# The interaction of membrane-active molecules with model membranes

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The search for alternatives for conventional antibiotics due to the uprise of resistances of pathogenic bacteria is not new, but still of prior interest. Beside antibacterial peptides that belong to the innate immune system of almost all species, also synthetic molecules that mimic the properties of these peptides have become promising candidates as alternatives. Our intend is to investigate the mechanism of action of antibacterial peptides and antibacterial polymers.

In our previous Hasylab reports we found that the antibacterial peptides NKCS and derivatives thereof shifted the inverse hexagonal phase transition temperatures of POPE, DOPE-trans and DiPOPE model membranes to higher values [1 and references therein]. In this report we investigated the influence of 8 new peptide derivatives of NKCS and functionalized polyethylene imine (PEI) [2] polymers on phospholipid model membranes. Furthermore, a first attempt was made to measure the influence of salt on the scattering of the negatively charged lipid POPG.

The SAXS measurements of vesicles were prepared in 10 mM sodium phosphate buffer (NaP) pH 7 for DOPE-trans and DiPOPE and 10 mM NaP plus 1 M sodium chloride (NaCl) buffer for POPG with a final lipid concentration of 25 mg/ml. Temperature dependent SAXS measurements were performed at the Soft Condensed Matter Beamline A2.

The results we found are in a good agreement with our previous experiments. All tested peptides shifted the inverse hexagonal phase transition temperature in a concentration dependent manner to higher values. The only exception was a randomly scrambled peptide sequence that corresponds to the less active second half of the peptide NKCS, which showed no effect on the phase transitions. Like it was found before for NKCS, the effect on DiPOPE was more pronounced than for DOPE-trans, which indicates an importance of the acyl chain length of the lipids.

The polymer PEI showed strong interaction with model membranes and even destructive properties at higher concentrations.

The addition of salt to the buffer used for POPG liposomes preparation resulted in a completely different scattering pattern of POPG (figure 1). When POPG was measured in 10 mM sodium phosphate buffer there is no signal visible, what can be due to the low concentration of the lipid and/or a precipitation of the sample. Usually the scattering of the unilamellar POPG vesicles exhibit no sharp peaks but a broad signal. After addition of 1 M sodium chloride to the buffer, the prepared POPG vesicles showed two sharp peaks at 30°C (figure 1), which were visible during the whole temperature scan from 30 to 60°C. This finding has to be repeated during our next experiments and also the interaction of our cationic peptides with the negatively charged POPG membranes will be investigated.

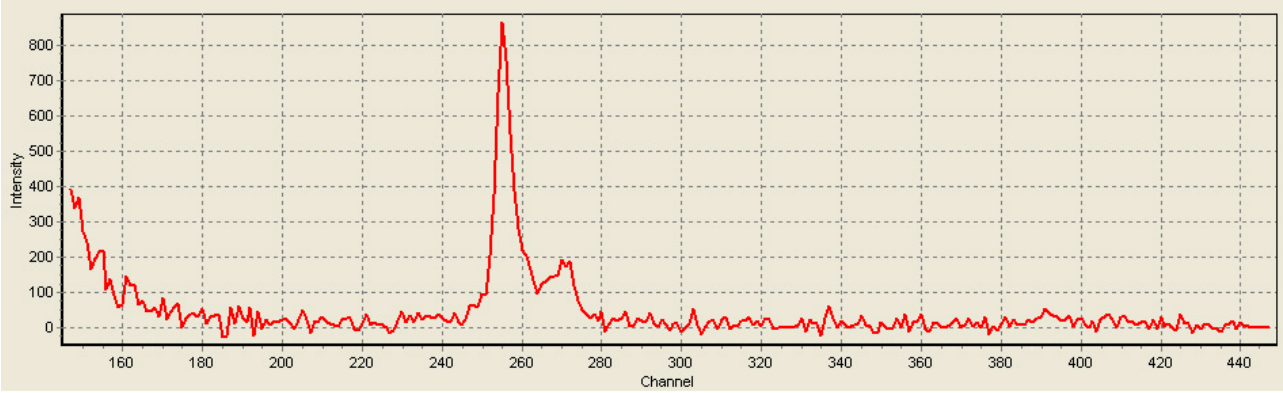

Figure 1: Diffraction pattern of POPG in 10mM NaP+1M NaCl Buffer at 30°C.

**Abbreviations used:** DOPE-trans: 1,2-dielaidoyl-sn-glycero-3-phosphatidylethanolamine; DiPOPE: 1,2-dipalmitoleoyl-sn-glycero-3-phosphatidylethanolamine; POPG: 1-palmitoyl-2-oleoyl-sn-glycero-3-[Phospho-rac-(1-glycerol)]

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## References

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