

Study of imidazolium-terminated cabosilane dendritic systems by EPR

Tamara Rodríguez Prieto

Host: Prof. Maria Francesca Ottaviani

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- ▶ 02 Main goal of the stay
- ▶ 03 Electron paramagnetic resonance (EPR)
 - EPR results. 5DSA probe
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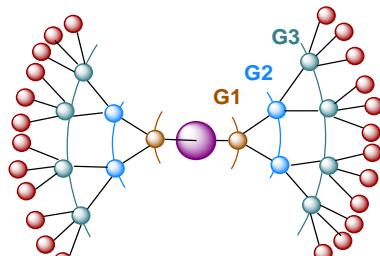
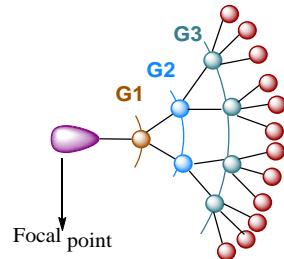
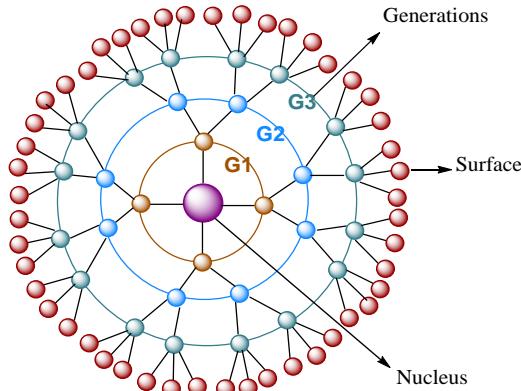
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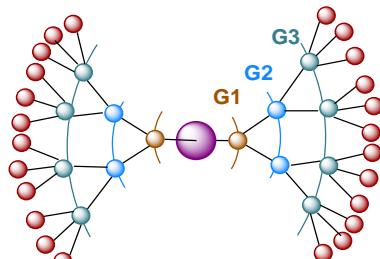
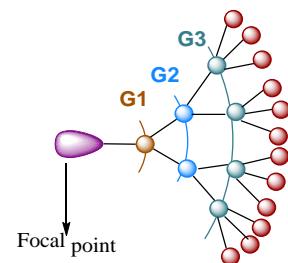
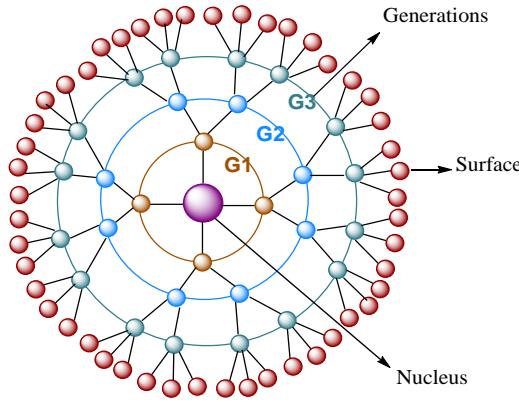
01 Introduction

What is a dendrimer?



01 Introduction

What is a dendrimer?

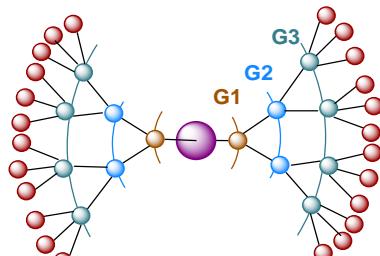
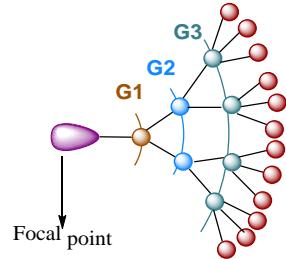
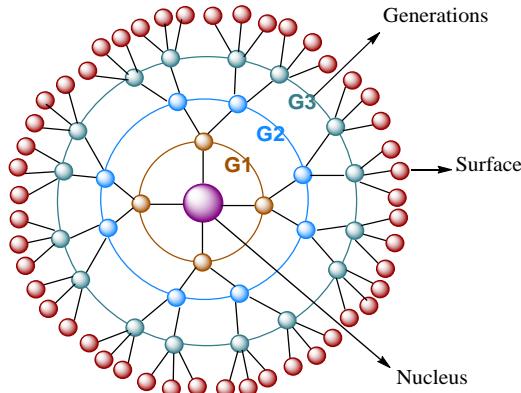


- Polymeric macromolecules
- Tridimensional
- Ideally monodisperse
- Multifunctional
- Versatile

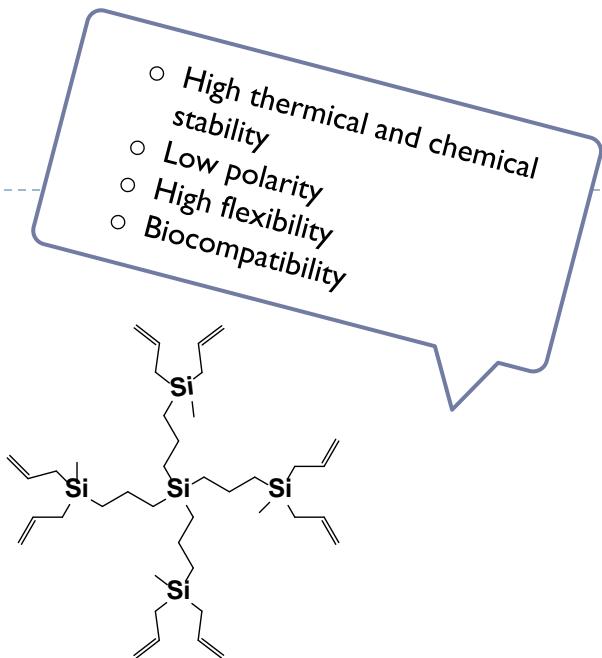


01 Introduction

What is a dendrimer?



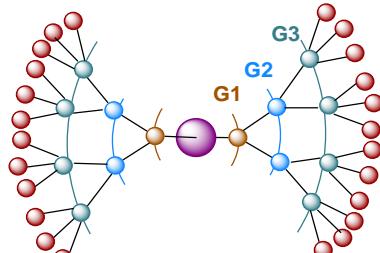
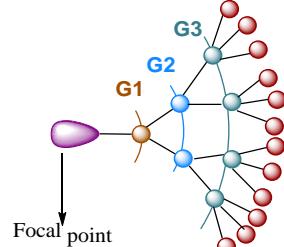
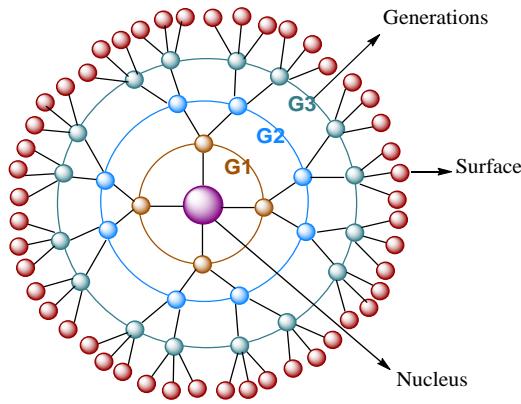
Carbosilane dendrimer



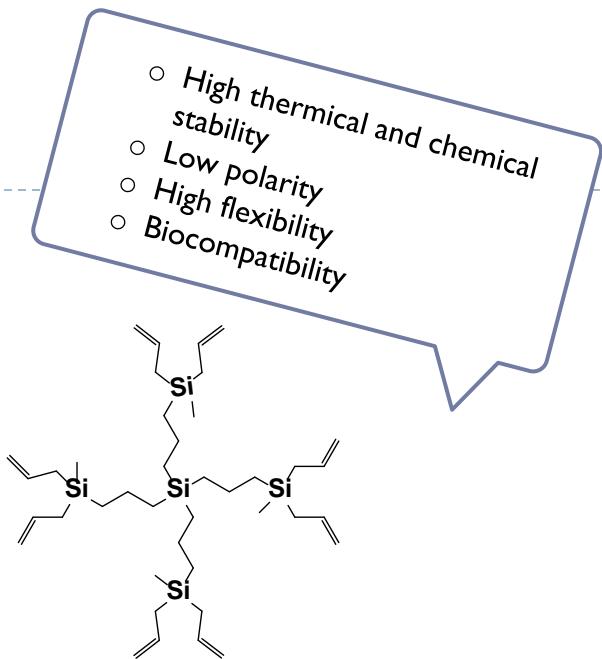
- High thermal and chemical stability
- Low polarity
- High flexibility
- Biocompatibility

01 Introduction

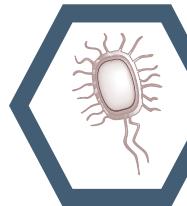
What is a dendrimer?



Carbosilane dendrimer



Drug delivery

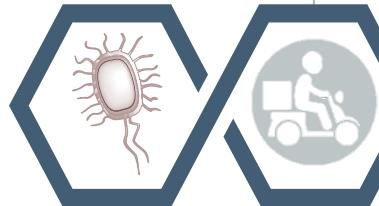


Antibacterial agent

Anticancer agent

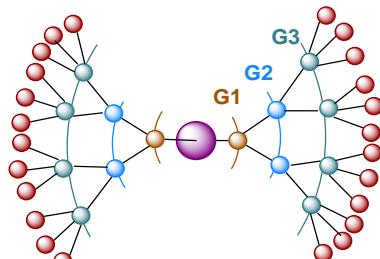
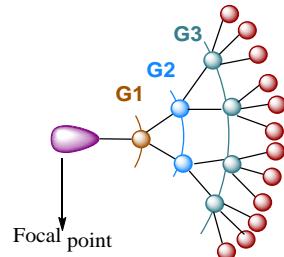
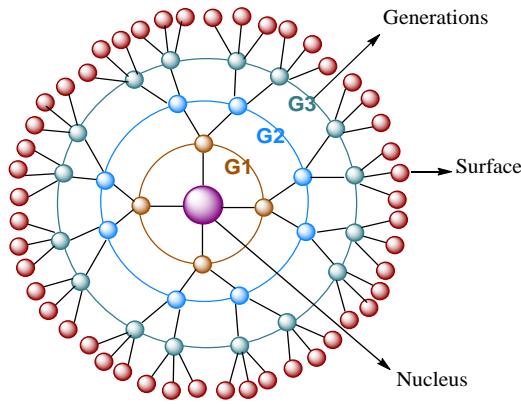


Antiviral agent

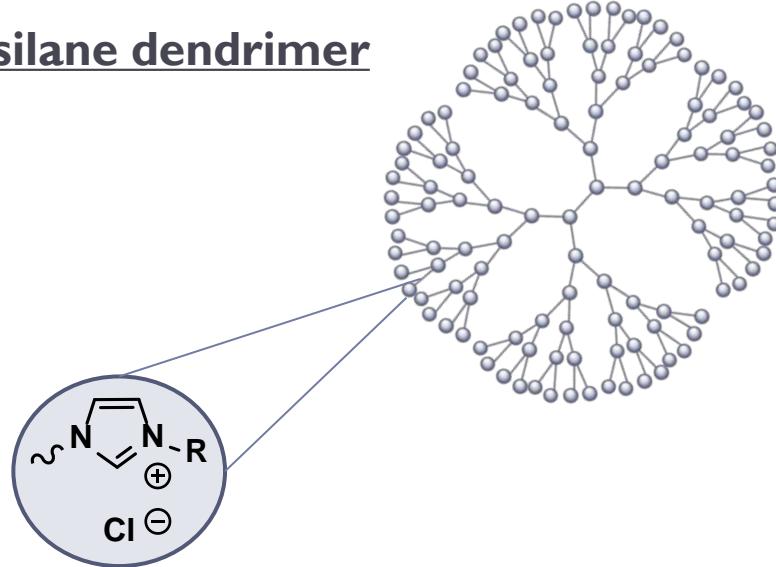


01 Introduction

What is a dendrimer?

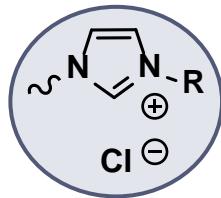


Carbosilane dendrimer



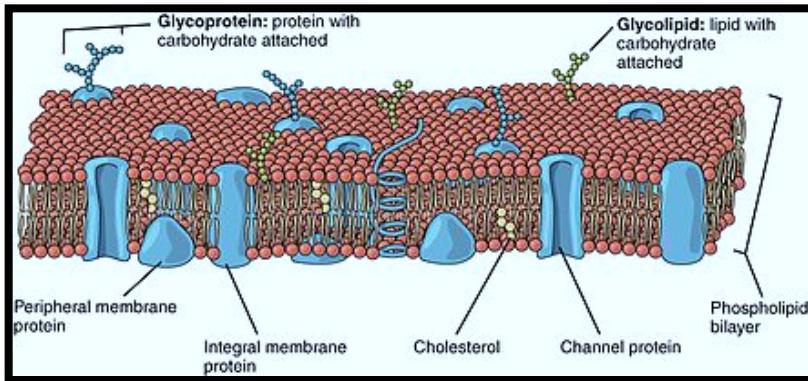
IMIDAZOLIUM SALTS

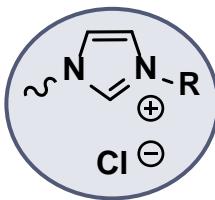
- ✓ High biological activity (interaction with membrane and biological molecules)
- ✓ Versatile groups
- ✓ N-Heterocyclic carbenes precursors



01 Introduction

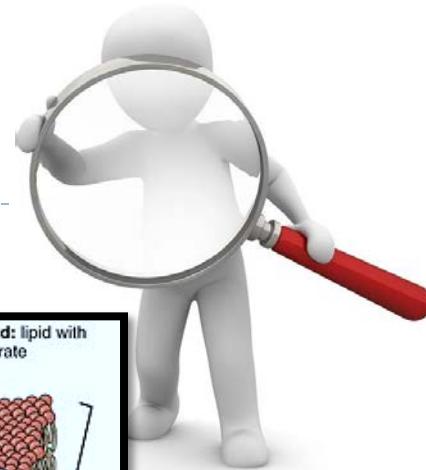
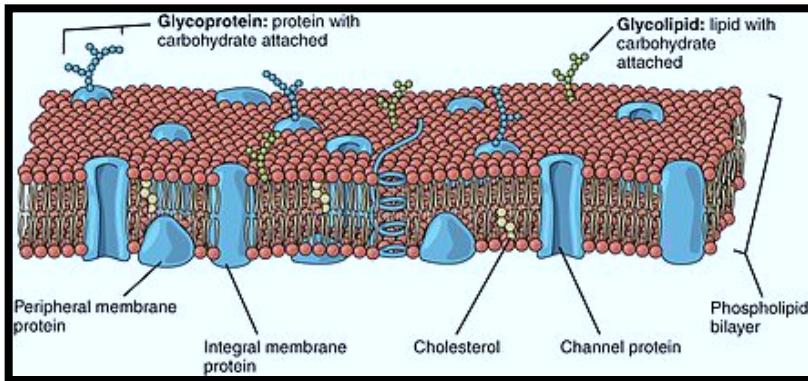
Membrane interaction



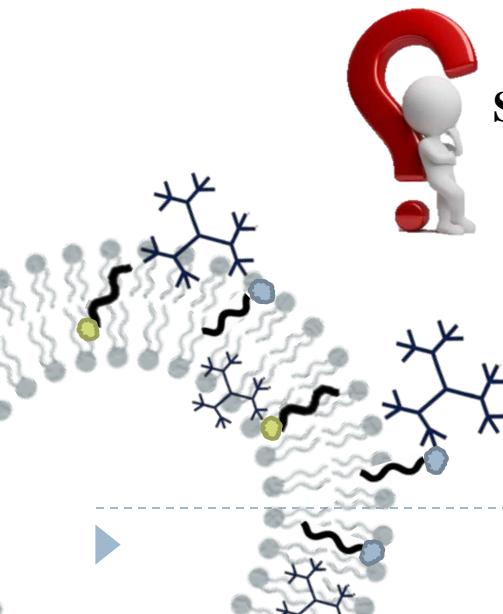


01 Introduction

Membrane interaction



Electron Paramagnetic Resonance (EPR)



Structural disruption of the anionic membrane

Interacts with the anionic membrane surface

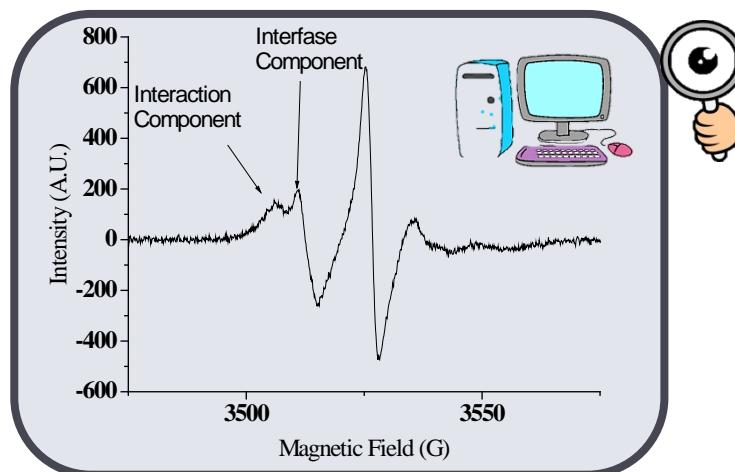


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02 Main goal of the stay

Study the dendritic behaviour at the bilayer domains, membrane fusion and permeability by EPR, using paramagnetic probes and a model of membrane.

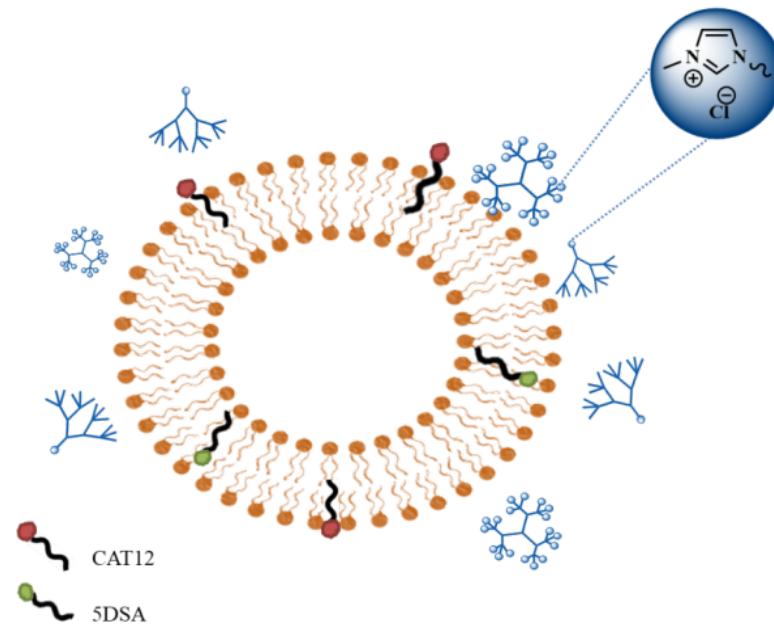


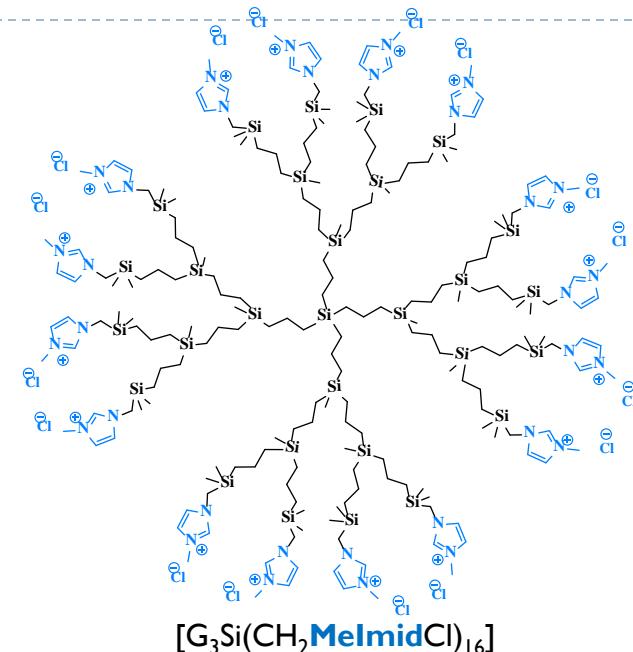
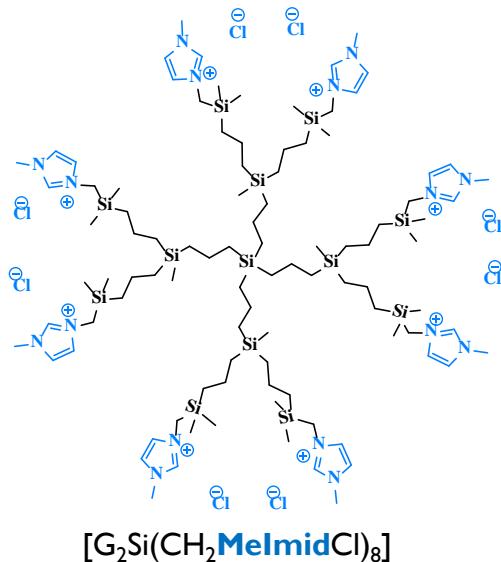
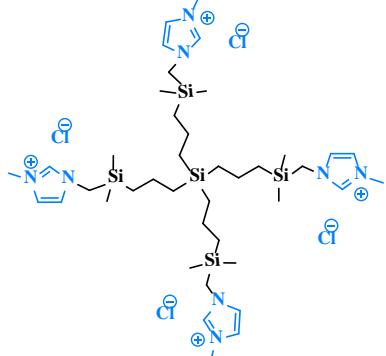
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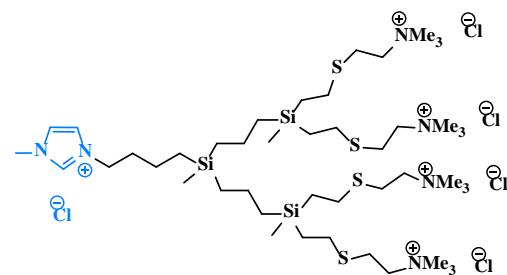


03 Electron Paramagnetic Resonance (EPR)

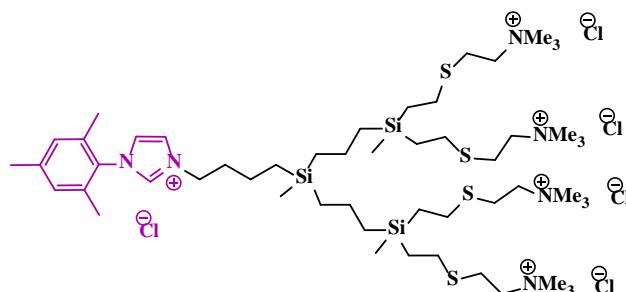
Dendrimers



Dendrons



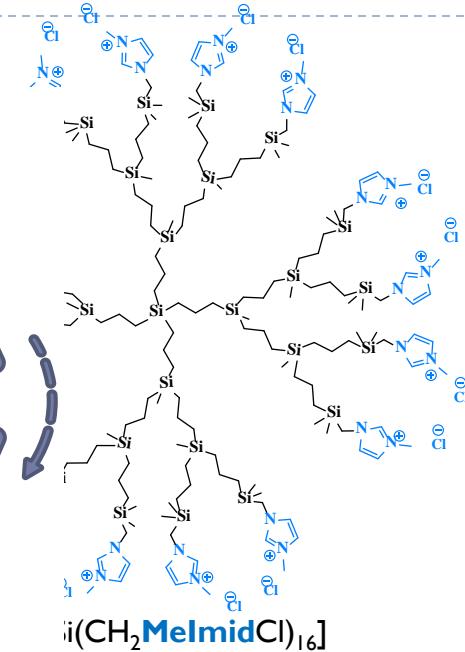
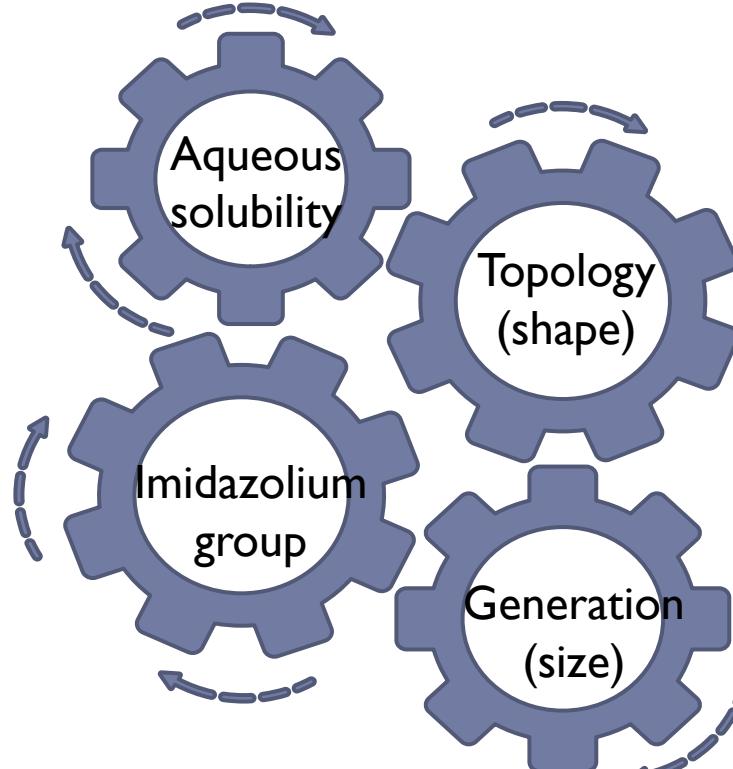
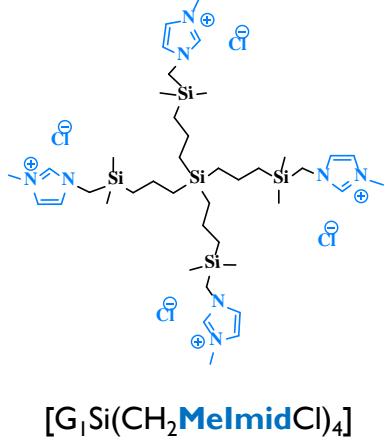
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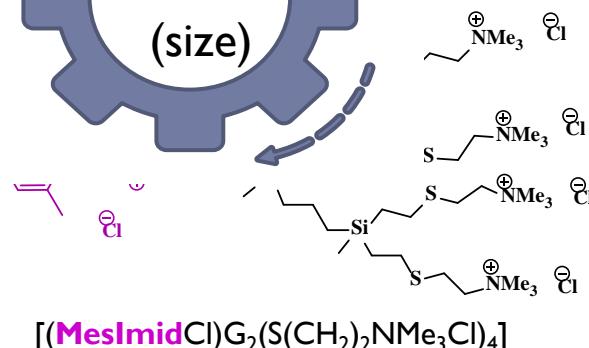
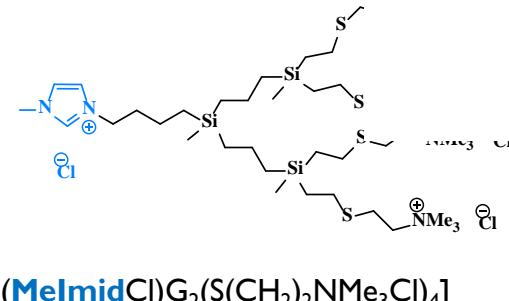
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03 Electron Paramagnetic Resonance (EPR)

Dendrimers

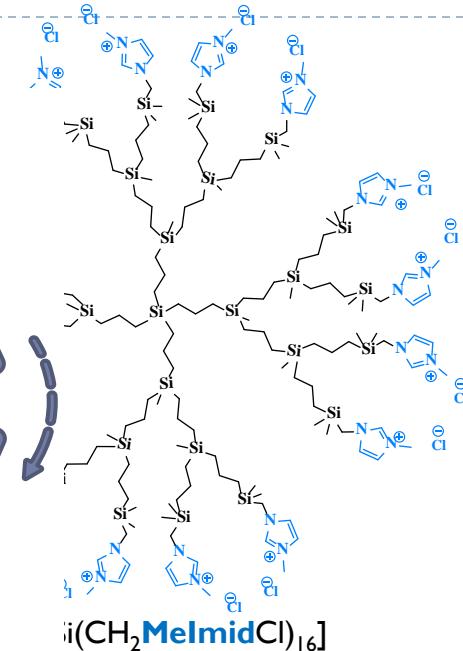
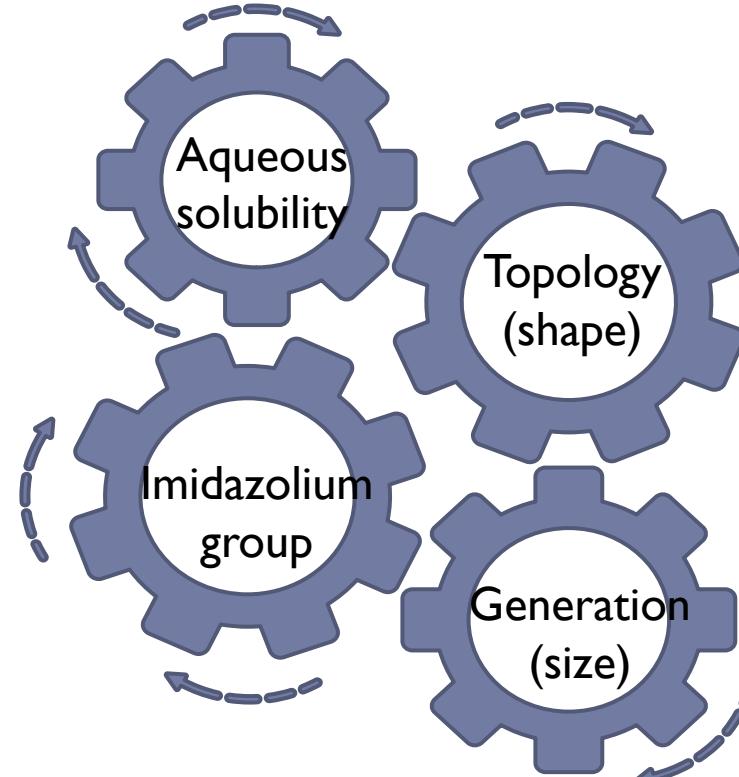
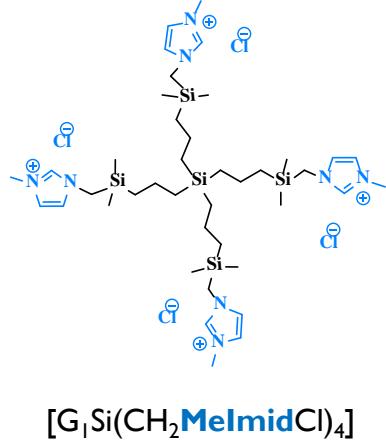


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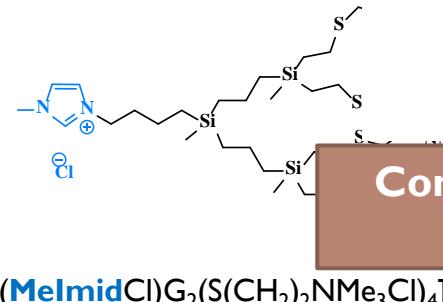


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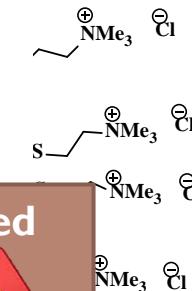
Dendrimers



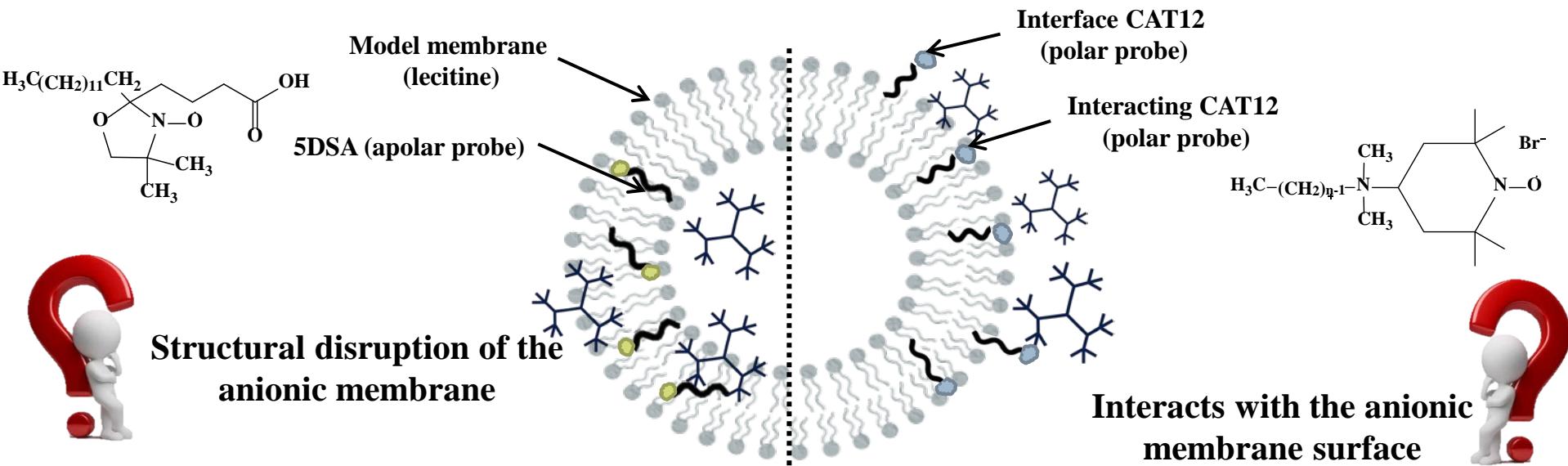
Dendrons



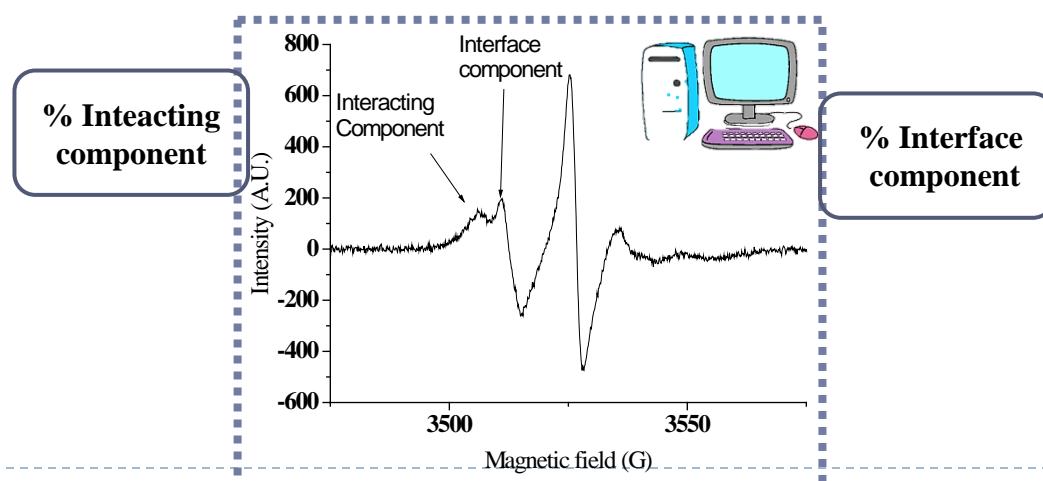
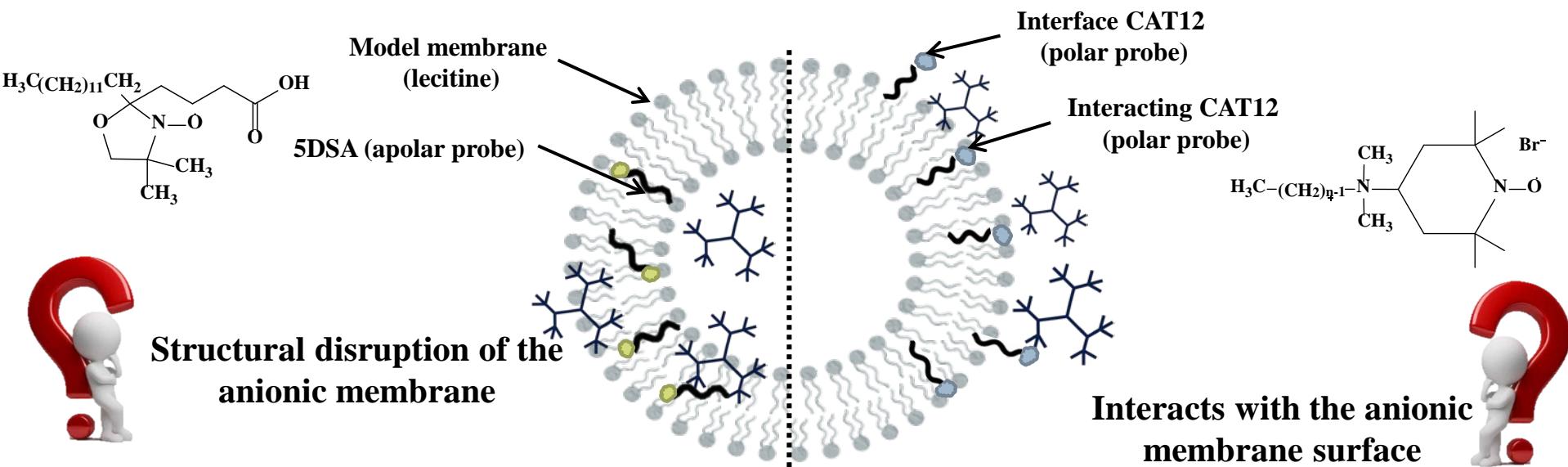
Conclusive results could not be obtained
of the dendrons by EPR



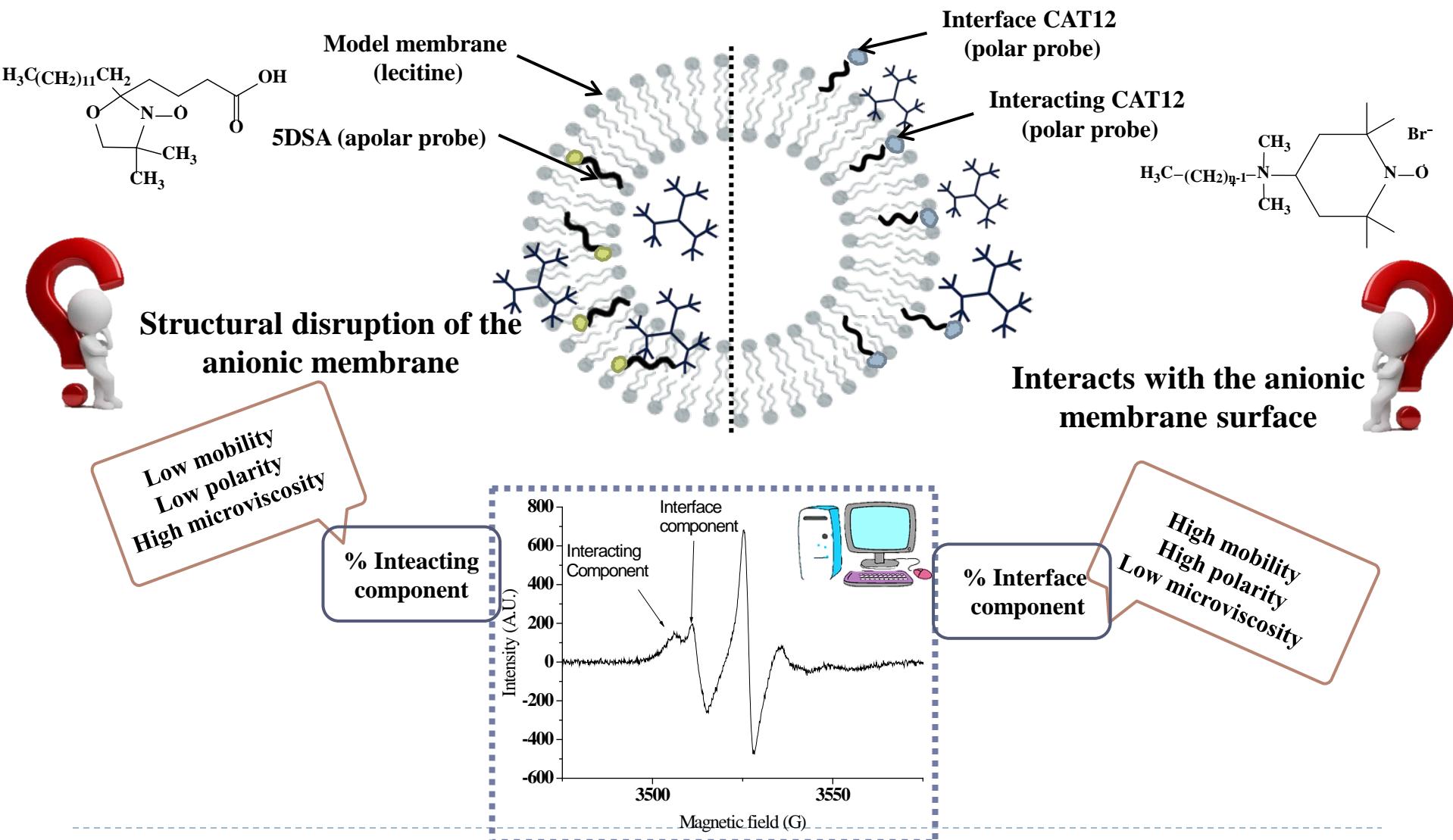
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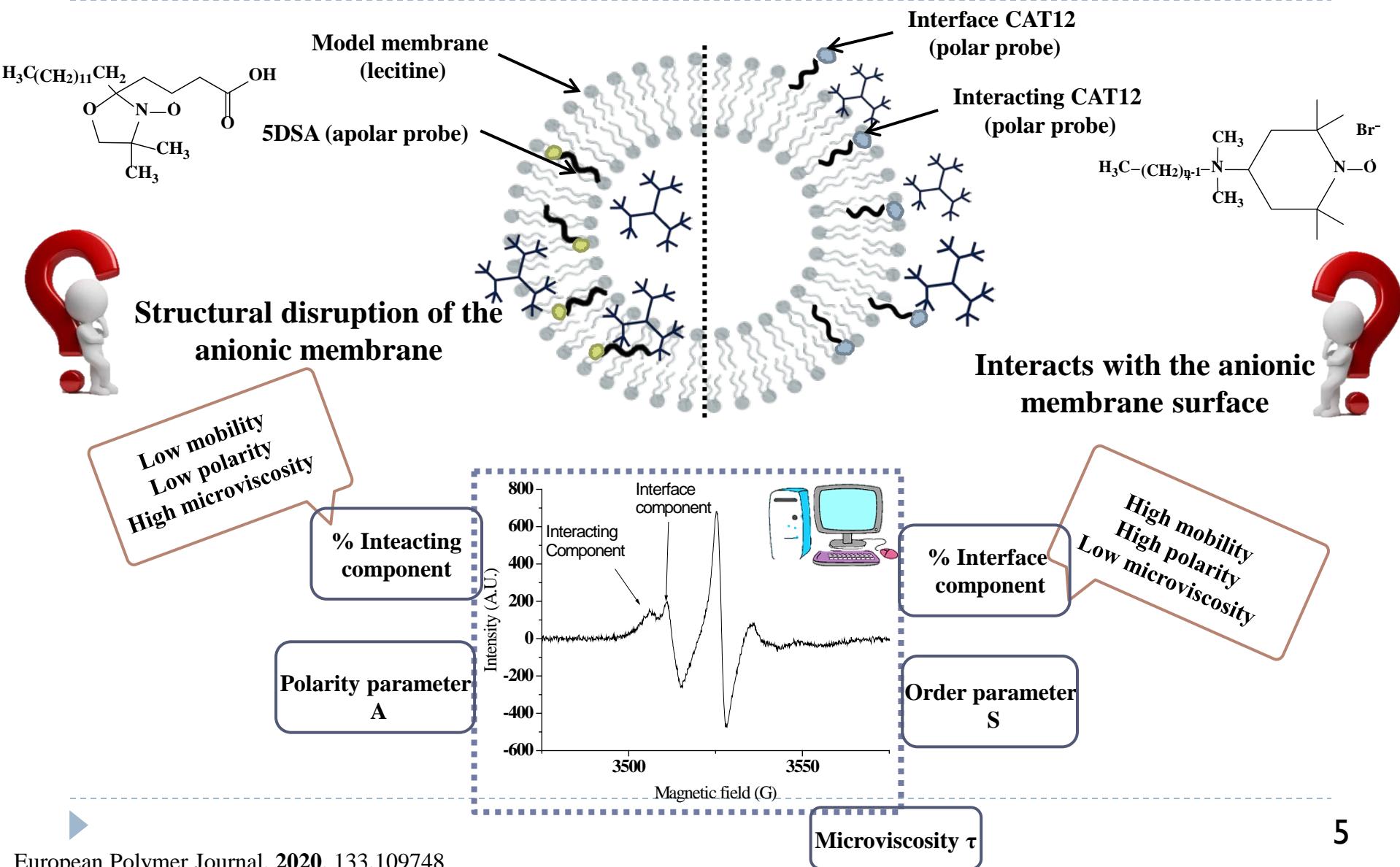


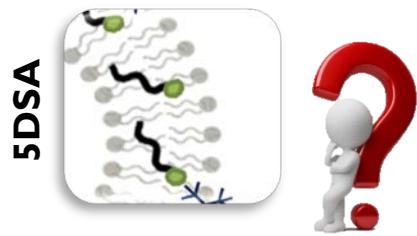
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EPR results. 5DSA probe

Low mobility

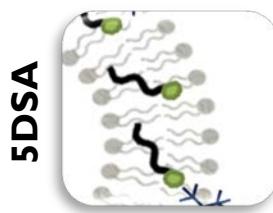


5DSA

Structural disruption of the anionic membrane

EPR results. 5DSA probe

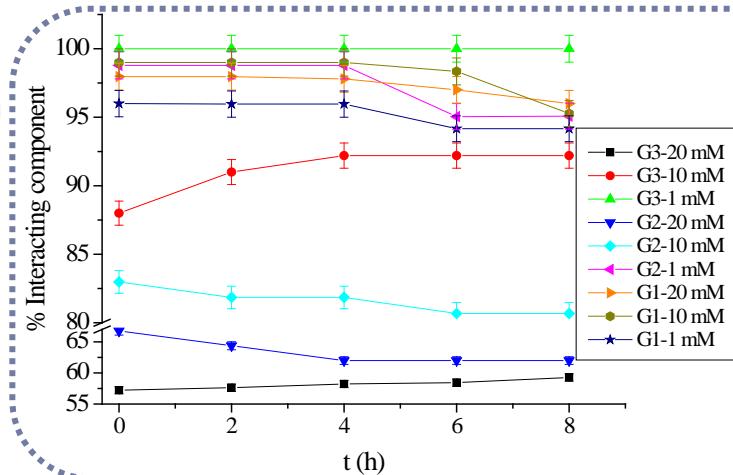
Low mobility



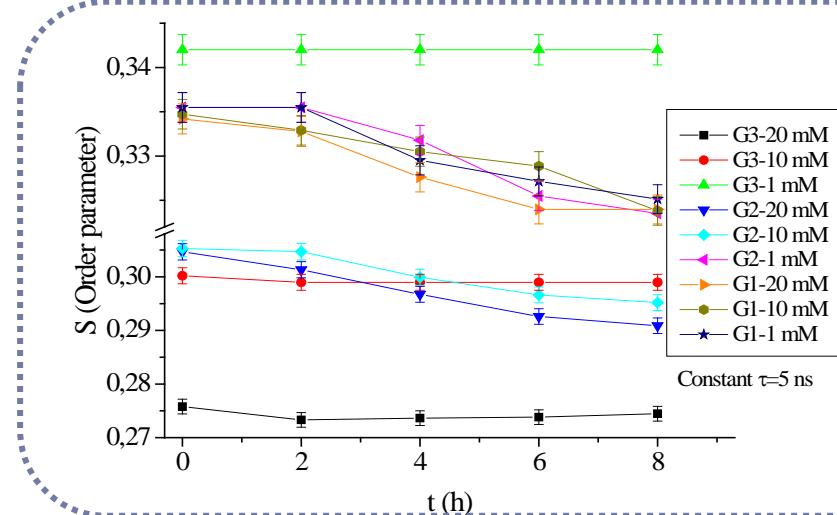
5DSA

Structural disruption of the anionic membrane

Interacting component

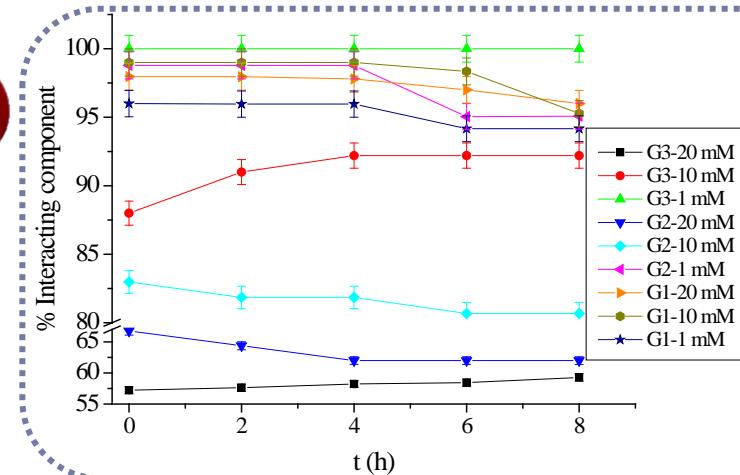
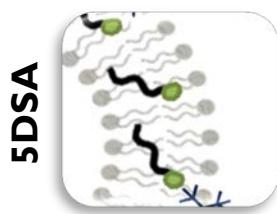


Order parameter (S)



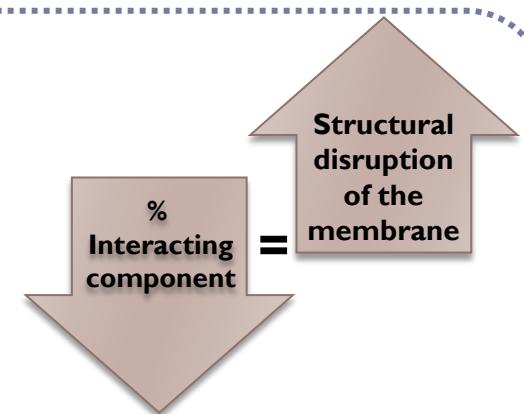
EPR results. 5DSA probe

Low mobility

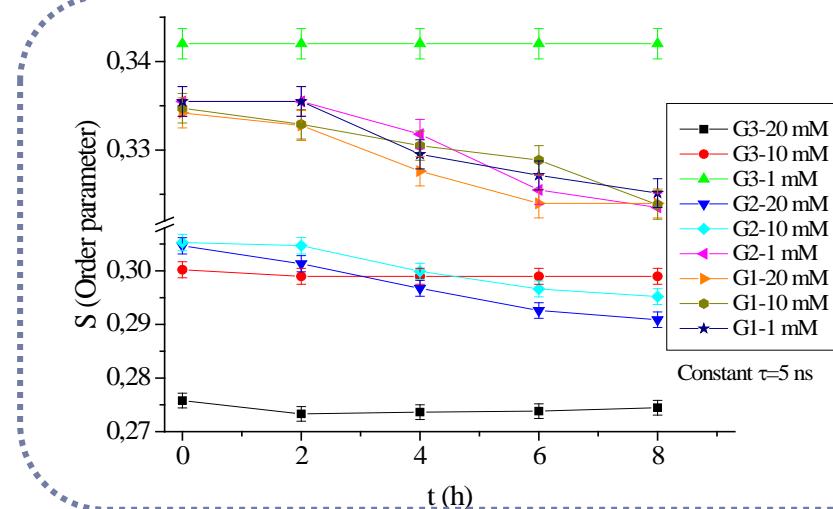


Structural disruption of the anionic membrane

Interacting component



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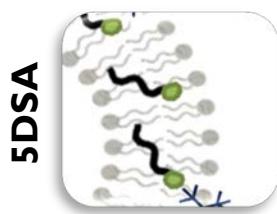


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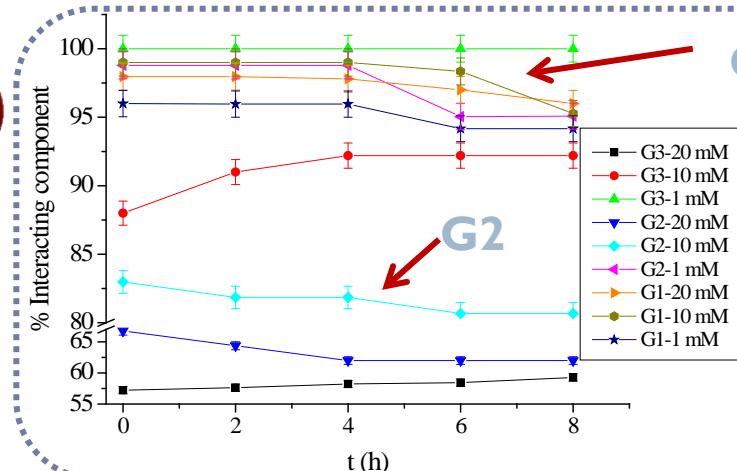
Structural disruption of the membrane

EPR results. 5DSA probe

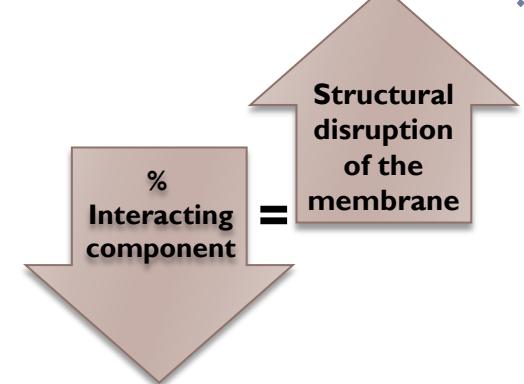
Low mobility



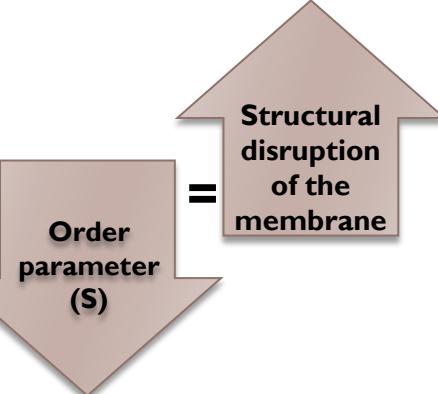
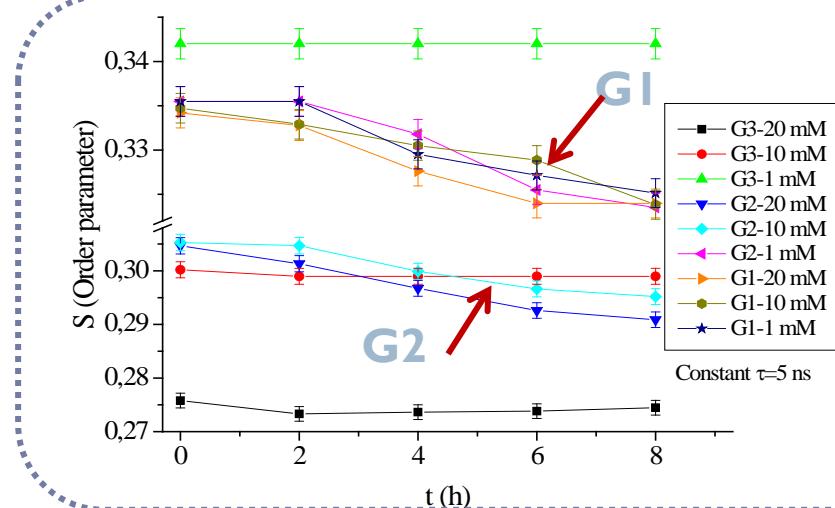
Structural disruption of the anionic membrane



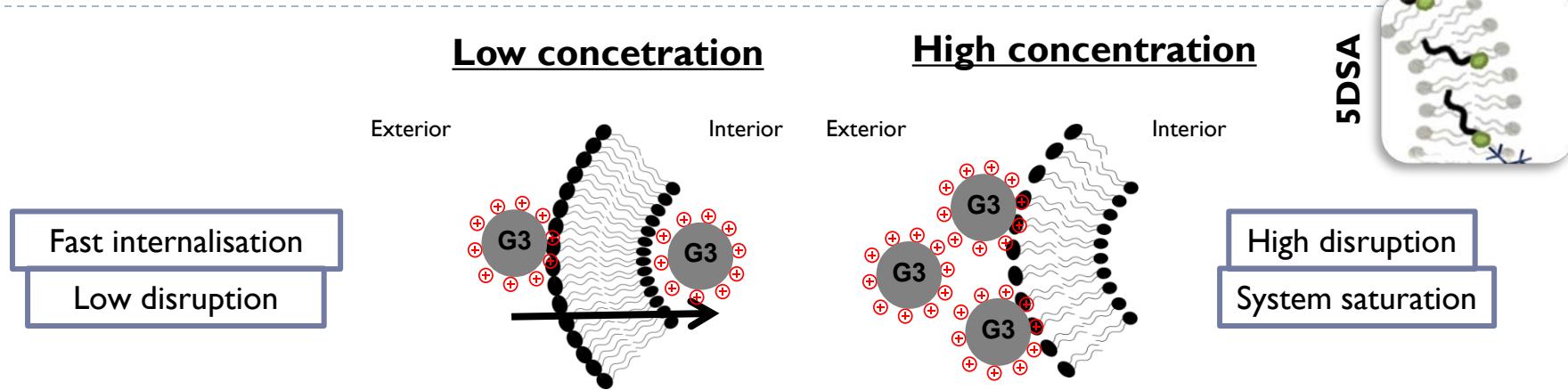
Interacting component



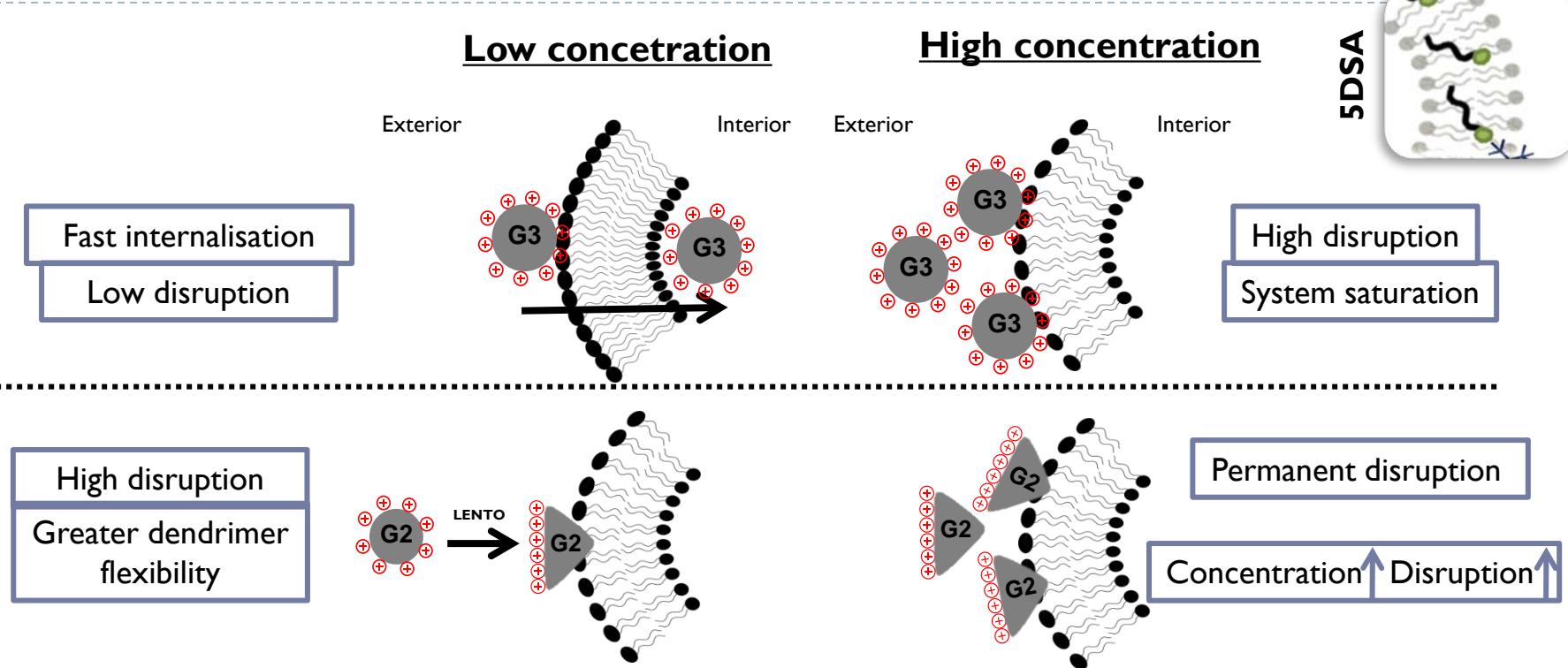
Order parameter (S)



EPR results. 5DSA probe



EPR results. 5DSA probe



EPR results. 5DSA probe

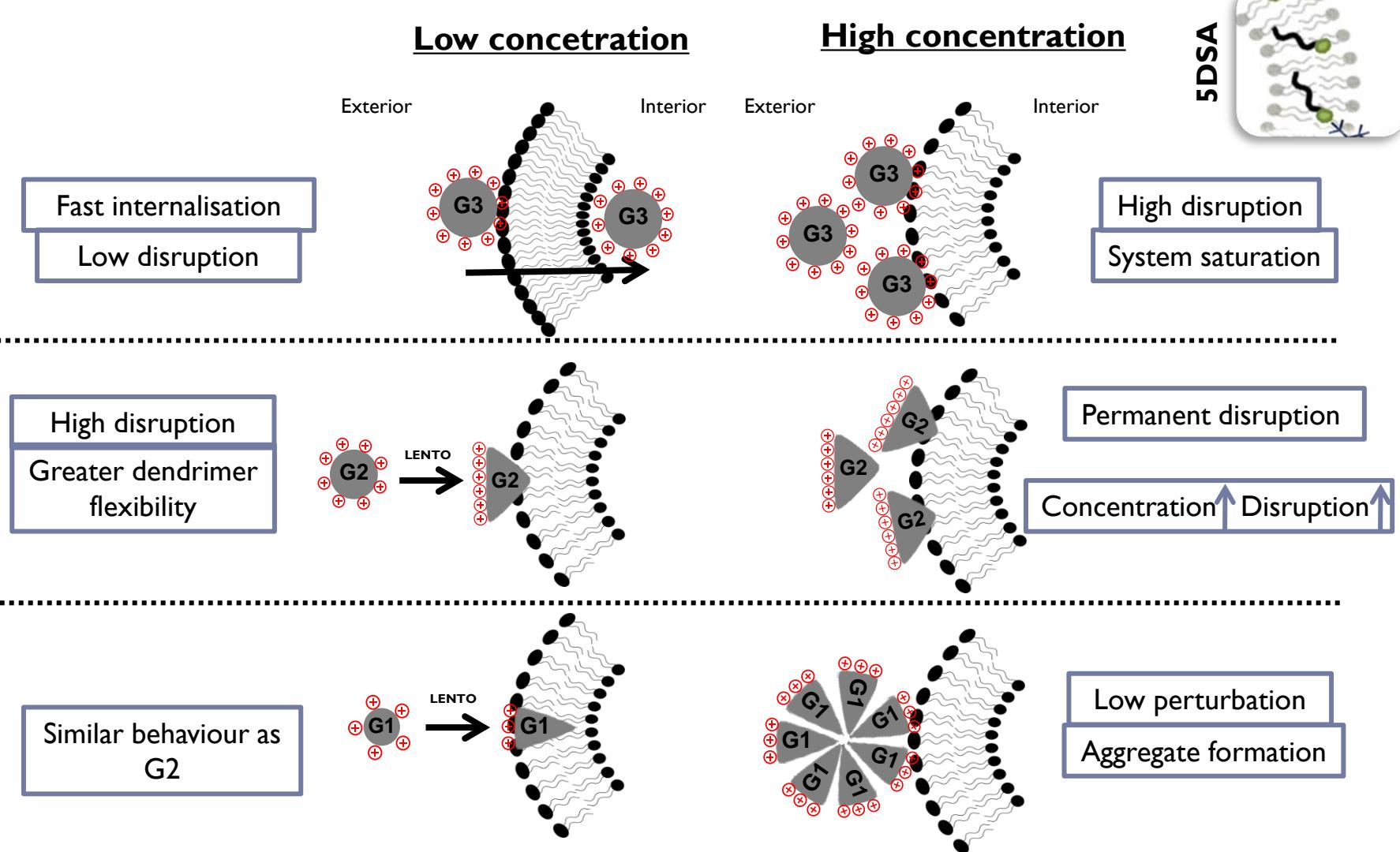
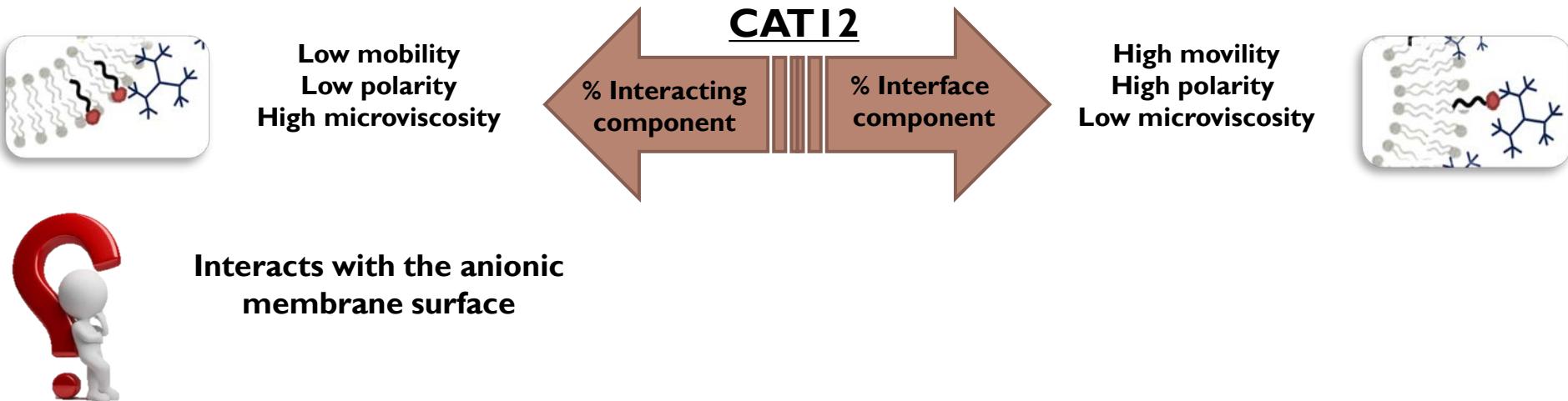


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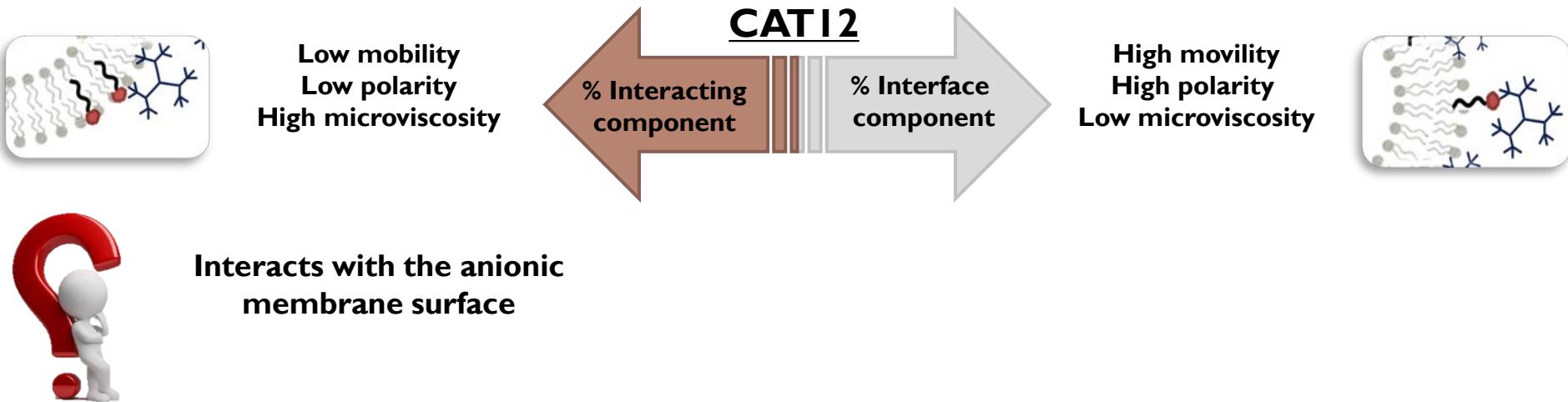
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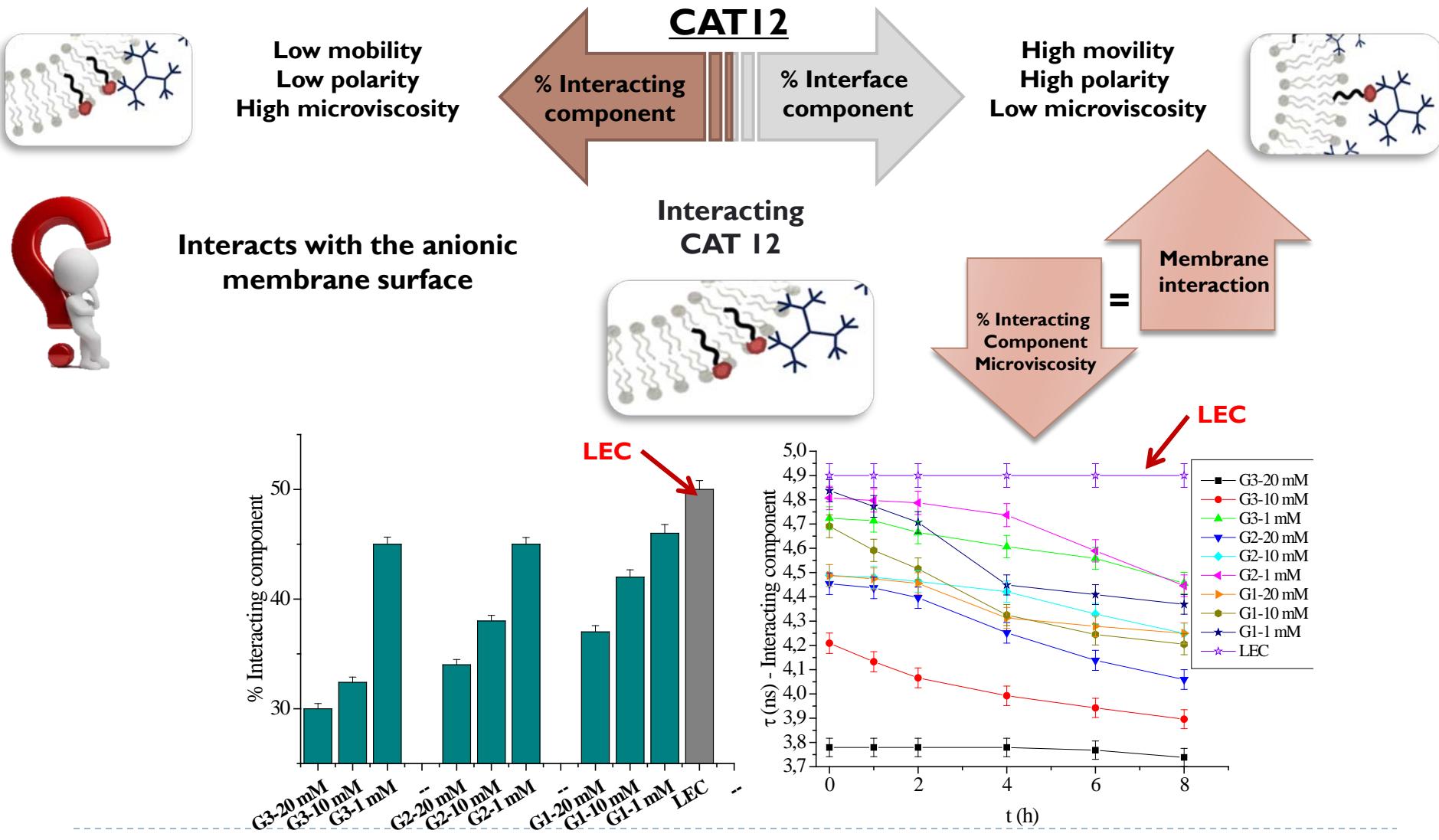
EPR results. CAT12 probe



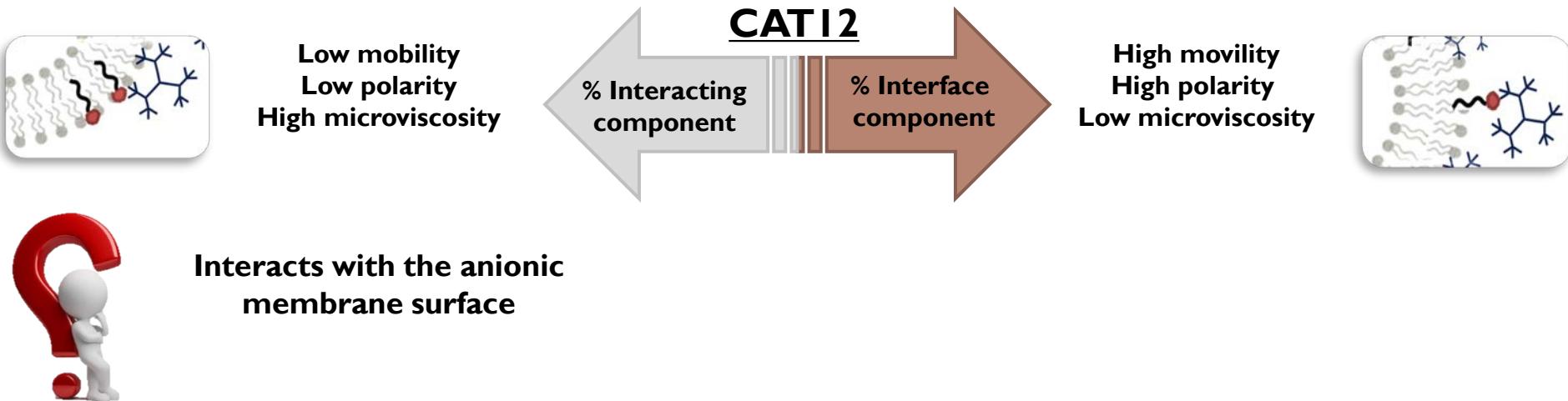
EPR results. CAT12 probe



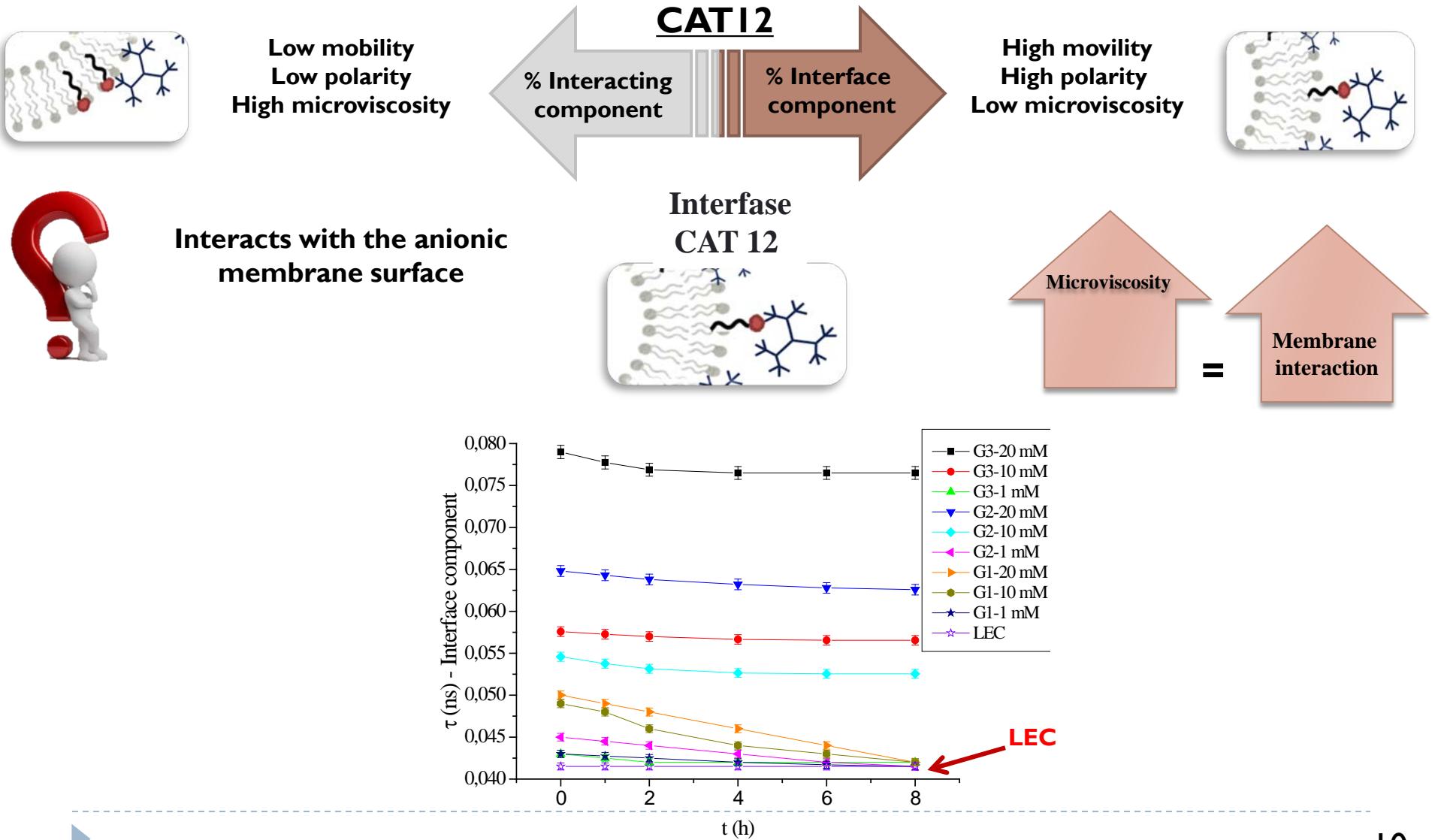
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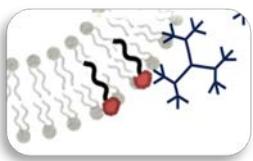
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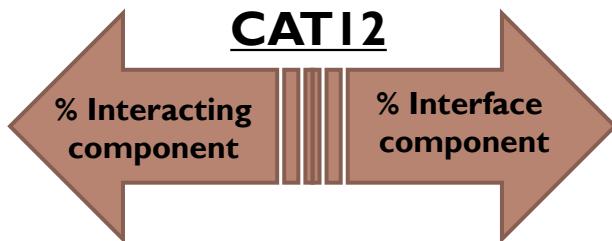
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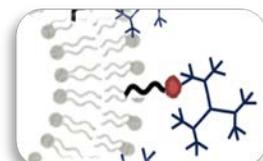
EPR results. CAT12 probe



Low mobility
Low polarity
High microviscosity



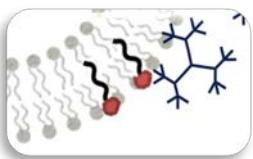
High mobility
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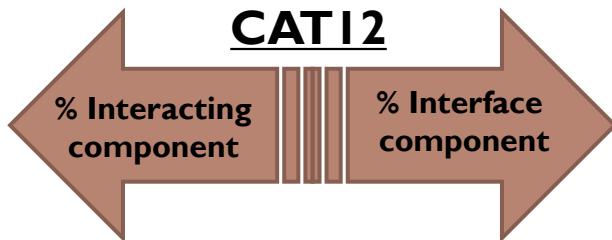
Interacts with the anionic
membrane surface



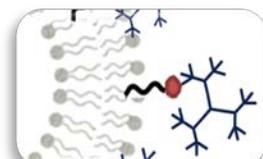
EPR results. CAT12 probe



Low mobility
Low polarity
High microviscosity



High mobility
High polarity
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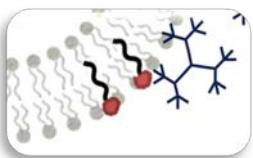


Interacts with the anionic
membrane surface

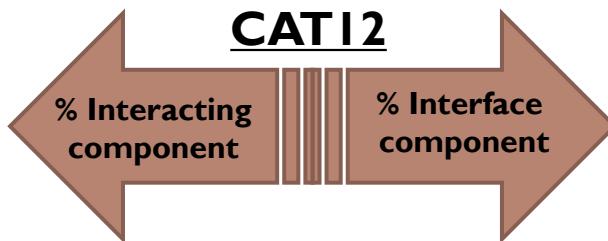
All dendritic systems interact with the anionic surface of the model membrane



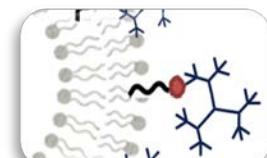
EPR results. CAT12 probe



Low mobility
Low polarity
High microviscosity



High mobility
High polarity
Low microviscosity



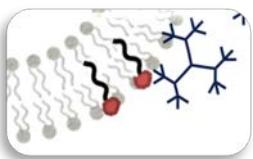
Interacts with the anionic
membrane surface

All dendritic systems interact with the anionic surface of the model membrane

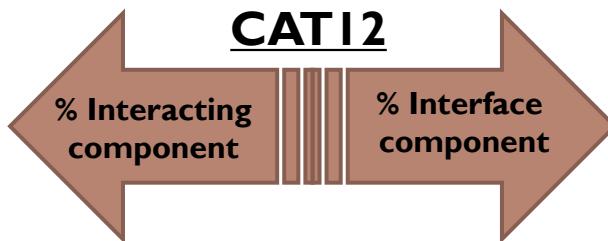
The interaction depends of the generation
(size) and concentration of the dendrimer
Generation↑ Concentration↑ Interacion↑



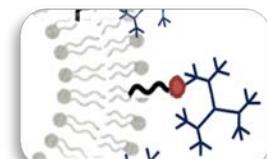
EPR results. CAT12 probe



Low mobility
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Interacts with the anionic membrane surface

All dendritic systems interact with the anionic surface of the model membrane

The interaction depends of the generation (size) and concentration of the dendrimer
Generation↑ Concentration↑ Interacion↑

Confirm the behaviour observed with 5DSA probe



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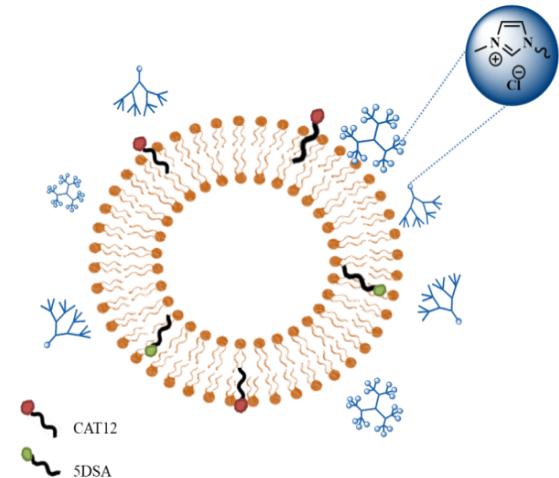


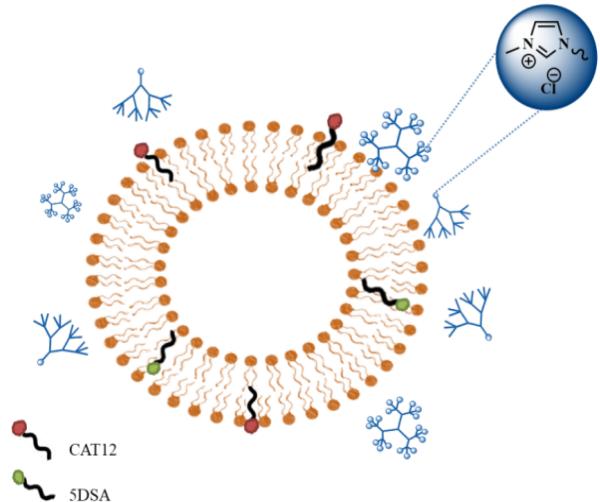
04 Conclusions

1. According to 5DSA results dendrimer are able to perturb the membrane, being greater the effect as the generation and concentration increase.

2. The behaviour of G3 at lowest concentration could be explained due to a possible internalization with fast kinetics, since the EPR spectra did not show structural perturbations of the liposomes.

3. According to CAT12 probe, all dendritic systems interact with the anionic surface of the membrane, being concentration and generation dependant.





Study of imidazolium-terminated cabosilane dendritic systems by EPR

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Host: Prof. Maria Francesca Ottaviani

16/03/2022