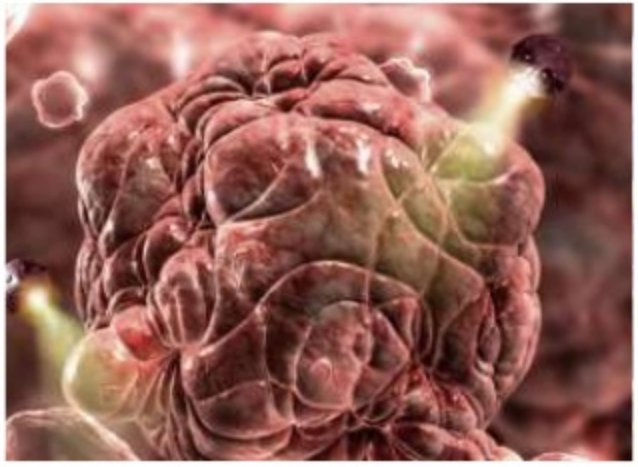
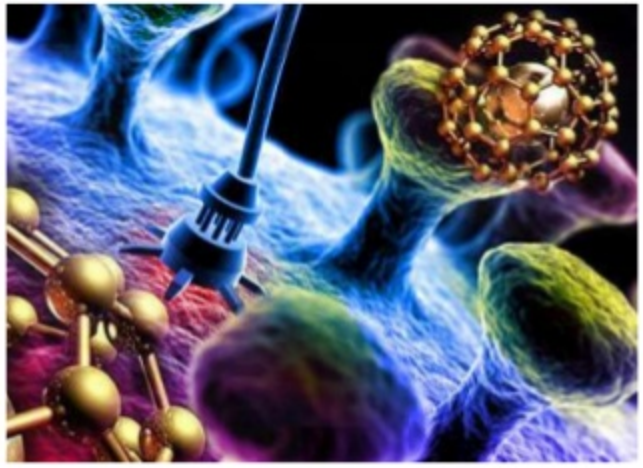




Today's hot issues in:

Cancer Nanobiotechnology

By: Naghmeh Poorinmohammad

na.poorin@gmail.com

Outline

- Why nanotechnology is promising in cancer control?
- How can it help?
- “Today” what does nanotechnology do to amaze us?
- Bright points aside/ Dark points aside...
- Biotechnologists! Any ideas?
- References

Why Nanotechnology is promising in cancer control?

1. **Limitations of Macromedicine:**

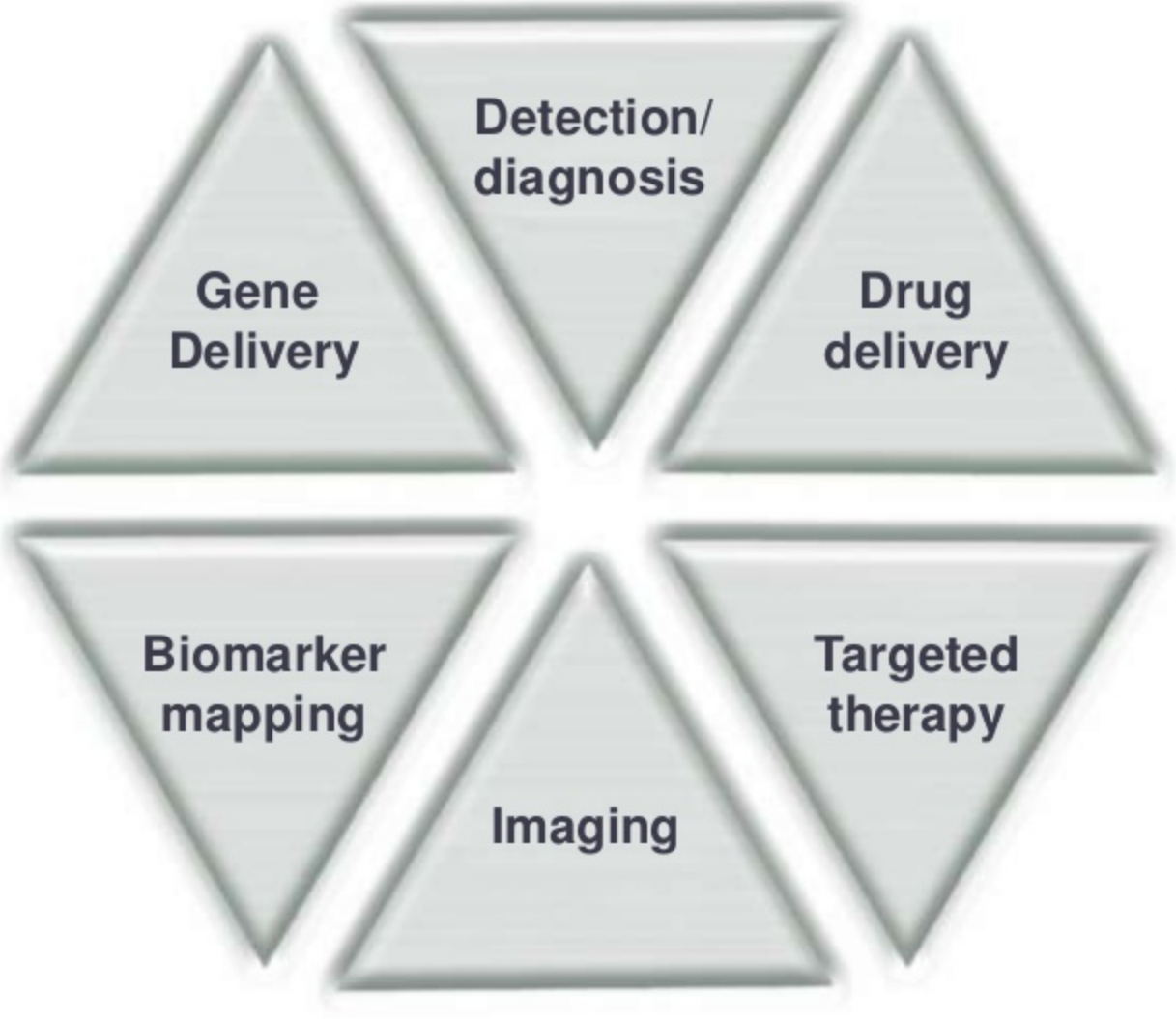
- Microscopic residual
- Functional damage to organs
- Resistance in cancer cells
- Side effects of therapies

2. **Novelty of "nano" and its uncovered potentials**

- It is promising in other fields
- It has shown unique properties

ATTENTION: We now know some nano limitations also!

How can it help?



Today what does nanotechnology do to amaze us?!

1. Nanotheranostics
2. Fighting with Cancer Stem Cells
3. Novel nanodevices

Today what does nanotechnology do to amaze us?!

1. **Nanotheranostics**
2. **Fighting with Cancer Stem Cells**
3. **Novel nanodevices**

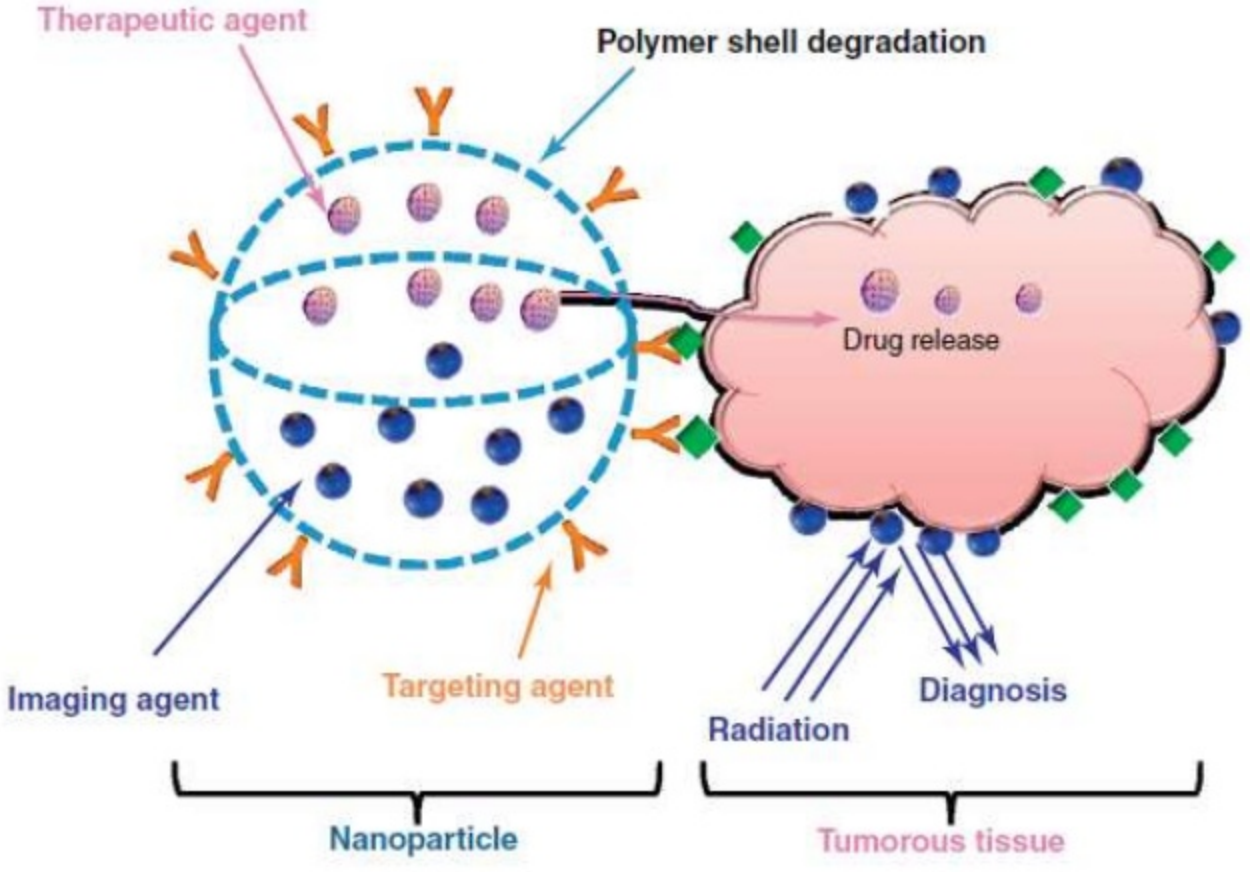
Today what does nanotechnology do to amaze us?!

1. **Nanotheranostics**
2. Fighting with Cancer Stem Cells
3. Novel nanodevices

- Therapeutics + Diagnostics
- Application of nanotechnology in preparation of dual-purpose nanomaterials used for simultaneous diagnosis and therapy.
- A combined technique will result in an improved disease management, reduced risks and reduced cost.
- Suitable theranostic approaches are expected for all diseases, especially cancer, in the future, although this will take some time.

Today what does nanotechnology do to amaze us?!

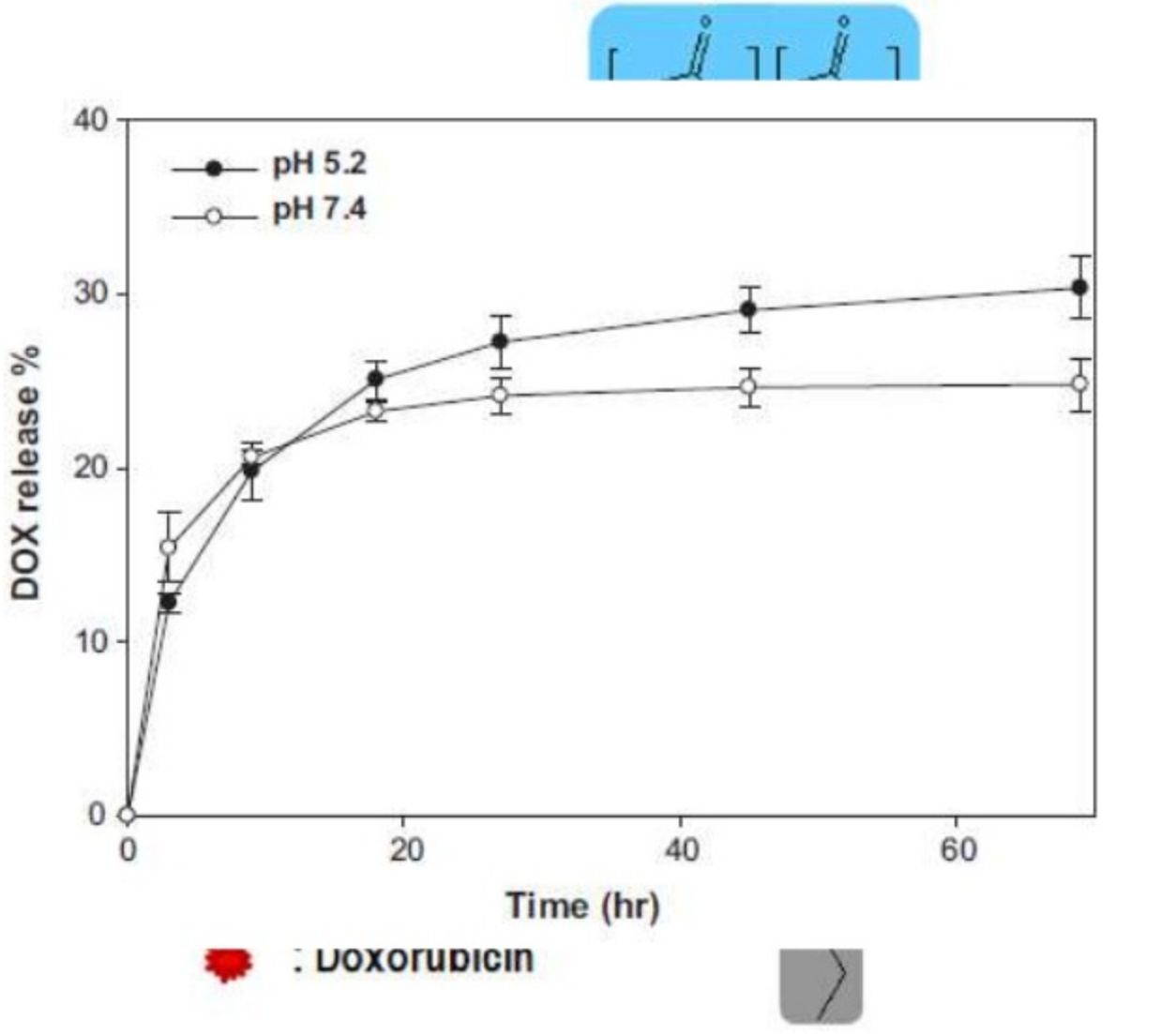
1. **Nanotheranostics**
2. Fighting with Cancer Stem Cells
3. Novel nanodevices



Today what does nanotechnology do to amaze us?!

1. **Nanotheranostics**
2. Fighting with Cancer Stem Cells
3. Novel nanodevices

- Case study 1:

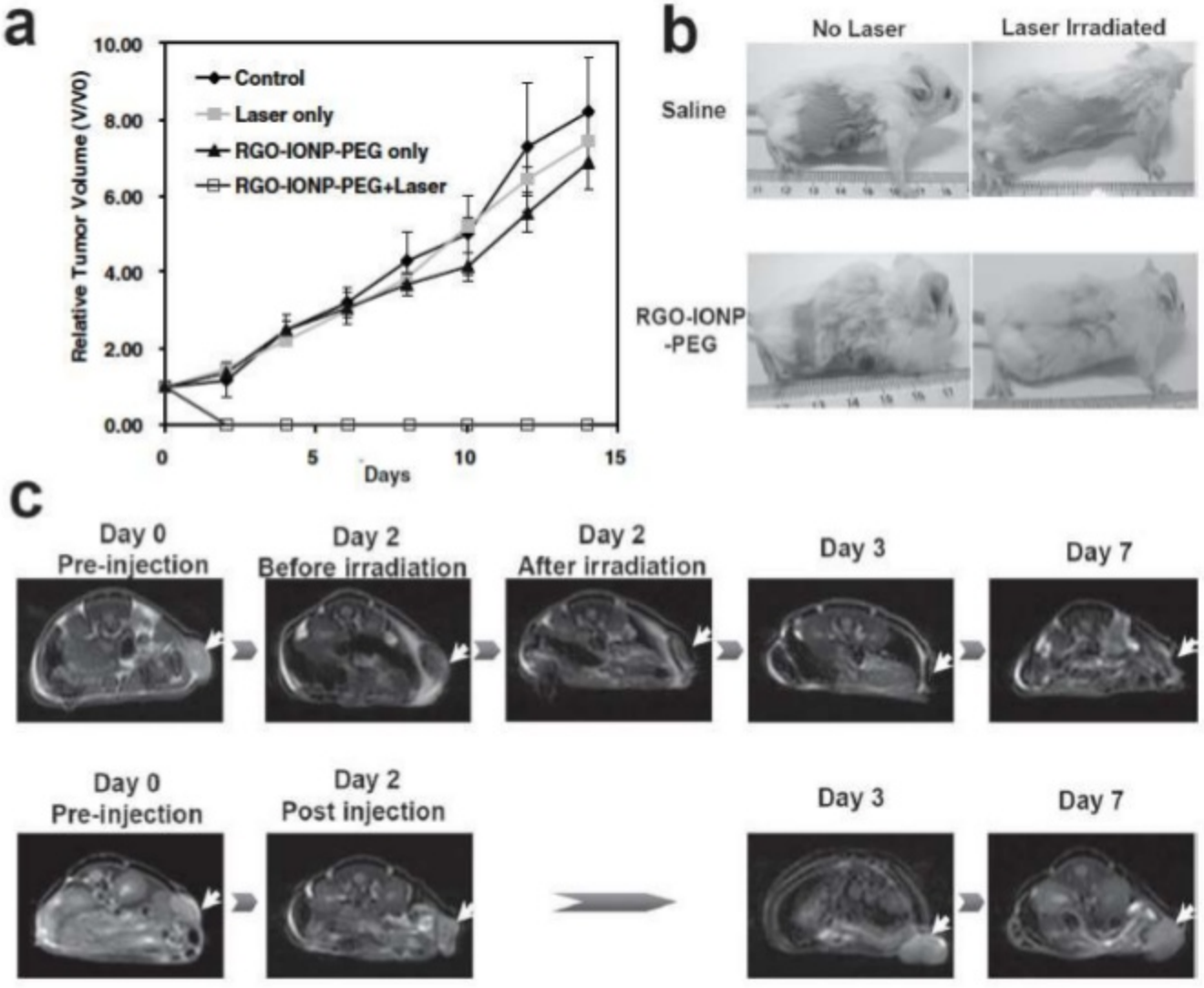


Yang, Hee-Man, et al. "Multifunctional poly (aspartic acid) nanoparticles containing iron oxide nanocrystals and doxorubicin for simultaneous cancer diagnosis and therapy." *Colloids and Surfaces A: Physicochemical and Engineering Aspects* 391.1 (2011): 208-215.

Today what does nanotechnology do to amaze us?!

1. **Nanotheranostics**
2. Fighting with Cancer Stem Cells
3. Novel nanodevices

- Case study 2:



Yang, Kai, et al. "Multimodal imaging guided photothermal therapy using functionalized graphene nanosheets anchored with magnetic nanoparticles." *Advanced materials* 24.14 (2012): 1868-1872.

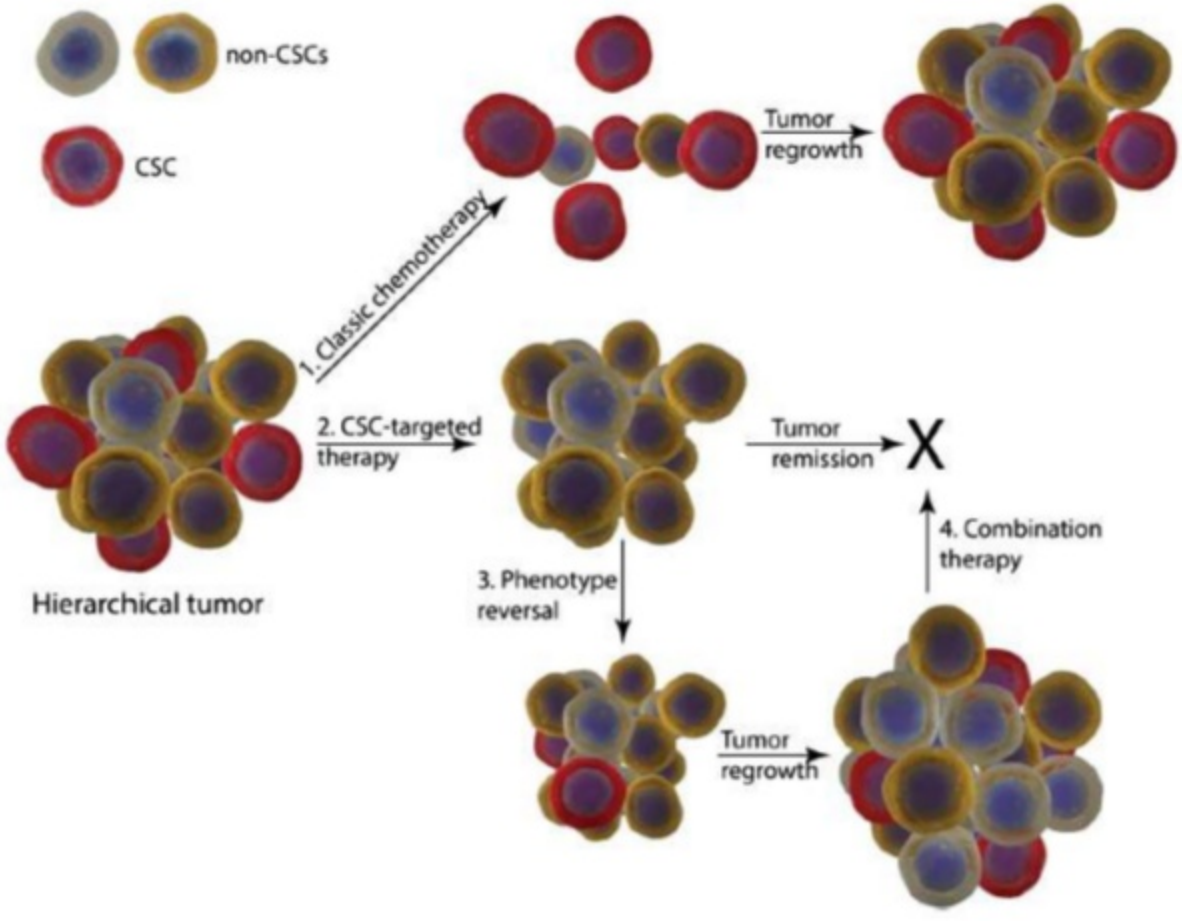
Today what does nanotechnology do to amaze us?!

1. Nanotheranostics
2. **Fighting with Cancer Stem Cells**
3. Novel nanodevices

- CSCs are functionally and phenotypically distinct from other tumor cells.
- Nanotechnology for the targeting of CSCs can provide us with a solution to cure cancer before a tumor forms
- curcumin shows anti-CSC activity, but its efficacy is limited by its poor bioavailability. Compared with free curcumin, curcumin-loaded nanomedicine showed enhanced stability, bioavailability and antitumor effects (Mimeault and Batra 2011)
- SWNTs conjugated with CD133 antibodies developed by Wang et al. and many other such studies.

Today what does nanotechnology do to amaze us?!

1. Nanotheranostics
2. **Fighting with Cancer Stem Cells**
3. Novel nanodevices

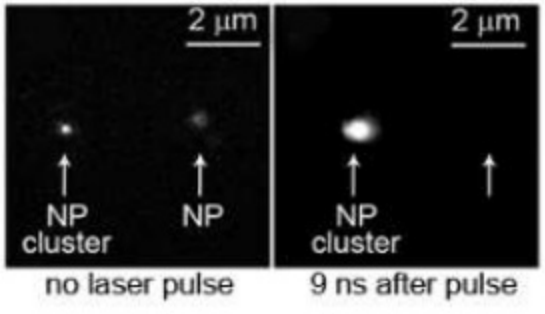


Today what does nanotechnology do to amaze us?!

1. Nanotheranostics
2. Fighting with Cancer Stem Cells
3. **Novel nanodevices**

✓ **Plasmonic Nanobubbles**

- When exposed to intense and short laser pulses, plasmon resonant nanoparticles may reach high temperatures and heat or even evaporate the surrounding space.
- The plasmonic nanobubble expands to its maximal diameter, then collapses back to the nanoparticle.
- PNBs show different optical efficacy.
- Plasmonic nanobubble can be 100-1000 times brighter than gold NPs.

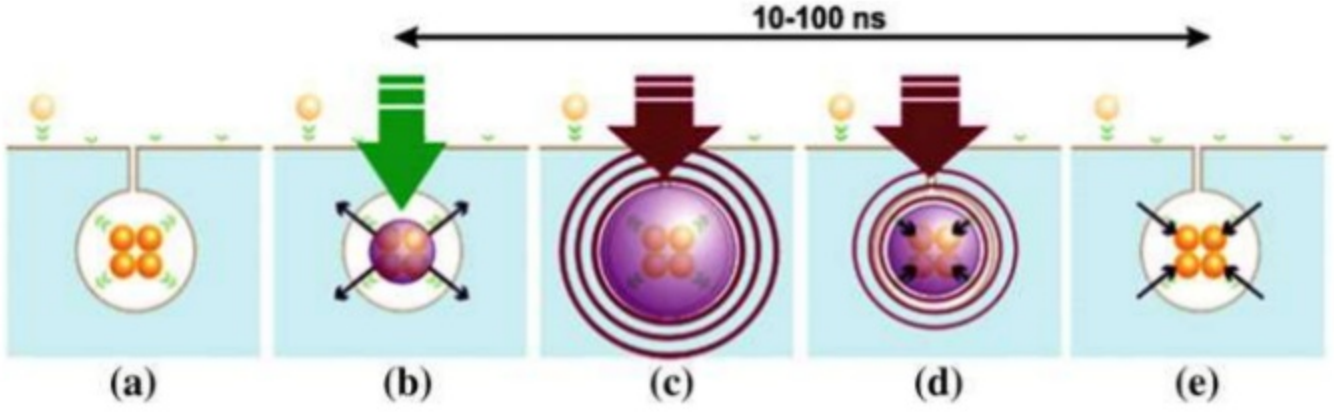


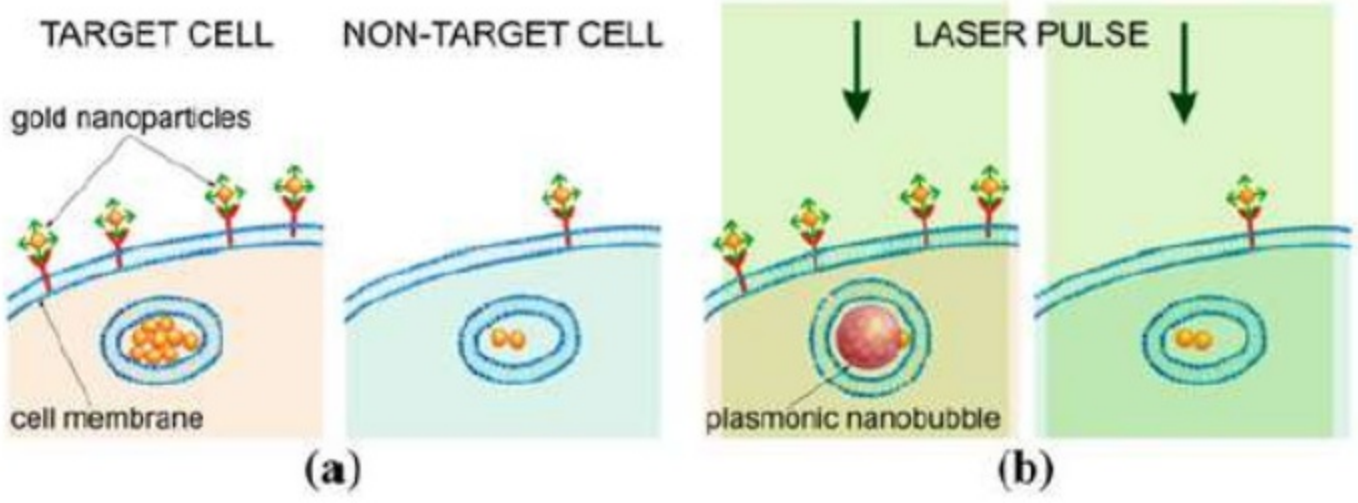
Lukianova-Hleb, Ekaterina Y., and Dmitri O. Lapotko. "Plasmonic Nanobubbles for Cancer Theranostics." Engineering in Translational Medicine. Springer London, 2014. 879-926.

Today what does nanotechnology do to amaze us?!

1. Nanotheranostics
2. Fighting with Cancer Stem Cells
3. **Novel nanodevices**

✓ Plasmonic Nanobubbles





Lukianova-Hleb, Ekaterina Y., and Dmitri O. Lapotko. "Plasmonic Nanobubbles for Cancer Theranostics." Engineering in Translational Medicine. Springer London, 2014. 879-926.

Bright points aside/ Dark points aside...

- **Toxicity/Biocompatibility studies**

Should be further investigated

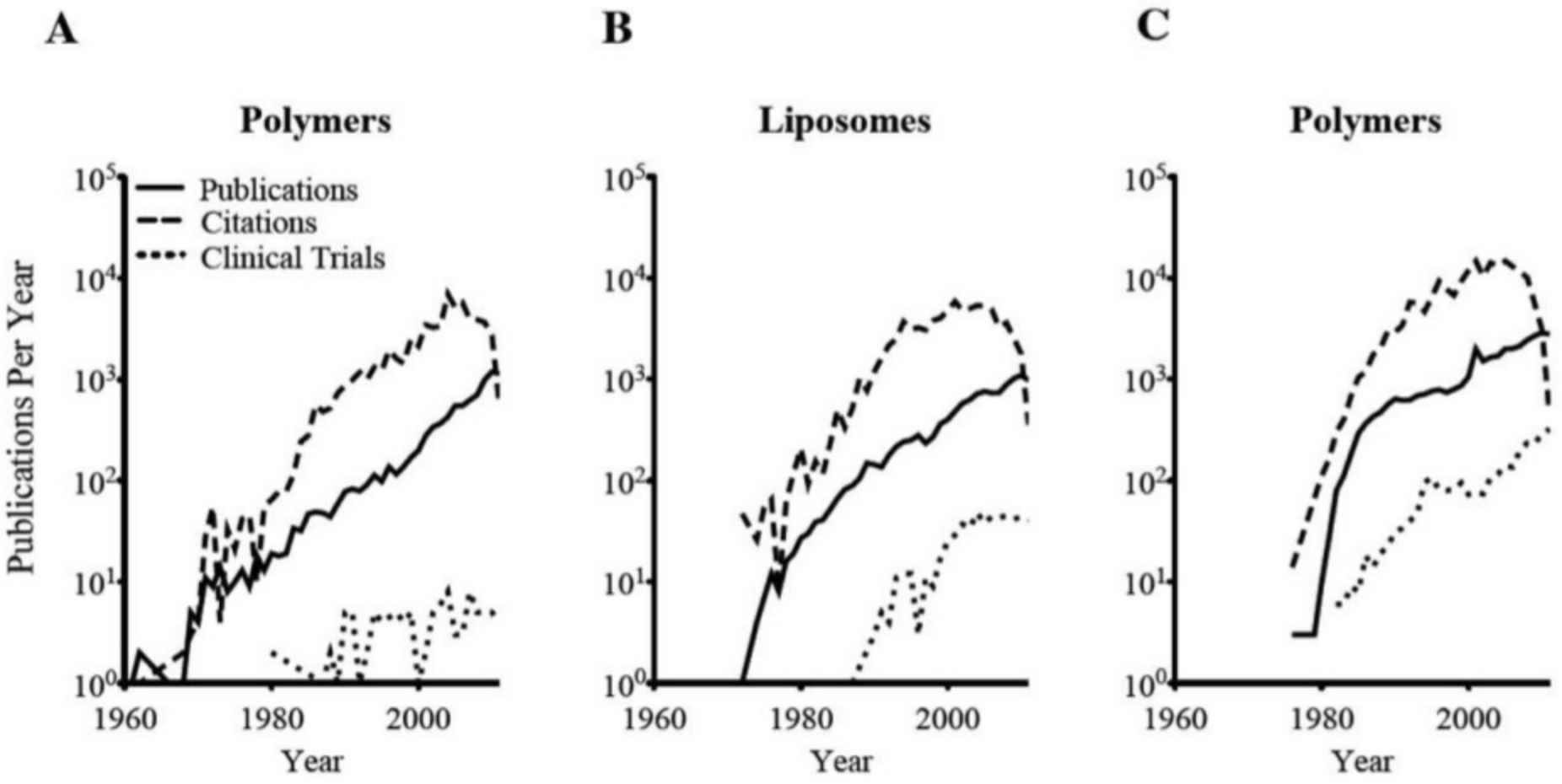
- **Costs**

Sometimes high

- **Research output**

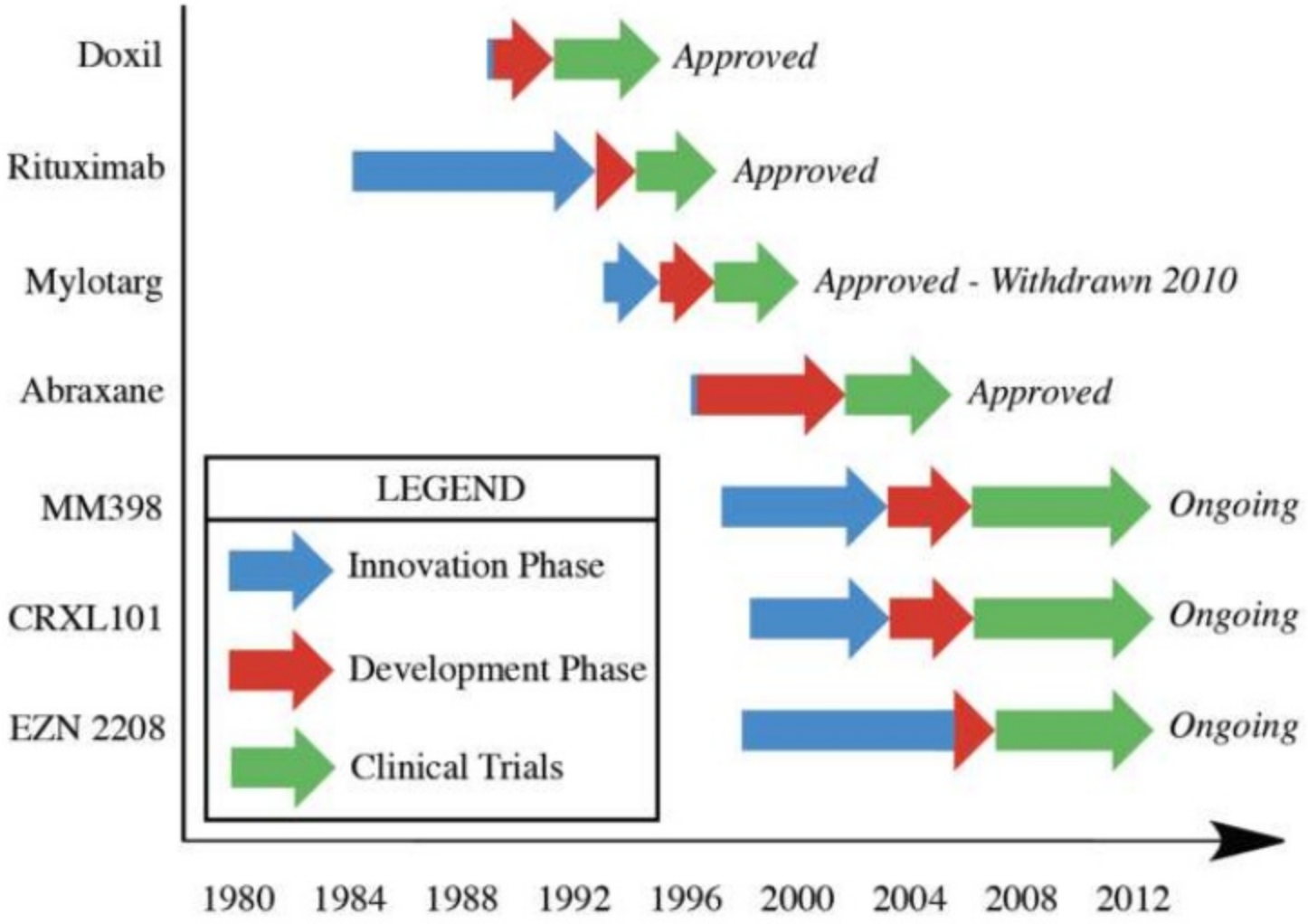
Let's see in the next slides...

Nanomedicine publication profiles over time



Venditto, Vincent J., and Francis C. Szoka Jr. "Cancer nanomedicines: so many papers and so few drugs!." *Advanced drug delivery reviews* 65.1 (2013): 80-88.

Nanomedicine innovation and approval timeline



Venditto, Vincent J., and Francis C. Szoka Jr. "Cancer nanomedicines: so many papers and so few drugs!." *Advanced drug delivery reviews* 65.1 (2013): 80-88.

BIOTECHNOLOGISTS!

Any Ideas?

References to Dig Deeper

- Venditto, Vincent J., and Francis C. Szoka Jr. "Cancer nanomedicines: so many papers and so few drugs!." Advanced drug delivery reviews 65.1 (2013): 80-88.

- Ahmed, Naveed, Hatem Fessi, and Abdelhamid Elaissari. "Theranostic applications of nanoparticles in cancer." Drug Discovery Today 17.17 (2012): 928-934.

- Lukianova-Hleb, Ekaterina Y., and Dmitri O. Lapotko. "Plasmonic Nanobubbles for Cancer Theranostics." Engineering in Translational Medicine. Springer London, 2014. 879-926.

- Janát-Amsbury, Margit M., and You Han Bae. "Nanotechnology in Cancer." Handbook of Anticancer Pharmacokinetics and Pharmacodynamics. Springer New York, 2014. 703-730.

- Sanna, Vanna, Nicolino Pala, and Mario Sechi. "Targeted therapy using nanotechnology: focus on cancer." International journal of nanomedicine 9 (2014): 467.

THANK YOU