Transistors, interconnects, flexible circuits
- ✓ Conductive films in touchscreens and displays
- ✓ Supercapacitors and high-performance batteries
- ✓ EMI shielding materials

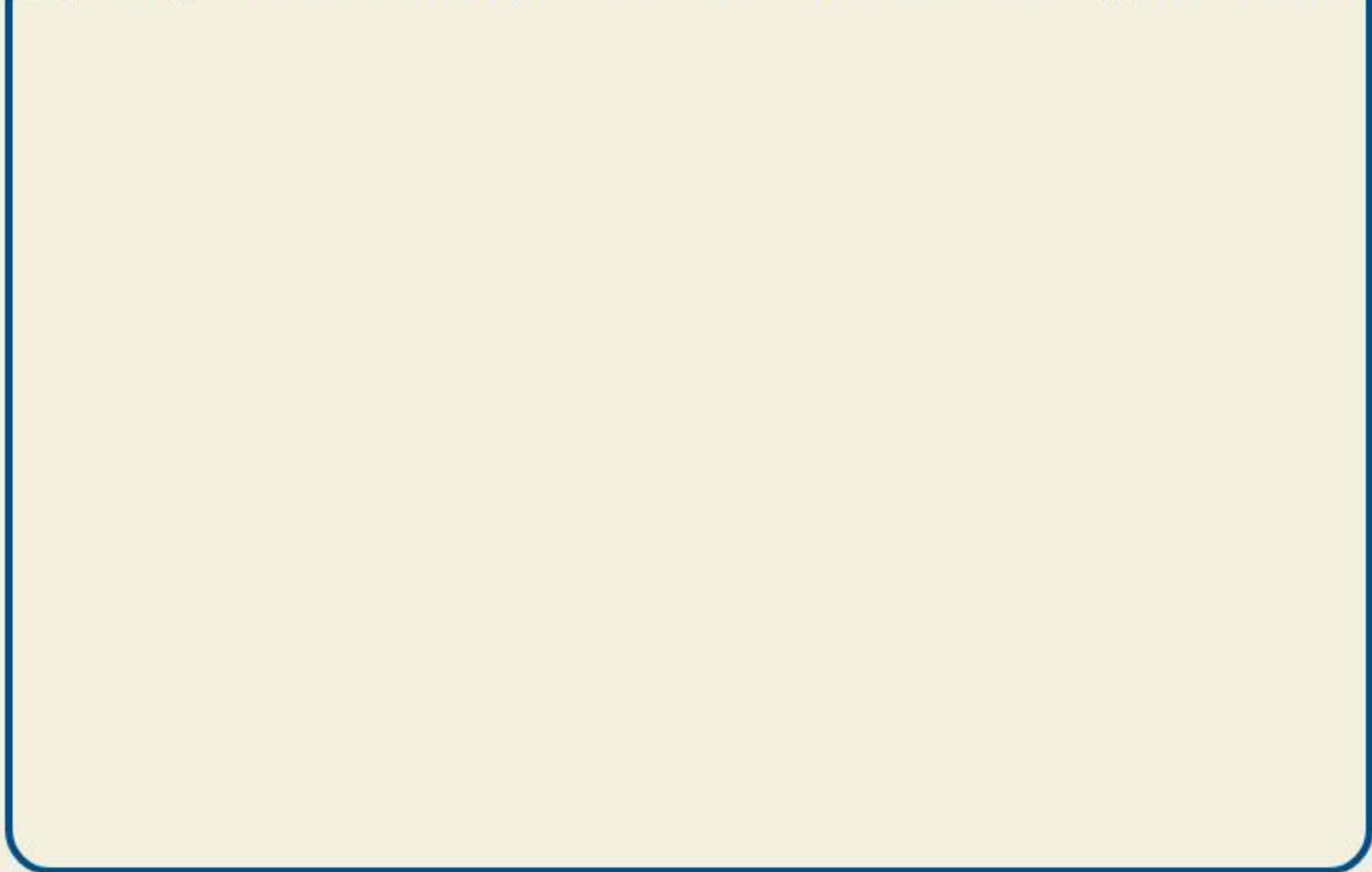
## Mechanical / Structural

- ✓ Aerospace and automotive lightweight composites
- ✓ Sports equipment: tennis rackets, bicycles, helmets
- ✓ Bulletproof jackets and protective armor
- ✓ CNT-reinforced cement and construction materials



# Applications (Part 2)

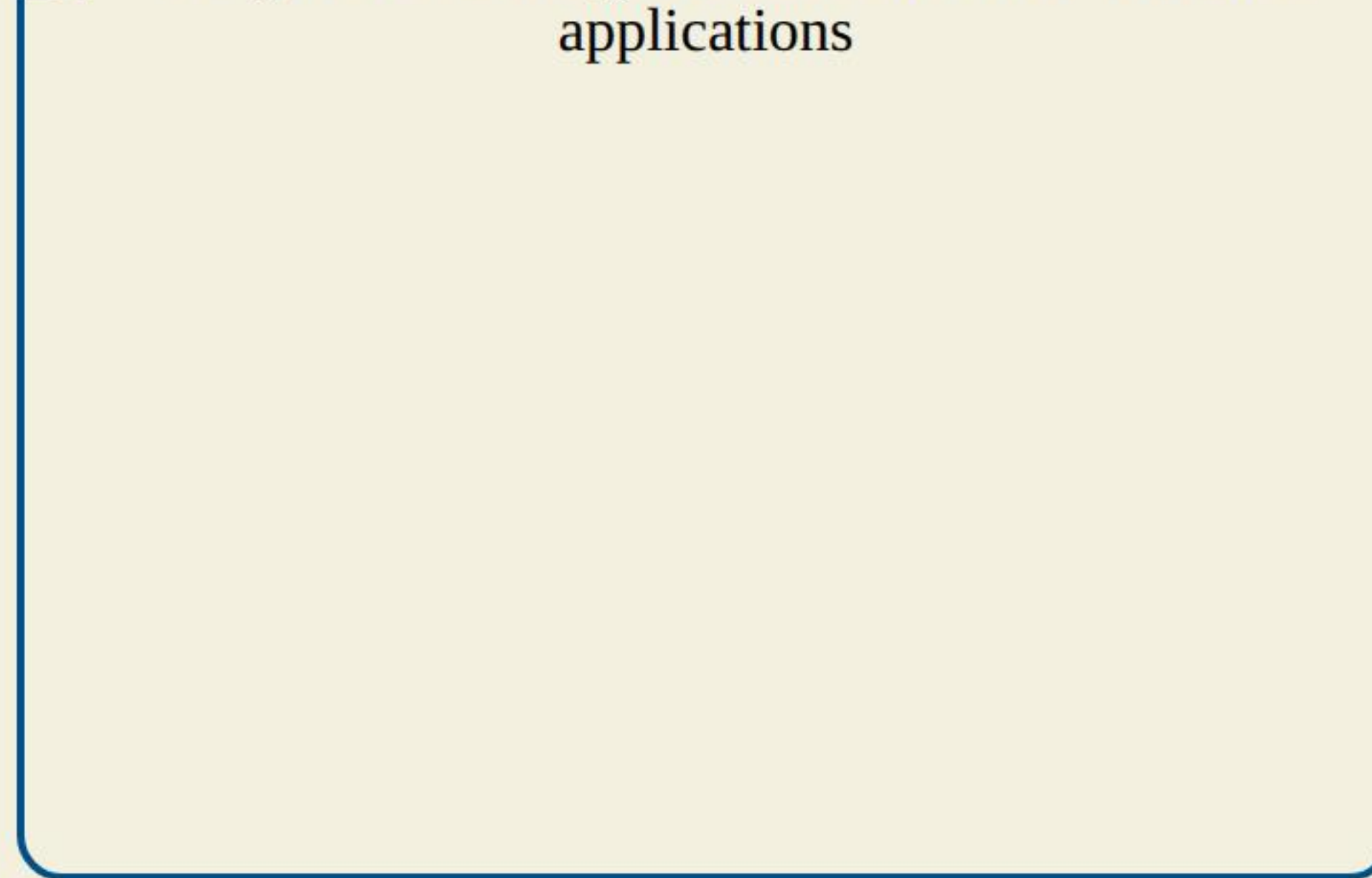
 AI-generated image of CNTs in medical applications



## Medical / Biotechnology

Targeted drug delivery, biosensors for glucose & cancer, and scaffolds in tissue engineering.

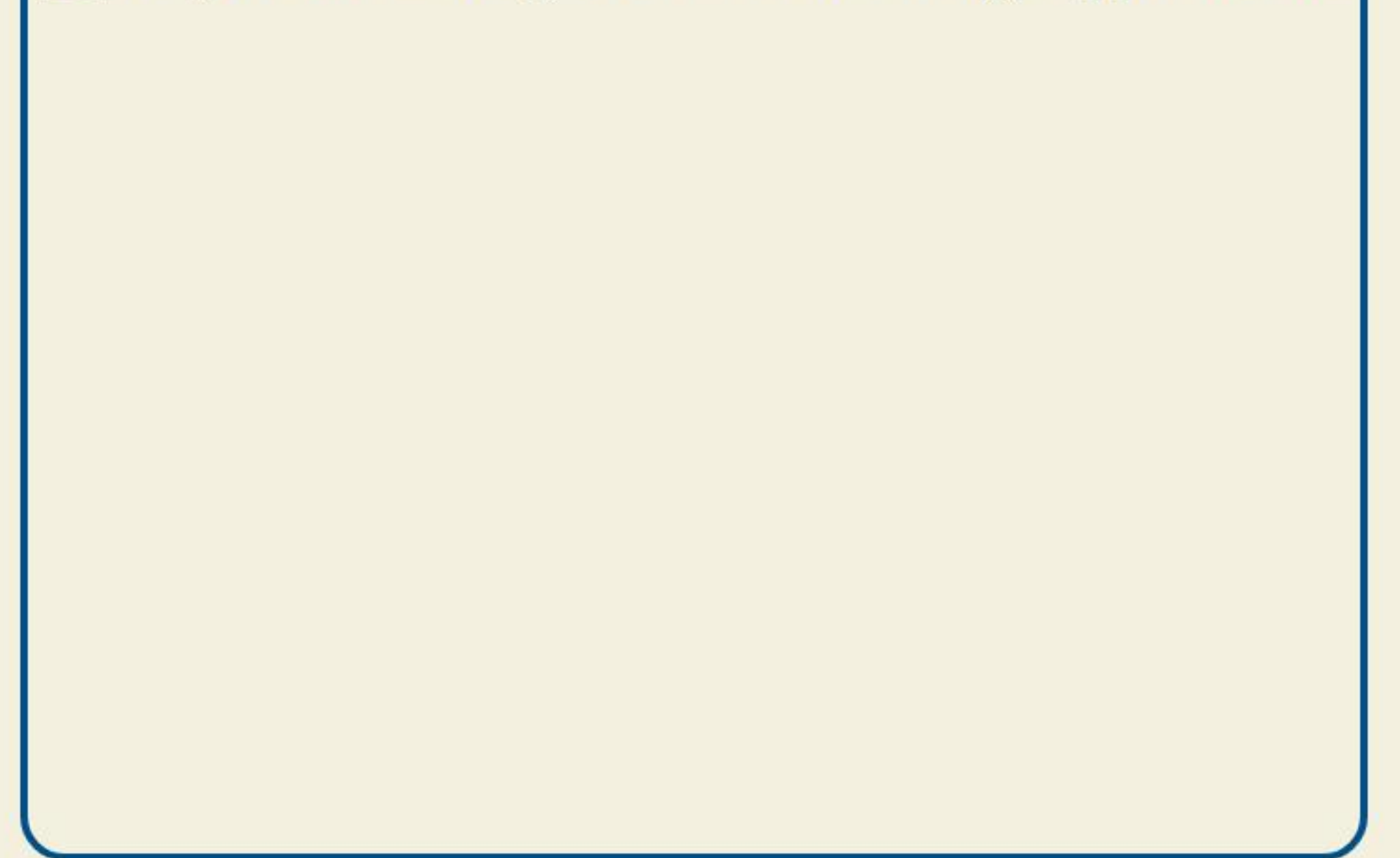
 AI-generated image of CNTs in environmental applications



## Environmental

Water purification & desalination filters, removal of heavy metals, and gas sensors for toxic gases.

 AI-generated image of CNTs in energy applications

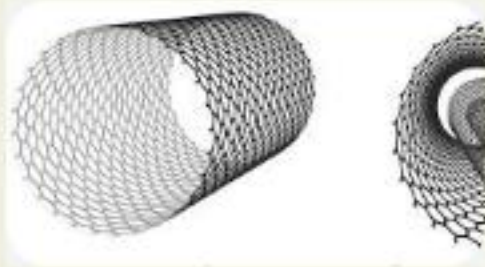


## Energy

Hydrogen storage devices, solar cells, fuel cells, and high-efficiency energy conversion electrodes.



# Image Sources



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