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Arginine-rich peptides vs. lysine-rich peptides: interaction with differently charged lipid bilayers

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BACKGROUND

Cell penetrating peptides

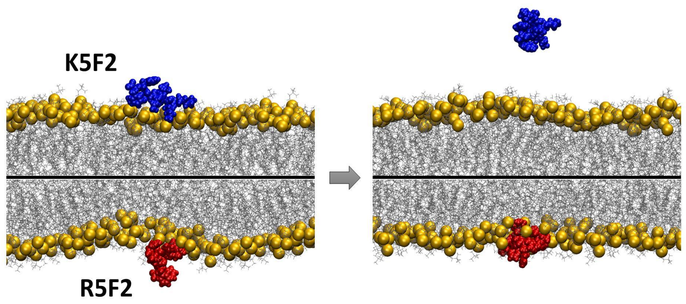
- short peptides built up from dominatly cationic and hydrophobic amino acid residues
- distinguished ability to pass through the cell membrane with molecular cargo
- uptake mechanism of CPPs still remain unclear
- **arginine** and **lysine** contained CPPs can be used to cross cell membranes

Liposomes

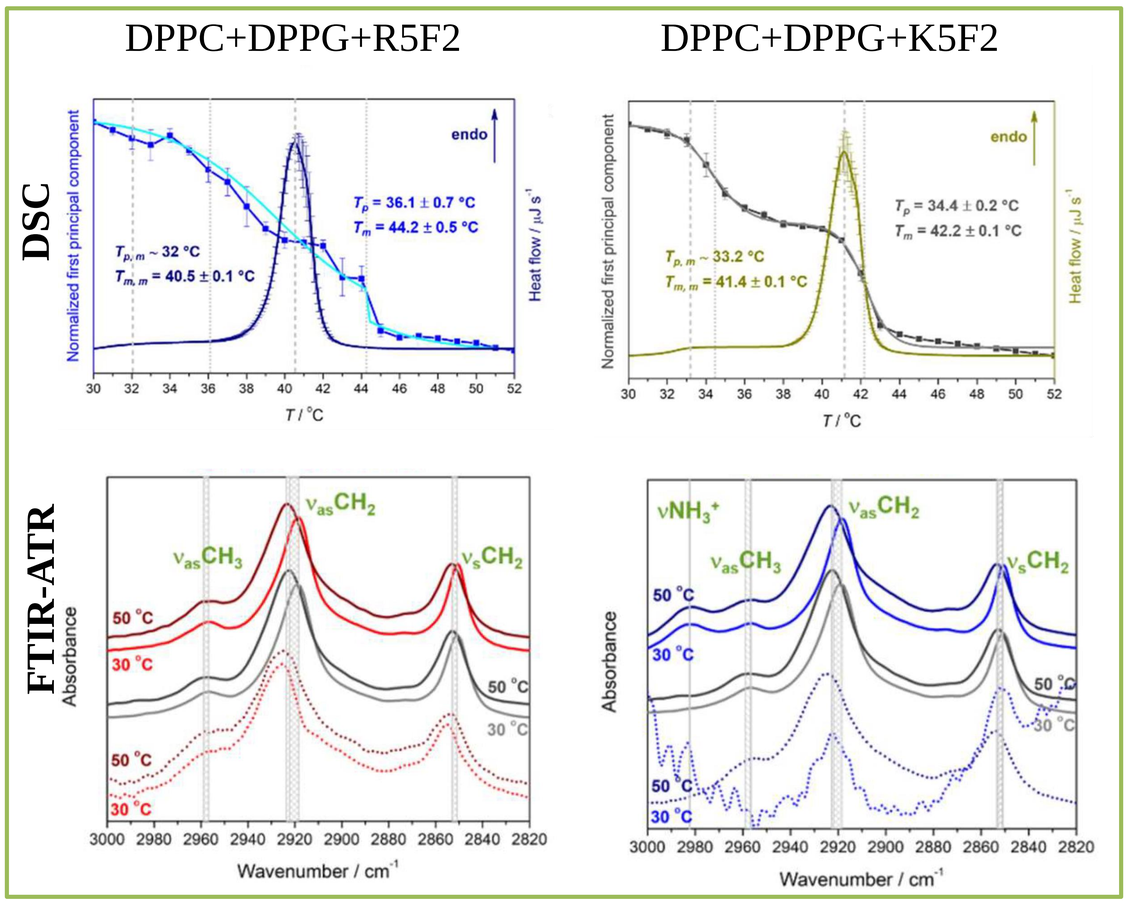
- spherical vesicles made by self-assembly of phospholipids
- simplified models of cell membrane
- important for understanding of fundamental biological processes such as **peptide-lipid interactions**

THE AIM OF THE STUDY

- investigate interaction of short cationic-hydrophobic peptides with lipid membranes and adsorption of petpides on lipid membranes as first step in cell penetration



RESULTS



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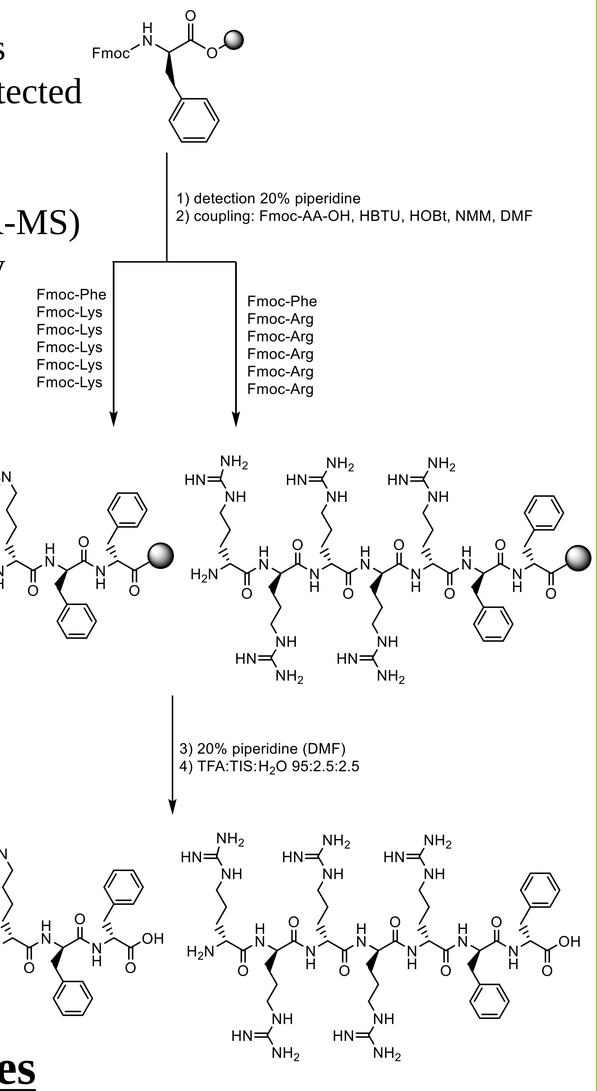
solid-phase synthesis

- synthesis of R5F2 and K5F2 heptapeptides
- performed automatically using Fmoc-protected amino acids
- structure of peptides confirmed by:
  i) high-resolution mass spectrometry (HR-MS)
  ii) nuclear magnet resonance spectroscopy (NMR spectroscopy)



preparation of lipid membranes

- large unilamellar vesicles (LUVs) composed of phosphatidylcholine (DPPC) and phosphatidylglycerol (DPPG) lipids
- addition of peptides to liposome suspensions
- investigation:
  i) impact of peptides on thermotropic behaviour of lipids with **differential scanning calorimetry** (DSC) and **UV-Vis spectroscopy**
  ii) molecular-level details of interaction with **infrared spectroscopy** (FTIR-ATR)

CONCLUSION

- adsorption of R5F2 and K5F2 peptides on DPPC+DPPG lipid bilayer was examined
- alternation of DPPC+DPPG thermotropic properties caused because of different mechanism of peptides
- R5F2 is adsorbed on DPPC+DPPG lipid bilayer (proton transfer-carboxylic moiety)

FOLLOW-UP

- examination of interaction of differently charged lipid bilayers with other heptapeptides (R5W2, K5W2, R5I2, K5I2)
- investigate which peptide is best potential cell penetrating peptide

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