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# Il QC della $^{99m}$Tc-Albumina nanocolloidale: dimensione delle particelle e biodistribuzione

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**Premio Galeno** – ***Milano, 22 giugno 2017***

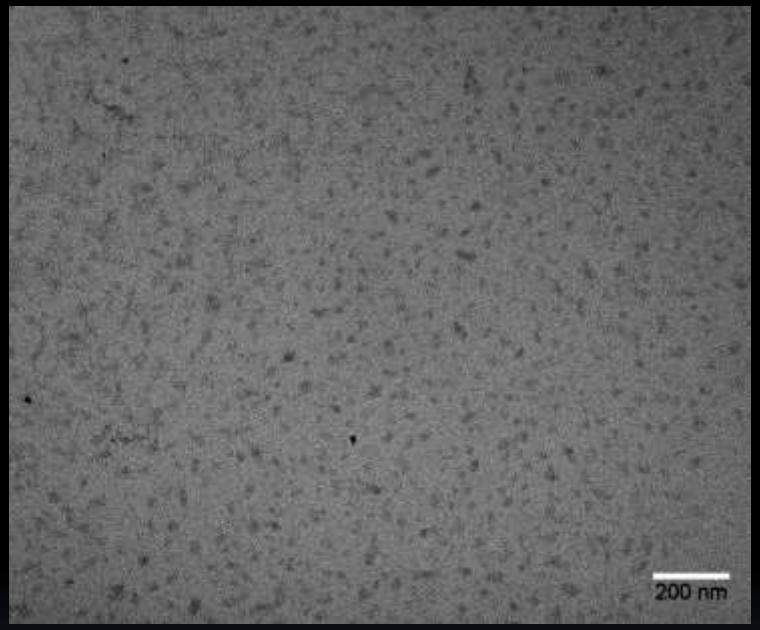
# NC-HSA

## Summary of chemical-physical data of $^{99m}Tc$ in NC-HSA kit

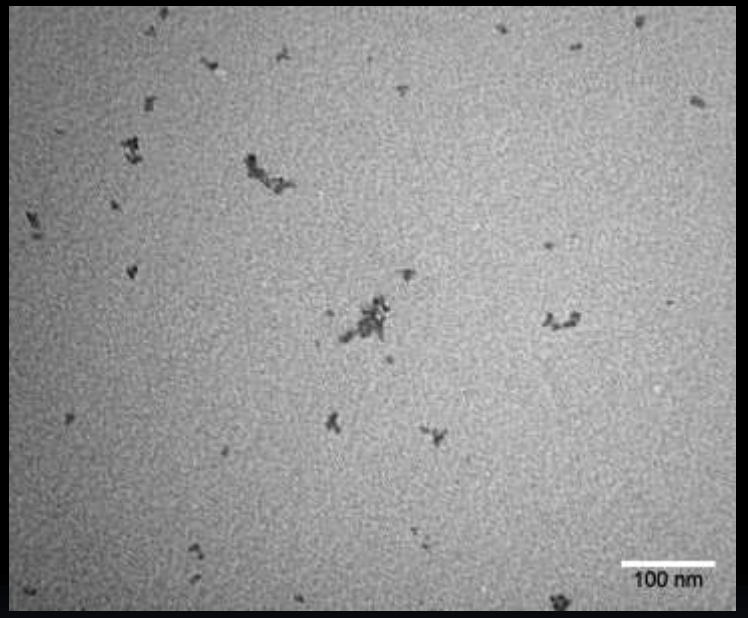
| | | |
|---|---|---|
| Specific of $^{99m}Tc$ Activity | $1.94 \cdot 10^{8}$ | GBq/g |
| Atomic Weight of $^{99m}Tc$ | 98.9063 | g/mol |
| Activity of $^{99m}Tc$ in NC-HSA kit | 5.5 | GBq |
| $^{99m}Tc$ mass in NC-HSA kit | 0.028347 | µg |
| $^{99m}Tc$ moles in NC-HSA kit | 0.287 | nmol |
| Number of $^{99m}Tc$ atoms in NC-HSA kit | $1.73 \cdot 10^{14}$ | atoms |

# System for "nanofiltration"

a



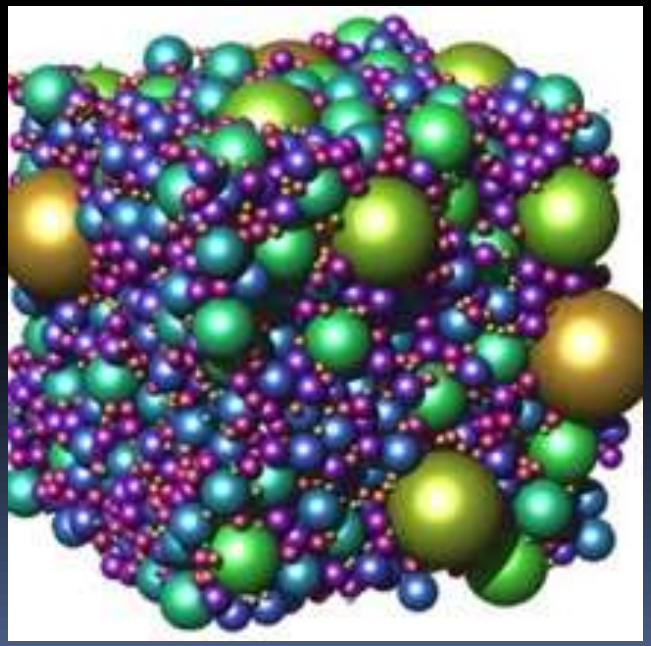

b

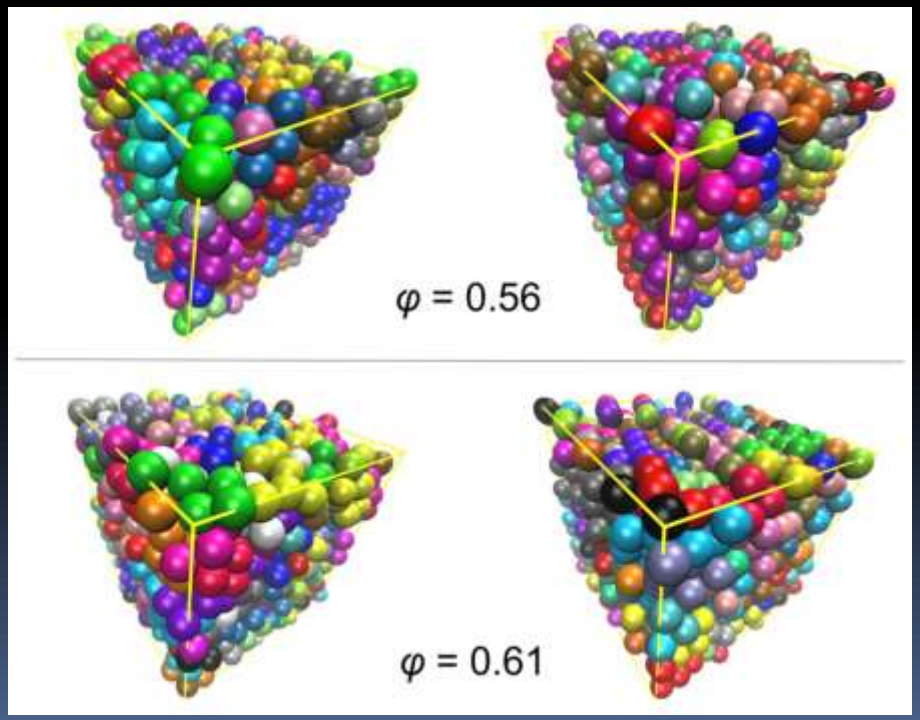



**TEM image of (a) Nanocoll (120000 x) and (b) Nanoalbumon (300000 x)**

# Mathematical Model

In our opinion, the major limit of previous models is the assumption the nanoparticles were considered as cubes ($\varphi = 1$) and calculations were only a "mean" of the entire scenery, while our mathematical model considers nanoparticles as spheres packed and a more realistic picture of number and volume of particles was obtained





# Mathematical model

Fundamental relation:

$$V_{\text{tot}} v(x) = \frac{1}{\varphi}\frac{4}{3}\pi\left(\frac{x}{2}\right)^3 N_{\text{tot}} n(x) = \frac{1}{\varphi}\frac{\pi}{6}x^3 N_{\text{tot}} n(x)$$

where ***x***: diameter of the particles; ***v(x)***: distribution of the volume of particles;

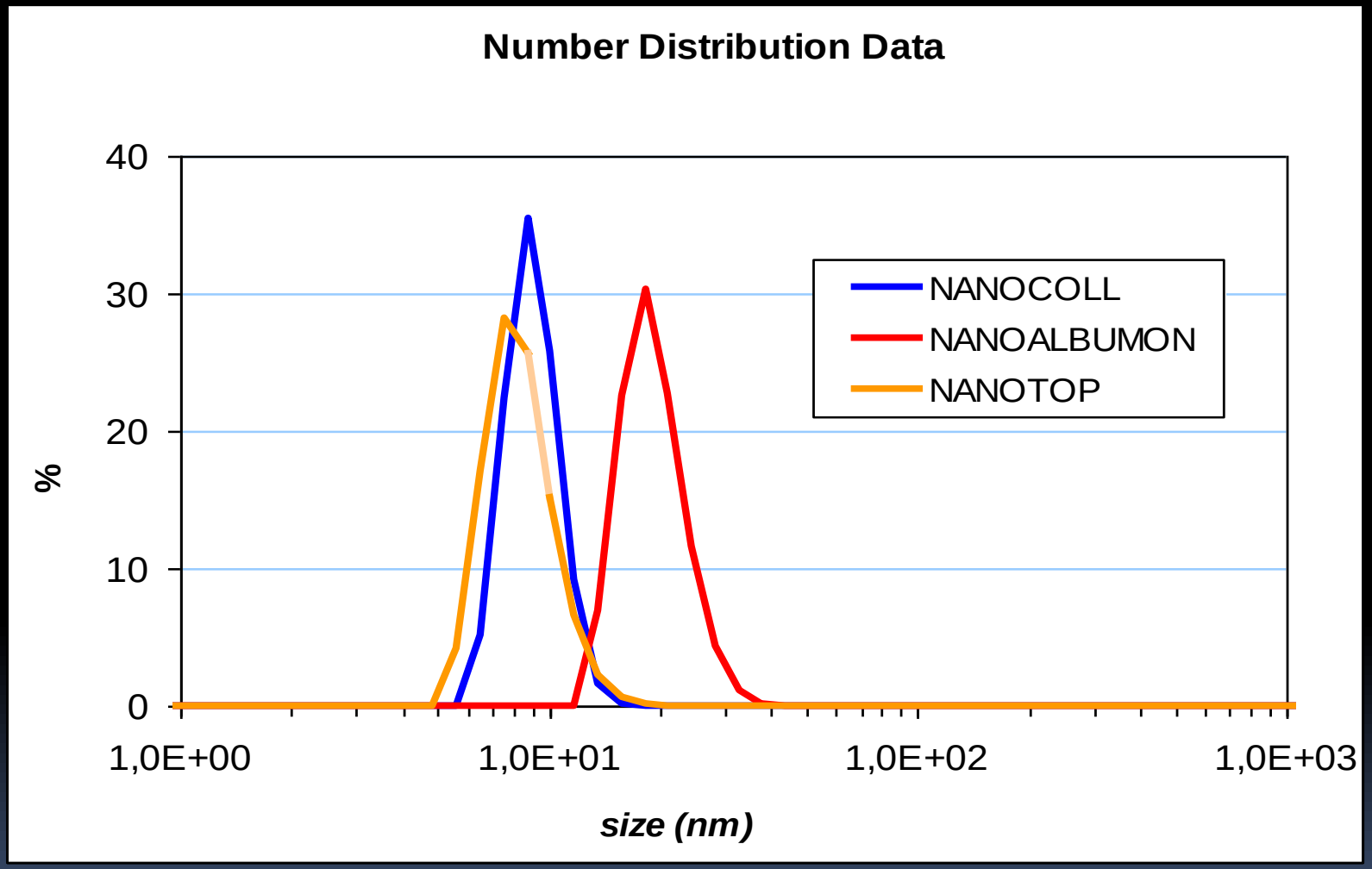
***n(x)***: distribution of the number of particles; φ= packing factor; **ρ**= density.

$$\frac{M_{\text{tot}}}{\varphi\rho} = V_{\text{tot}} = \int_{-\infty}^{+\infty} V_{\text{tot}} v(x)\,\mathrm{d}x = \frac{\pi}{6\varphi} N_{\text{tot}} \int_{-\infty}^{+\infty} x^3 n(x)\,\mathrm{d}x$$

The chain of equalities allows us to find the total volume **Vtot** and the total number of particles **Ntot** in the concrete case of the lab data:

$$V_{\text{tot}} = \frac{M_{\text{tot}}}{\varphi\rho}, \qquad N_{\text{tot}} = \frac{6M_{\text{tot}}}{\rho\pi\sum_{i=1}^{K} x_i^3 n(x_i)}$$

# Particle distribution



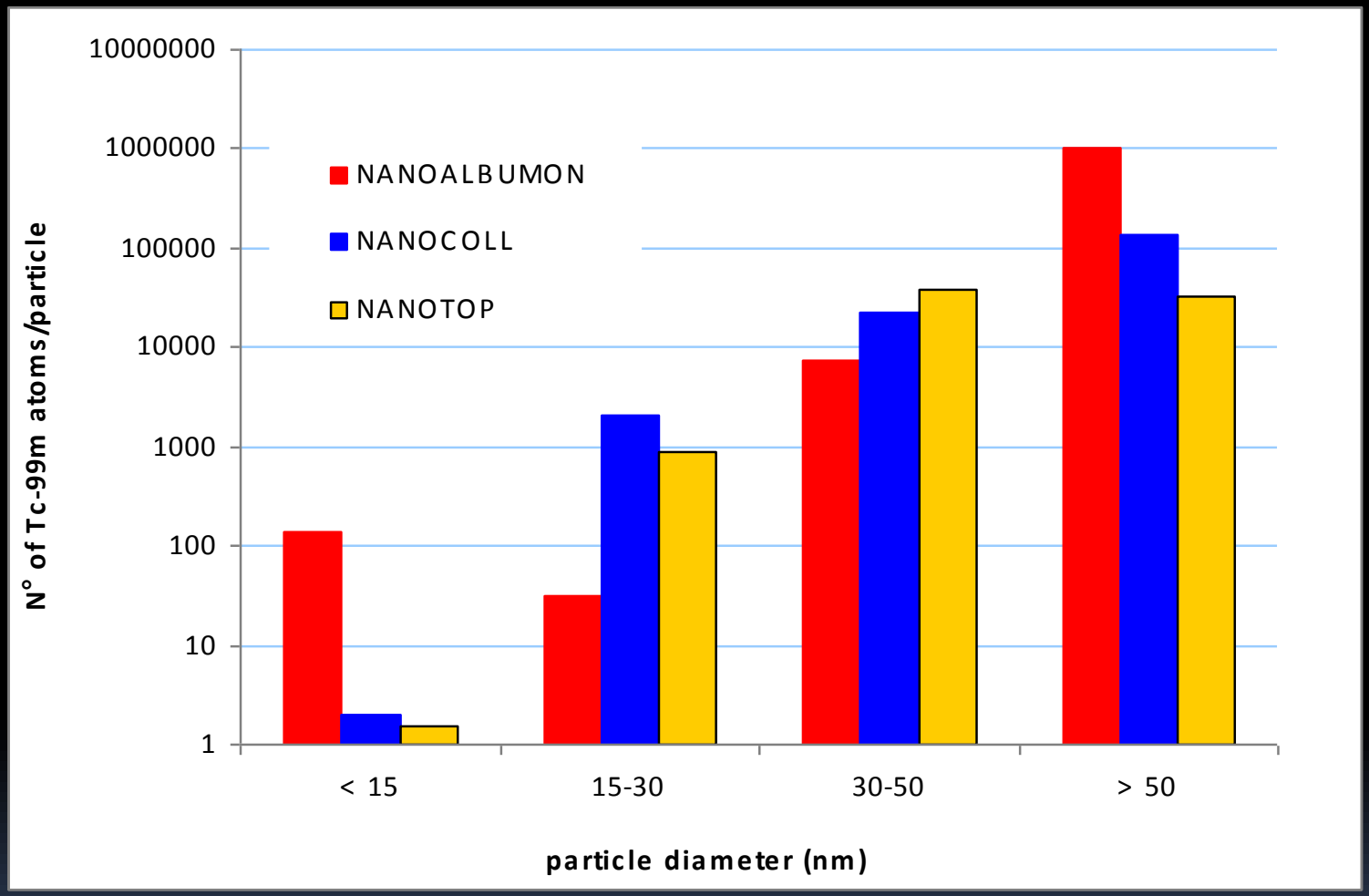

Analysis of three different nanocolloids ($^{99m}$Tc-HSA-NC) at DLS

# Radioactivity distribution (filtration)

| | % radioactivity | | |
|---|---|---|---|
| Ø particle (nm) | Nanocoll | Nanoalbumon | Nanotop |
| Ø >50 | 9 | 25 | 8 |
| 30< Ø <50 | 53 | 55 | 46 |
| 15< Ø <30 | 28 | 15 | 37 |
| Ø <15 | 10 | 5 | 9 |

**Ø: diameter of particles; CI (95%) = ± 5%.**

# Radioactivity distribution




Comparison of three nanocolloids as the result of elaboration of radioactivity distribution data with DLS data as described in the mathematical model

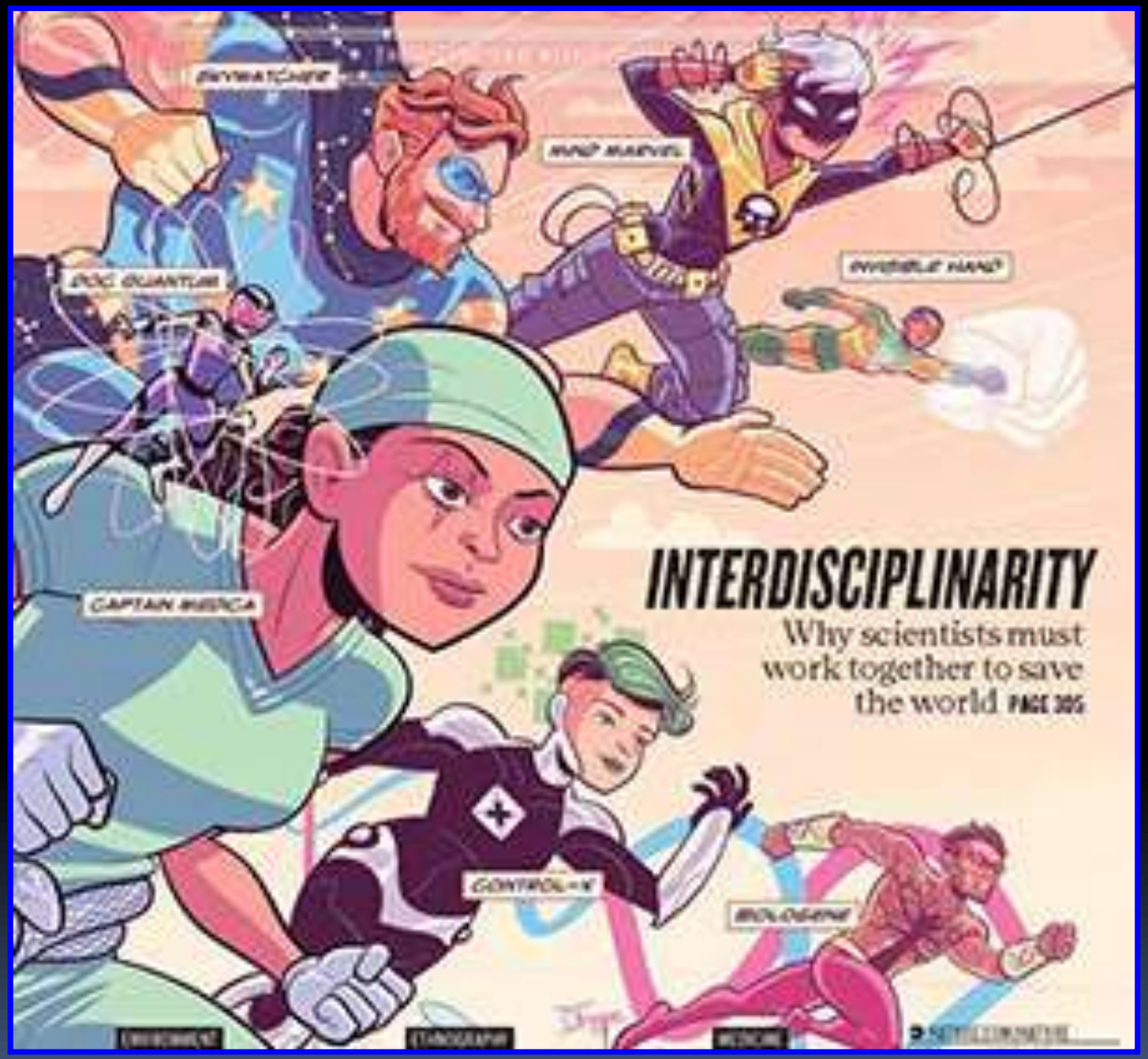
# multi-, inter-, trans- disciplinarity

physician

chemist

physicist

mathematician




pharmacist

biologist

engineer

# Thanks for listening!

You can find me on ***Research Gate*** as:

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