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Carbon Nanotubes for Radiation Therapy

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**INTRODUCTION**

**WHAT ARE NANOTUBES?**
- Nanotubes are allotropes of Carbon in a cylindrical nanostructure (which in a scale of a billionth of a meter).
- At this very small scale, certain elements, like Carbon, exhibit different properties than they do on the normal or macro scale.
- Currently, there are 5 main types of nanotubes, which are as follows:

1. **SINGLE-WALLED CARBON NANOTUBES**
2. **MULTI-WALLED CARBON NANOTUBES (CROSS-SECTIONAL VIEW)**
3. **TORUS (SEEN HERE AROUND A SINGLE WALLED CARBON NANOTUBE)**
4. **CUP-STACKED**
5. **CARBON NANOBUDS (WITH COLOR-CODED ELECTRICAL CONDUCTIVITIES FOR EACH TYPE)**

**ROLE OF THE NANOTUBE**
- This closed form of the tube avoids any punctures to internal organs. [1]
- To ensure that the nanotube reaches its correct destination, its outer surface is modified with either a sugar or other targeting molecule. [1]
- This targeting molecule is derived from the halide salt used before cooling.
- Depending on the target organ or region, different salt compounds of the targeting molecules are used.
- For example, N-acetylglucosamine is used to send it to the lungs. [1]

**NANOTUBES FOR RADIOTherAPY**
- **How it works?**
  The single walled nanotube is used as an open capsule containing the required irradiated drug.
- **Why it works?**
  Since the irradiated drug behaves as a bunch of photons, they can easily get out at their intended destinations.

**DRUG DELIVERY MECHANISM**
- A single-walled nanotube ‘cage’ is used to store and transport the required drug to the target area in the body. [2]
- This capsule is filled with molten radioactive metal halide salts. [2]
- Upon cooling, the ends of the tube seal creating a tiny nanocapsule with a ‘sugary’ outer surface, to improve its compatibility inside the body. [2]
- This now sealed nanotube is then introduced into the body through this sugary pill.

**CONCLUSION**

**WHY IS IT BETTER?**
- Though today’s traditional radiotherapy is non-invasive, it does end up damaging the surrounding healthy cells.
- In testing done so far (on lab mice), it has shown no problems with radiation leaking into the healthy parts of the body or any other such consequences. [1]

**RESEARCH BEING DONE...**
- This potential breakthrough is the result of the hard work of the team consisting of:
  - Ben Davis, and
  - Malcolm Green from the University of Oxford, UK and
  - Kostas Kostarelos from the School of Pharmacy, University of London, UK. [1]

**OTHER USES OF NANTUBES**
- Due to their nature, nanotubes have wide ranging existing and potential applications.
- They are also being used in various marine components, sports gear and some wind turbines.
- In the medical field, they are used as supports for bone growth and in alternate cancer therapies (such as the Kanzui cancer therapy).

**REFERENCES**