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Jožef Stefan International Postgraduate School  
and Young Researchers' Day CMBO

*19 and 20 April*

## Proteins and carbon nanomaterials

The interaction of carbon nanomaterials with serum proteins and cholinesterases

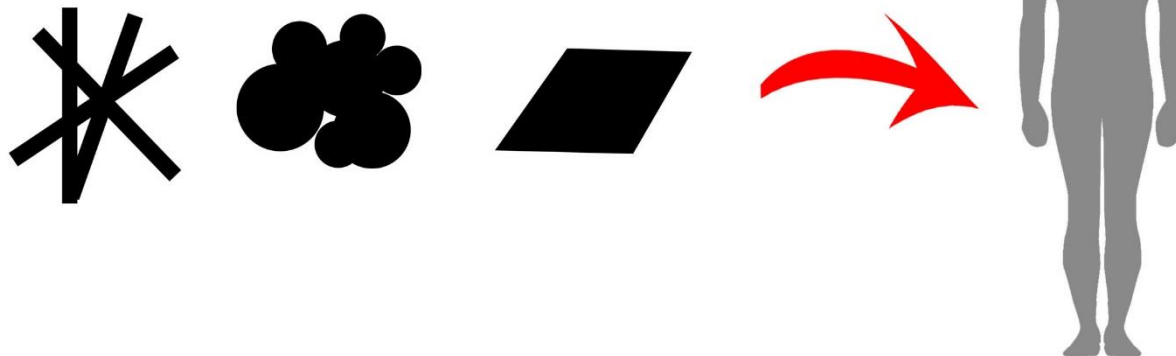
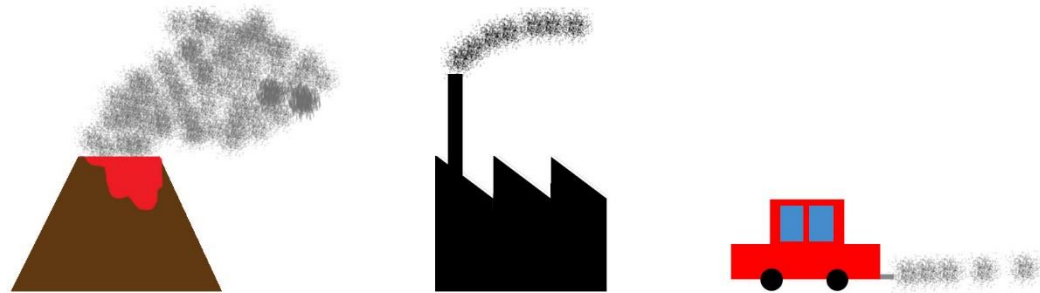
Maja Sopotnik,  
Boitechnical faculty, UL  
Poster number: 67

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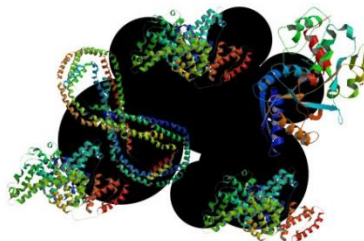
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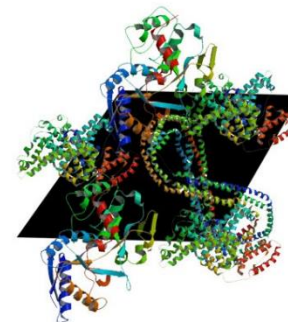
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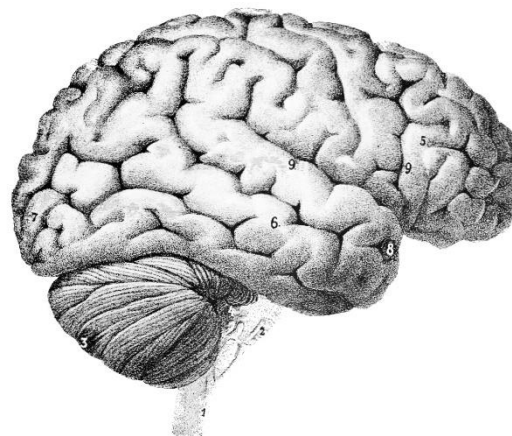
MWCNT




CARBON  
BLACK




GRAPHENE  
OXIDE





**The interaction of carbon nanomaterials with serum proteins and cholinesterases**

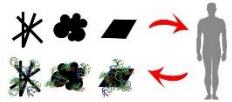


Maja Sopotnik<sup>1</sup>, univ. dipl. biol.  
Study programme: Nanosciences  
Biotechnical Faculty, University of Ljubljana  
Supervisor: prof. dr. Damjana Drobne  
Co-Supervisor: prof. dr. Kristina Sepčić

Maja Sopotnik<sup>1</sup>, Adrijana Leonardi<sup>2</sup>, Igor Križaj<sup>3</sup>, Darko Makovec<sup>4</sup>, Peter Dušak<sup>5</sup>, Tina Mesarič<sup>6</sup>, Nataša Poklar Urlih<sup>7</sup>, Ita Junkar<sup>8</sup>, Kristina Sepčić<sup>9</sup>, Damjana Drobne<sup>1</sup>

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### Formation of the protein corona



When nanomaterials enter the blood circulation, they become covered by a layer of proteins, called the **PROTEIN CORONA**. This protein corona governs the destiny of the nanomaterials in the body.

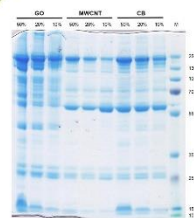
### Carbon nanomaterials

- Present in the environment
- Come from natural sources such as volcanic eruptions, artificial sources such as incomplete combustion of diesel fuel and are also industrially produced
- Highly sorptive for biological molecules
- Different shapes, sizes and surface curvatures
- They are known to adsorb and inhibit cholinesterase enzymes
- MWCNT – multi-walled carbon nanotubes
- CB – carbon black
- GO – graphene oxide

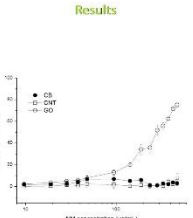


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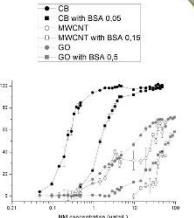
### Results



**Figure 1.** SDS-PAGE analysis of the protein corona of three different carbon nanomaterials incubated in three different human serum concentrations.



**Figure 2.** The percentage of inhibition of butyrylcholinesterase in 1% human serum by different carbon nanomaterials.




**Figure 3.** The percentage of inhibition of electric eel acetylcholinesterase by different pristine carbon nanomaterials and carbon nanomaterials pre-coated in different concentrations (mg/ml) of bovine serum albumin (BSA).

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### Conclusions

- Pre-coating of carbon nanomaterials with BSA reduces their inhibitory action towards cholinesterases
- GO requires to be incubated with higher concentrations of BSA to reach this effect than CB and MWCNT, which shows its lesser affinity towards the binding of BSA
- When mixed with human serum, GO, unlike CB and MWCNT, reduced the activity of the intrinsic butyrylcholinesterase enzyme
- Carbon nanomaterials protein corona is enriched in apolipoproteins and complement factors. The complement system plays a role in the immune response towards foreign substances and apolipoproteins are known to facilitate the translocation of nanoparticles through the blood-brain barrier.



<sup>1</sup>University of Ljubljana, Biotechnical Faculty, Department of Biology, Vrhovna pot 111, SI-1000 Ljubljana, Slovenia  
<sup>2</sup>Department of Molecular and Biomedical Sciences, Institut Pasteur de Trieste, Strada 28, SI-34100 Udine, Slovenia  
<sup>3</sup>Department for Materials, Institute of Jožef Stefan Institute, Strada 39, SI-1000 Ljubljana, Slovenia  
<sup>4</sup>University of Ljubljana, Biotechnical Faculty, Department of Food Science and Technology, Smetanova 171, SI-1000 Ljubljana, Slovenia  
<sup>5</sup>Department of Software Engineering and Cybernetics, Jozef Stefan Institute, Strada 39, Ljubljana SI-1000 Slovenia

