



Hot Topic:

The Biomolecular Corona: From biological barrier to engineering tool?

April 24, 2017

Complement proteins bind to nanoparticle protein corona and undergo dynamic exchange *in vivo*

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Association of Blood Proteins with Large Unilamellar Liposomes *in Vivo*

RELATION TO CIRCULATION LIFETIMES*

(Received for publication, February 20, 1992)

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NANOMEDICINE

Evolution of the nanoparticle corona

Understanding how complement proteins bind to nanoparticles and participate in their surface 'corona' can provide further insight into the relevance of the protein corona concept in medicine.

Marilena Hadjidemetriou and Kostas Kostarelos

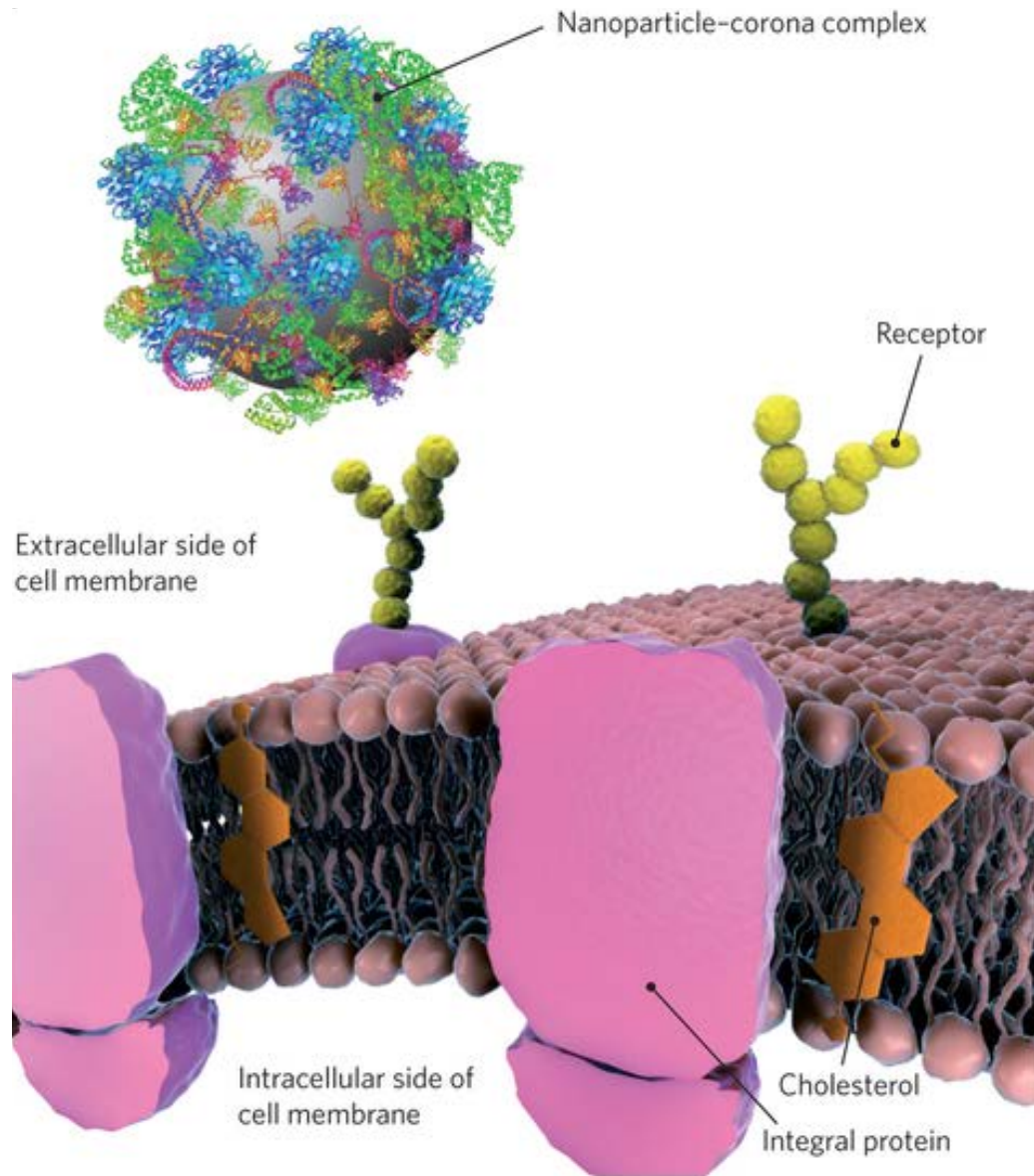
Sources:

Chen, F. et al. Nat. Nanotech. 12, 387–393 (2017)

Hadjidemetriou, M. et al. Nat. Nanotech. 12, 288–290 (2017)

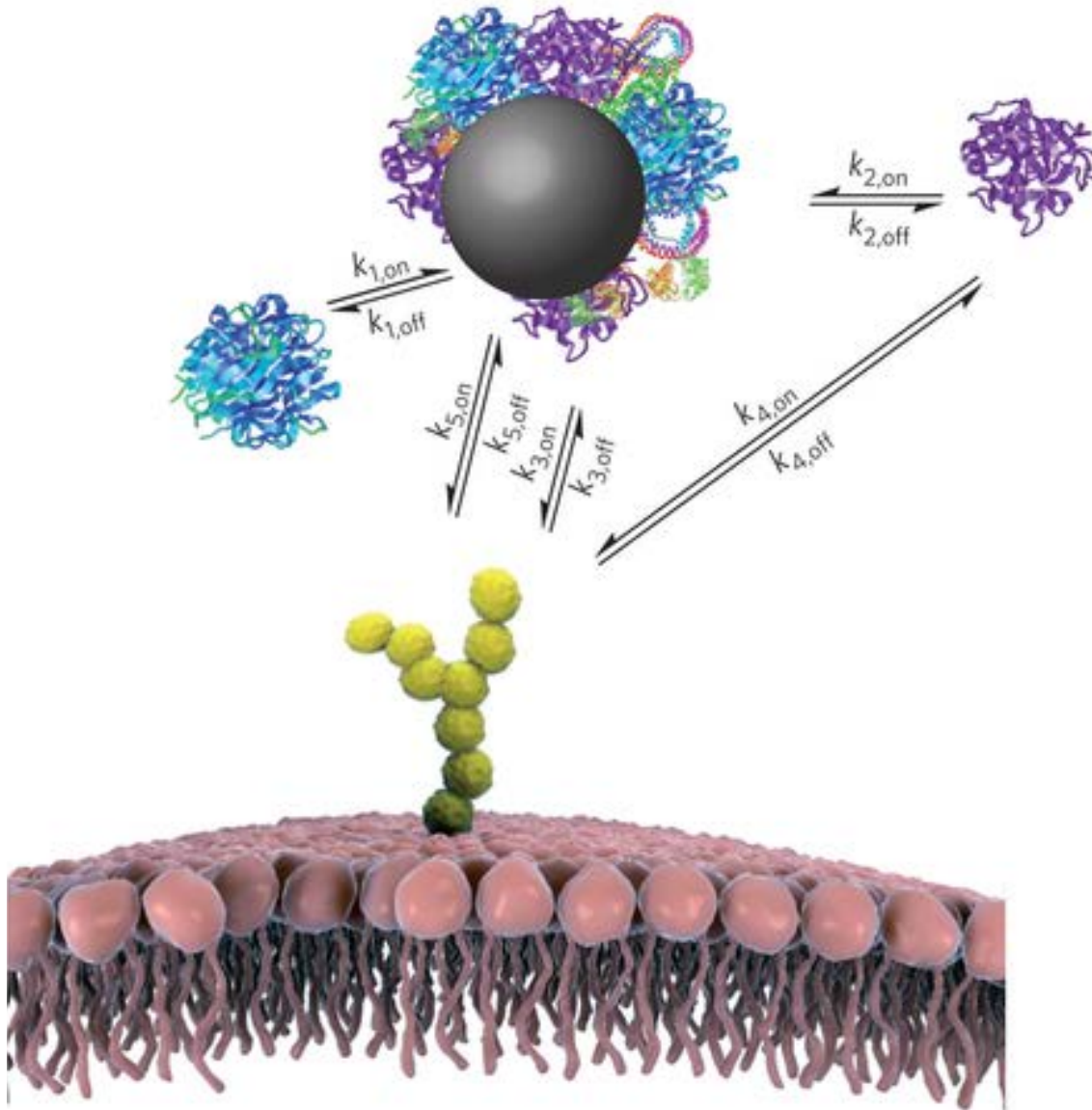
Chonn, A. et al. J Biol Chem., 267, 18759–18765 (1992)

The Nanoparticle Corona Concept



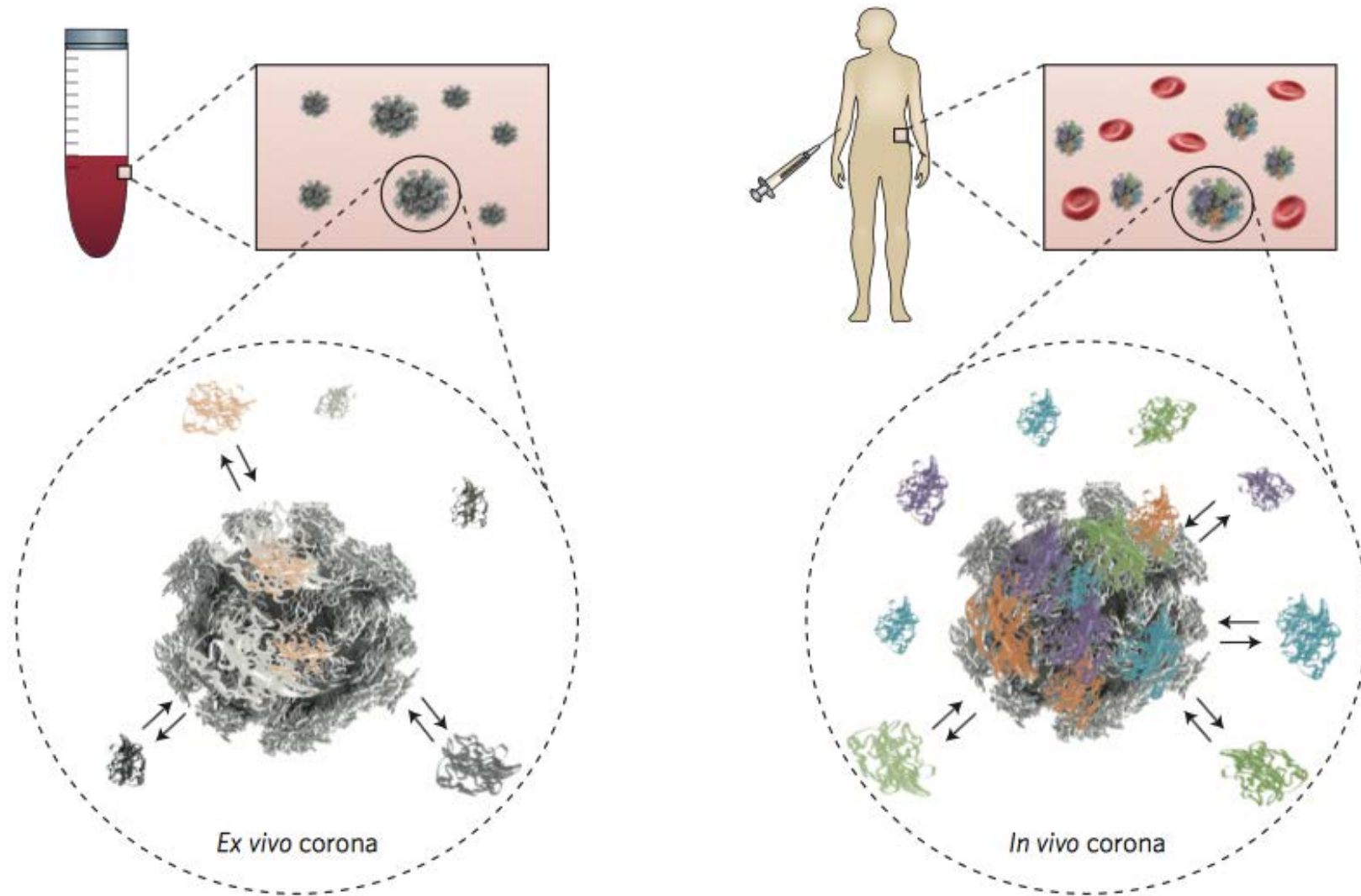
- The 'corona' of biomolecules lowers the surface energy of the nanoparticle and promotes its dispersion
- The **nanoparticle-corona complex**, rather than the bare nanoparticle, interacts with biological machinery.

The Biological Identity of a NP



- The corona constitutes a major element of the **biological identity** of the nanoparticle.
- **Soft vs. Hard** corona complexes
- The corona around the NPs is **kinetically unstable**, undergoing constant exchange with the physiological environment.
- Impact on NP targeting

The Biomolecular Corona *In Vivo*



- Static conditions
- Reaches equilibrium

- High flow conditions
- Dynamic exchange
- Molecularly rich

Evolution of Nanoparticle Corona



'Protein adsorption'



- Liposomes **and** polymeric NPs
- **Ex vivo and in vivo** investigations
- **Qualitative** characterization
 - Gel electrophoresis
- **Pharmacology** of NPs
 - Functionalization (PEG dilemma)
 - Opsonization
 - Blood circulation half-life

'Protein corona'



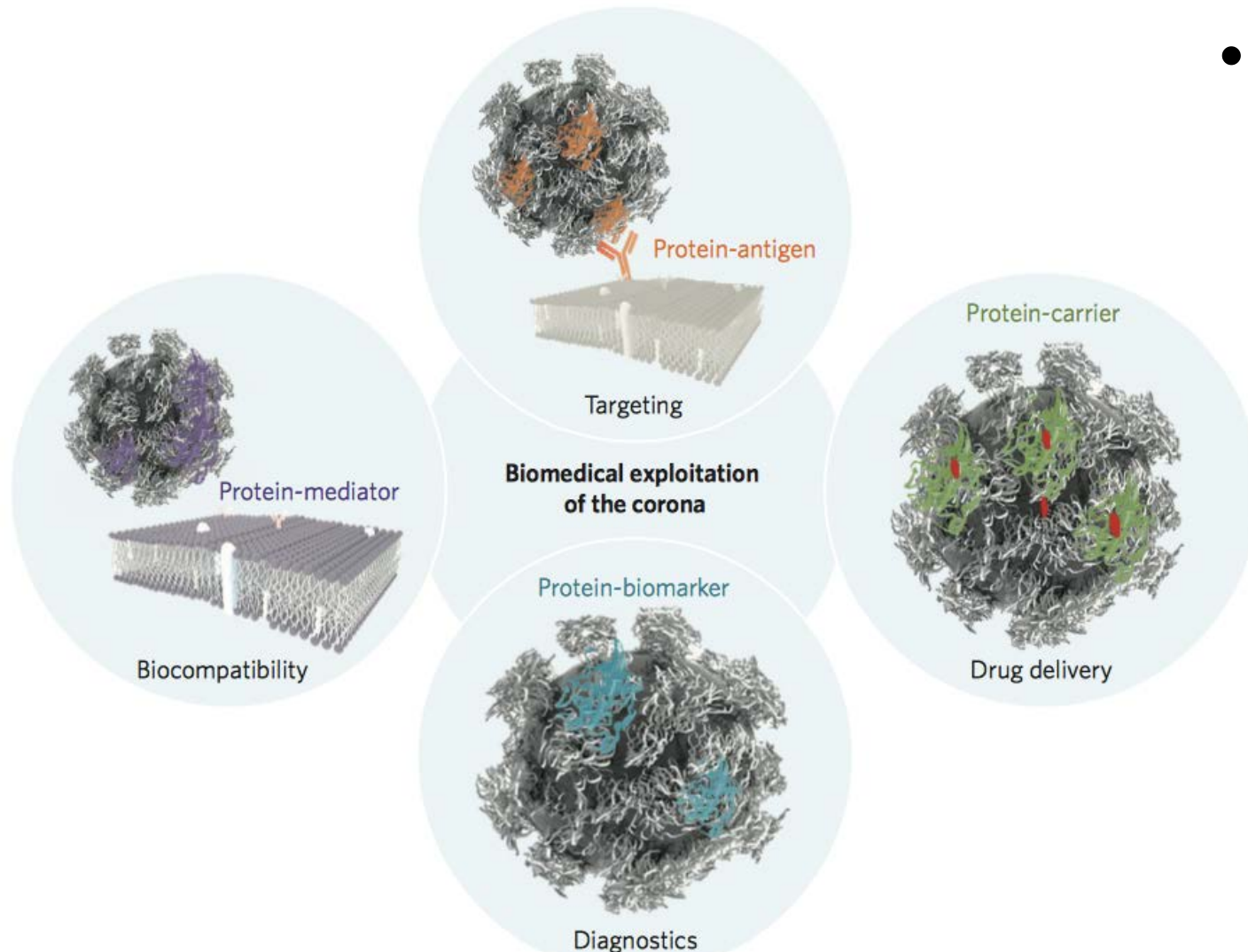
- Lipid, carbon, metal-based NPs
- **Ex vivo** investigations
- **Protein** characterization
 - Mass spectrometry
- **Biological impact**
 - Cytotoxicity
 - Cell internalization
 - Targeting

'Biomolecular corona'



- Lipid, carbon, metal-based NPs
- **Ex vivo and in vivo** investigations
- **Molecular** characterization
 - Mass spectrometry
 - Genomics
 - Lipidomics
 - Metabolomics
- Biomedical **exploitation**
 - Targeting
 - Diagnosis
 - Drug delivery etc.

From Obstacle to Engineering Tool?



- Can we exploit the biomolecular corona:
 - As a means to **target** specific cells?
 - To mitigate potential **cytotoxicity** of NPs
 - As a “**bio-fingerprint**” for early disease detection?

Take home

Although the corona is difficult to fully understand, its role in affecting targeting/delivery of nanoparticles is becoming clearer and can potentially be used to further enhance nanoparticle therapy

Discussion Questions

- Can you think of potential implications / applications of nanoparticle corona in the context of cancer?

Discussion Questions

- How important is it to understand hard vs soft corona?
- How can we learn more about the soft corona?

THANK YOU!

