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# Increase of Tumor Necrosis Factor Activity by Formation of Nanocomposites From Cerium Dioxide Nanoparticles

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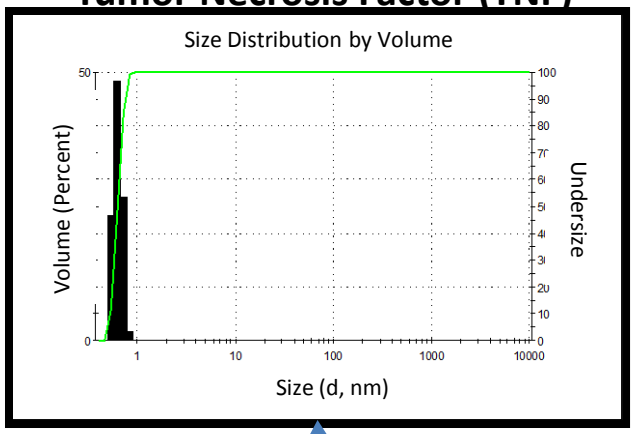
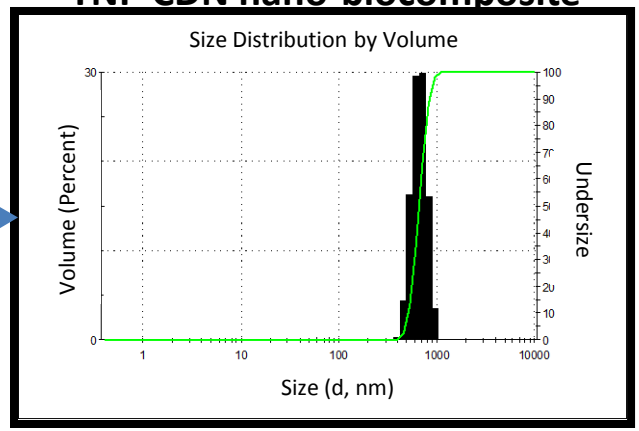
**Tumor Necrosis Factor (TNF)**




**Cerium Dioxide Nanoparticles (NCD)**

**TNF-CDN nano-biocomposite**




**Zetasizer Nano ZS (Malvern, UK)**

# Abstract:


- Because the tumor necrosis factor (TNF) is involved in the regulation of many physiological and pathological processes in the body, there is a very important task to study the mechanisms of its action and use in the therapy, in particular, possible ways to improve the biological activity and reduce the toxicity. The previous papers demonstrated the increasing of activities of the flu vaccine and α-interferon via the conjugation with the cerium dioxide nanoparticles (NCD) probably due to the formation of nano-biocomposites. Therefore the aim of this study was to explore the possibility of forming nano-biocomposites of TNF and NCD.
- The possibility of nano-biocomposites formation was proven via the growth of hydrodynamic diameter of the peptide in the presence of NCD : the size of conjugates depended on the duration of the process, the complete stabilization occurred at 10-th hour after contact of TNF and NCD in aqueous solution.



- **Keywords:** cerium dioxide; tumor necrosis factor; hydrodynamic diameter; Zetasizer Nano ZS; nano-biocomposites

# Introduction:

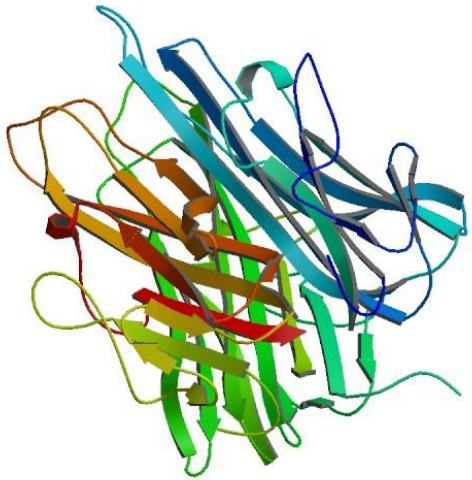
Tumor necrosis factor (TNF):

- acts as a mediator of cytotoxicity

ensuring destruction of cancer target cells;

- participates in the regulation of various

physiological and pathological processes in the body.



**rhTNF-α**
Promega Corporation
Part# 9PIG524

Modifications of substance of the target **rhTNF-α** lead to:

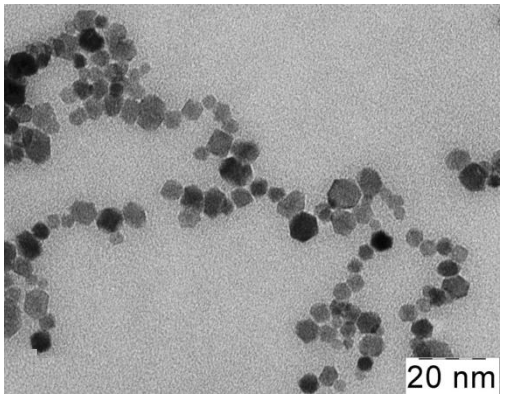
- improve the biological properties;
- increase activity;
- reduce the toxicity of TNF.

# Introduction:

Combining the **nanoparticles of cerium dioxide (NCD)** with:

- Interferon;
- Vaccines ;

ensures the growth of their biological activity.




Size ~5.8 [5.65-5.85] nm
ζ-potential ~+12 mV

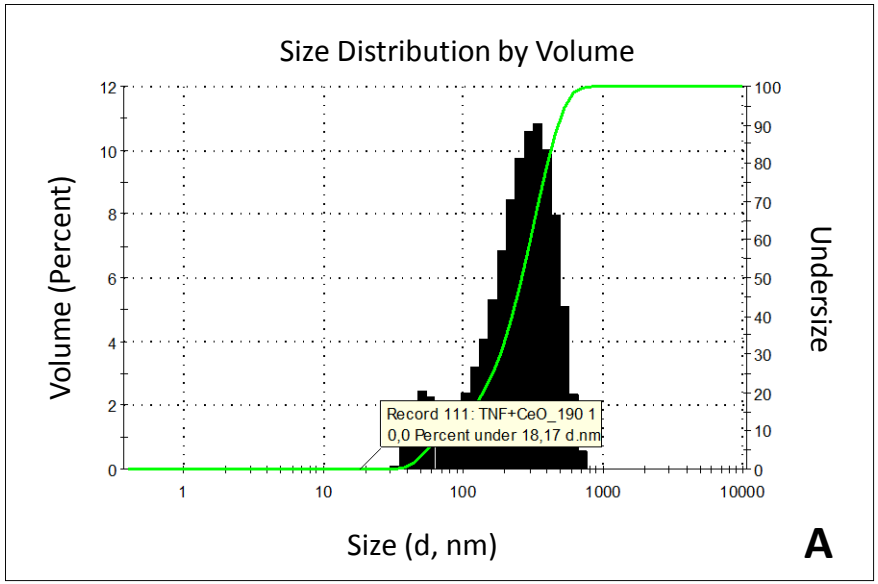
possible mechanisms for implementation → **nano-biocomposite formation**

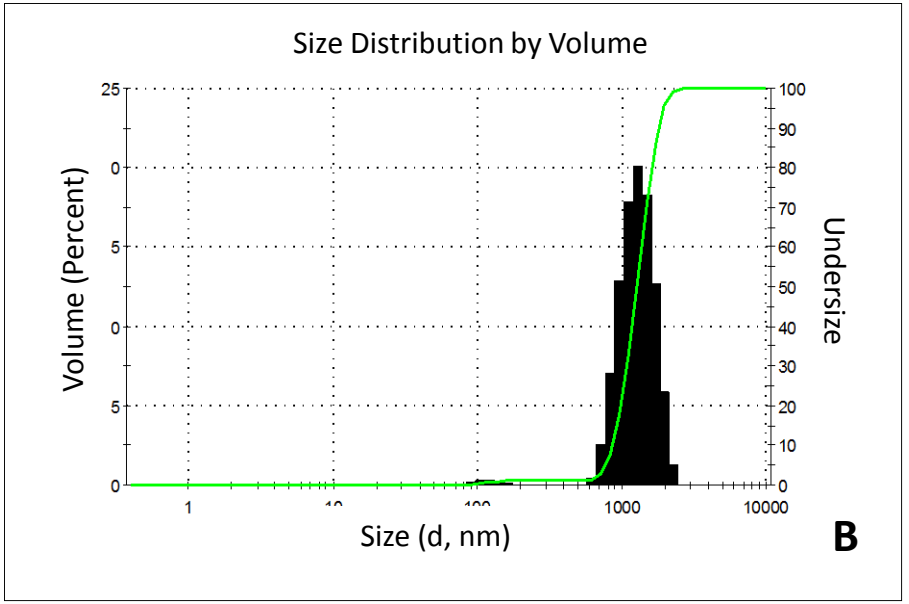
Basing on the preliminary data, we've

explored the process of interaction NCD with rhTNF-α.

# Results and discussion:

Hydrodynamic diameter of rhTNF-α-NCD nano-biocomposite

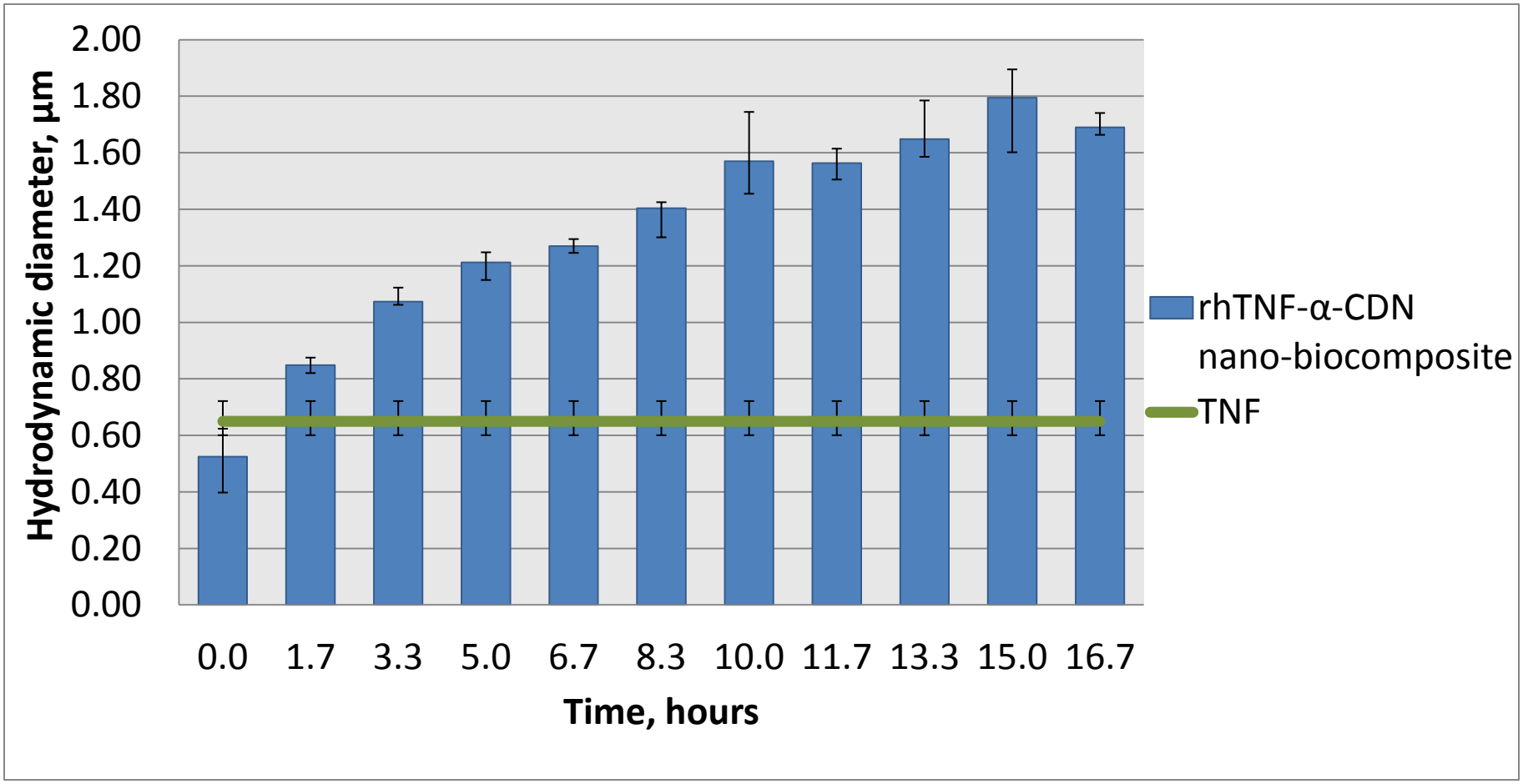



**A** – after 1,7 hours

**B** – after 17 hours

# Results and discussion:




The dependence of hydrodynamic diameter of rhTNF-α-NCD sample on time

# Results and discussion:

| | time, hours | hydrodynamic diameter, µm | interquartile range, µm |
|---|---|---|---|
| rhTNF-α | – | ~0.62 | [0.56-0.71] |
| rhTNF-α-NCD | 1.7 | ~0.85 | [0.82-0.88] |
| | 5 | ~1.20 | [1.15-1.20] |
| | 10 | ~1.57 | [1.46-1.74] |
| | 13.3 | ~1.65 | [1.59-1.79] |
| | 17 | ~1.69 | [1.66-1.74] |

In the range of 10 to 17 hours of observation,
the NCD-rhTNF-α nano-biocomposites size was stabilized

# Conclusions:

- The modification of rhTNF-α by NCD leads to the formation of stable nano-biocomposites having increased HD.

- Our preliminary *in vitro* study showed that such nano-biocomposite of NCD-modified rhTNF-α is more active than the pristine rhTNF-α (probably, due to adjuvant-mimic properties of NCD).

- The findings are the rationale for the creation of new highly efficient nanocomposite drugs.

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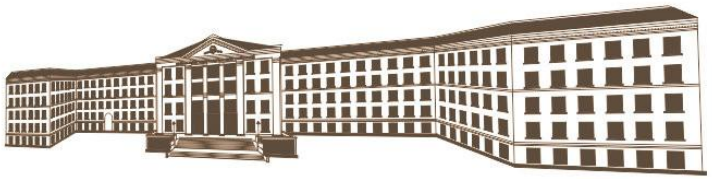

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