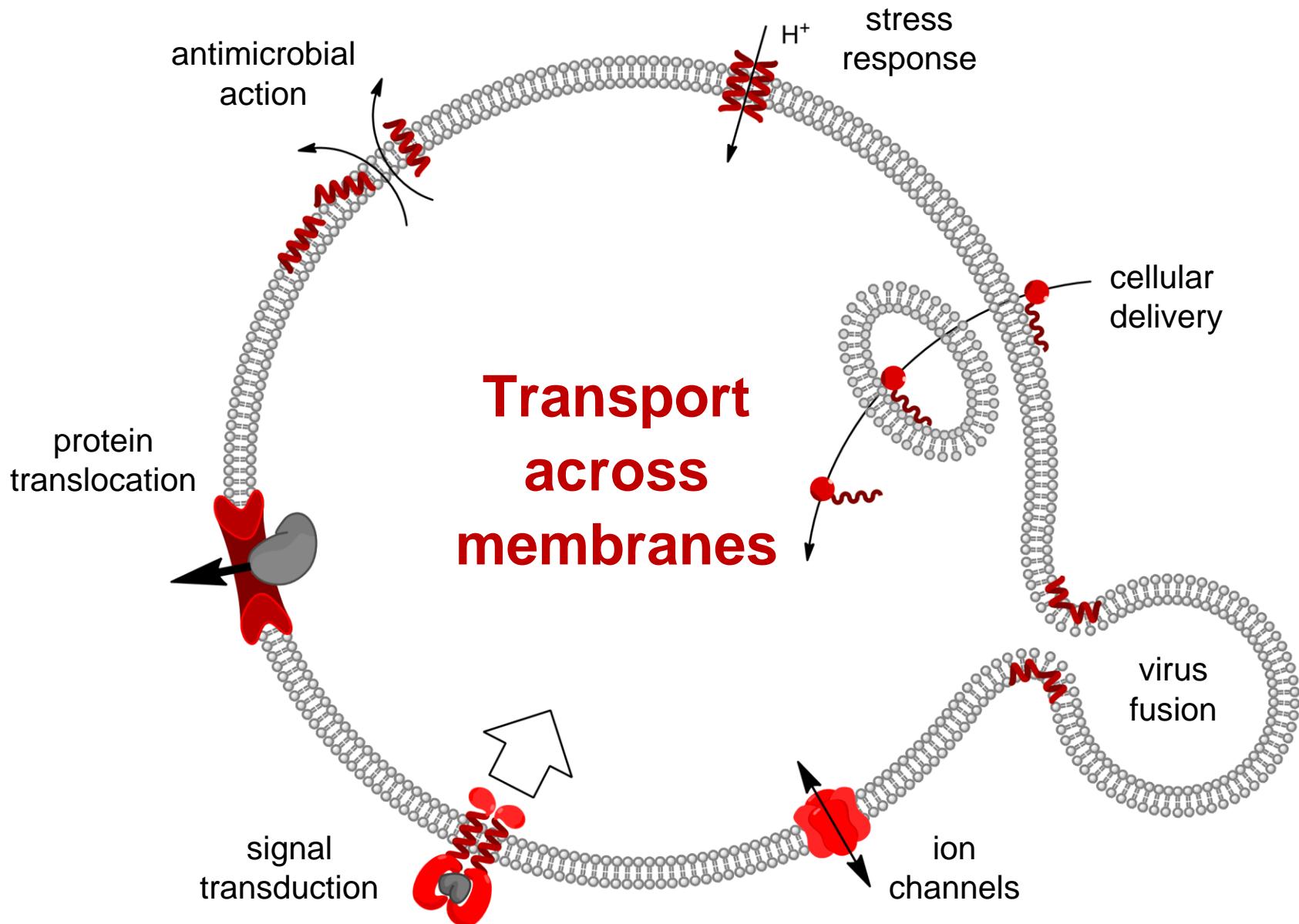


# Forschungsprojekte am LS Biochemie

Prof. Anne S. Ulrich (IOC & IBG-2)

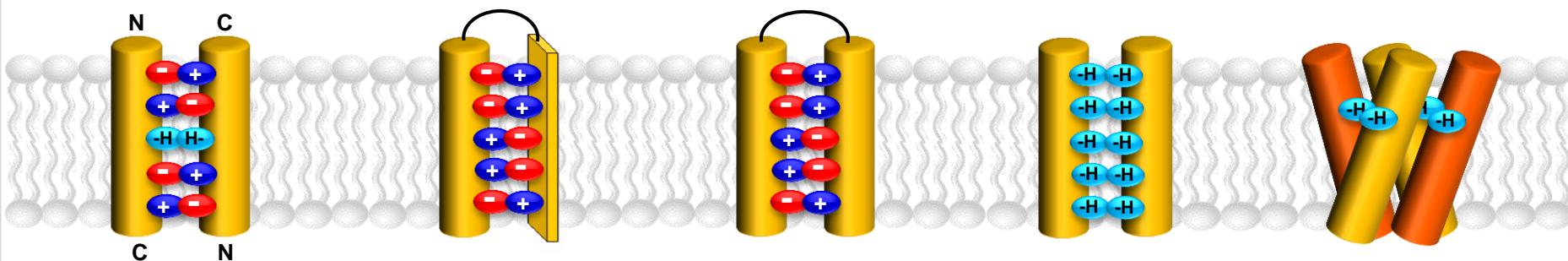
Institute for Biological Interfaces 2 (IBG-2)





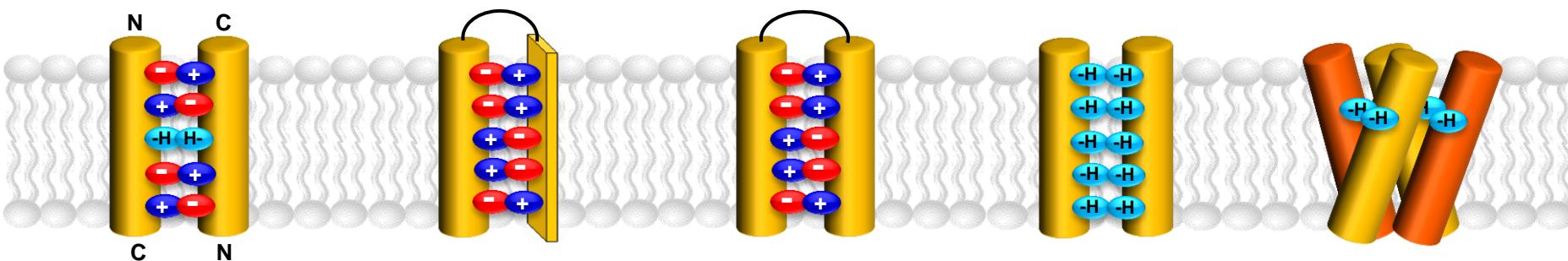
# Structure → function → applications

New concepts for helix-helix recognition and assembly: charge zippers & H-bonds



# Structure → function → applications

New concepts for helix-helix recognition and assembly: charge zippers & H-bonds



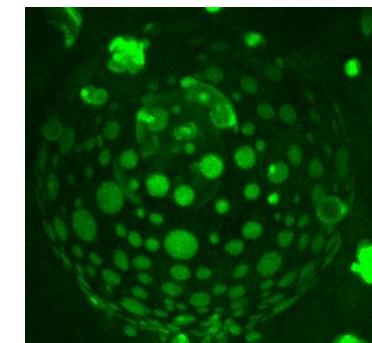
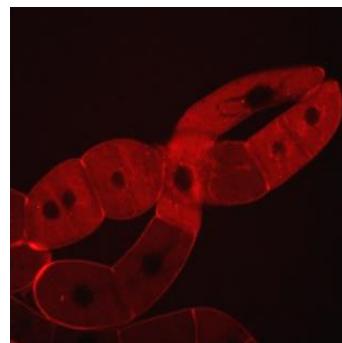
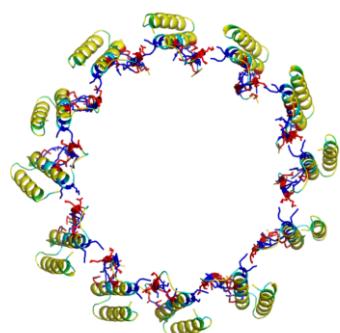
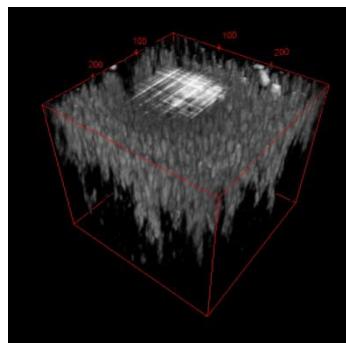
**TisB:** bacterial stress response induces biofilms

**TatA:** oligomeric pore for protein translocation

**Dermcidin:** antimicrobial peptide from human sweat

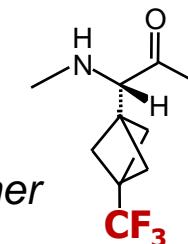
**BsrG:** mysterious bacterial toxin

**PDGF-receptor:** activated by viral E5 oncoprotein



# Experimental approach

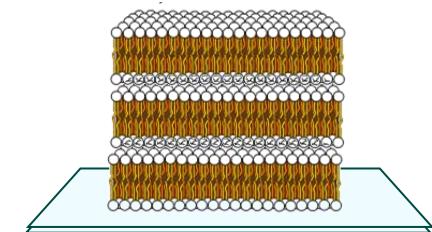
**Materials:** Synthetic peptides (<sup>19</sup>F-NMR labels): *Parvesh Wadhwani*



Recombinant proteins (<sup>15</sup>N-NMR): *Dirk Windisch, Torsten Walther*

Liposome technology, amino acids: *Sergii Afonin*

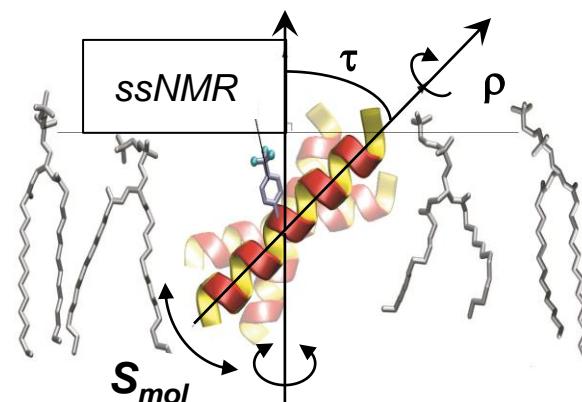
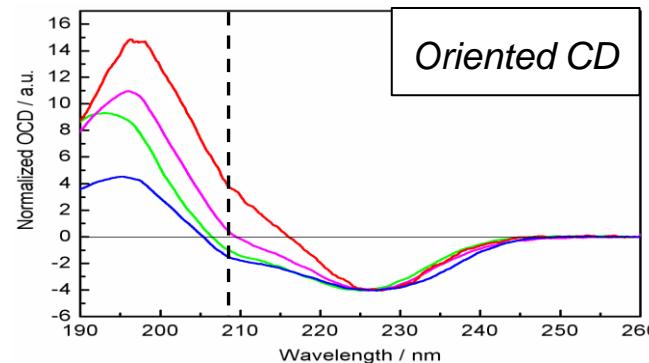
**Methods:** Solid-state NMR: *Stephan Grage, Erik Strandberg*



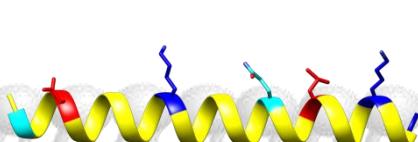
Circular dichroism: *Jochen Bürck*

Fluorescence, FRET: *Johannes Reichert*

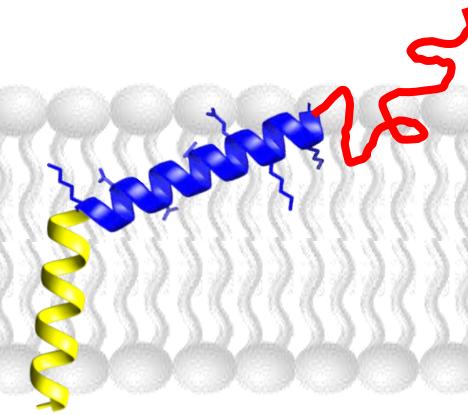
Microbiology assays: *Marina Berditsch*



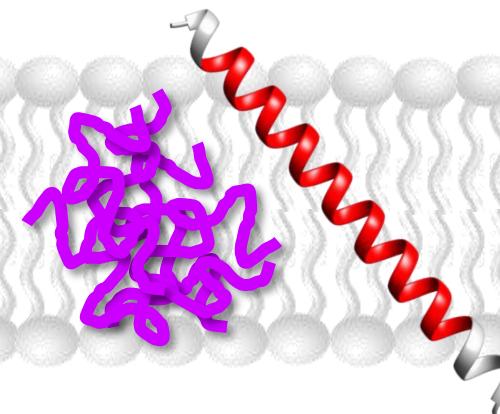
# Helices in membranes



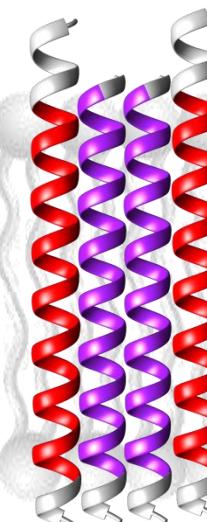
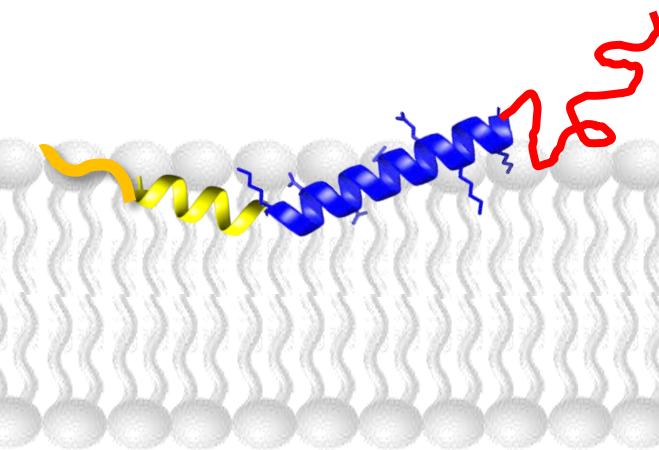
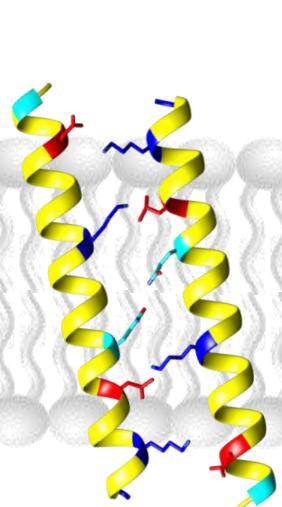
amphiphilic helices  
& charge zippers



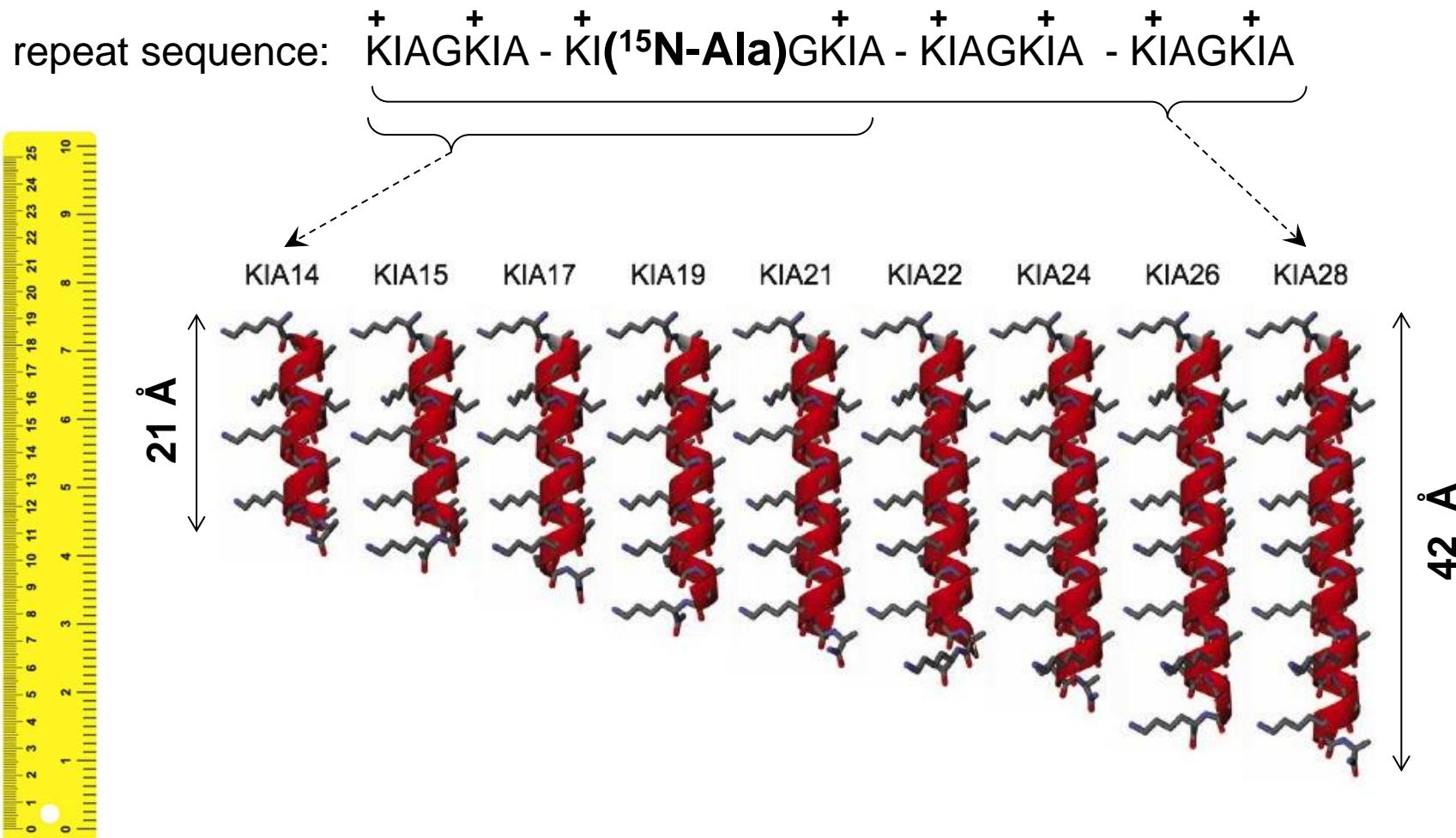
Tat translocase:  
flip of short TM-helix



PDGF-receptor:  
clustering via long E5



# Example: amphiphilic „molecular rulers“



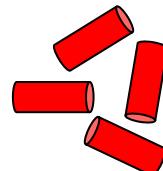
# $^{15}\text{N}$ -NMR

*inserted peptide*

*surface-bound*



*disordered peptide*



# $^{31}\text{P}$ -NMR

*aligned lipid (DMPC)*

KIA14

KIA15

KIA17

KIA19

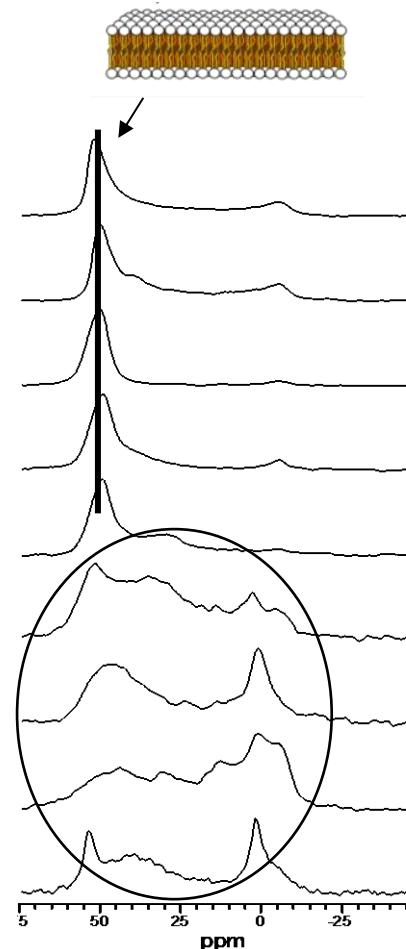
KIA21

KIA22

KIA24

KIA26

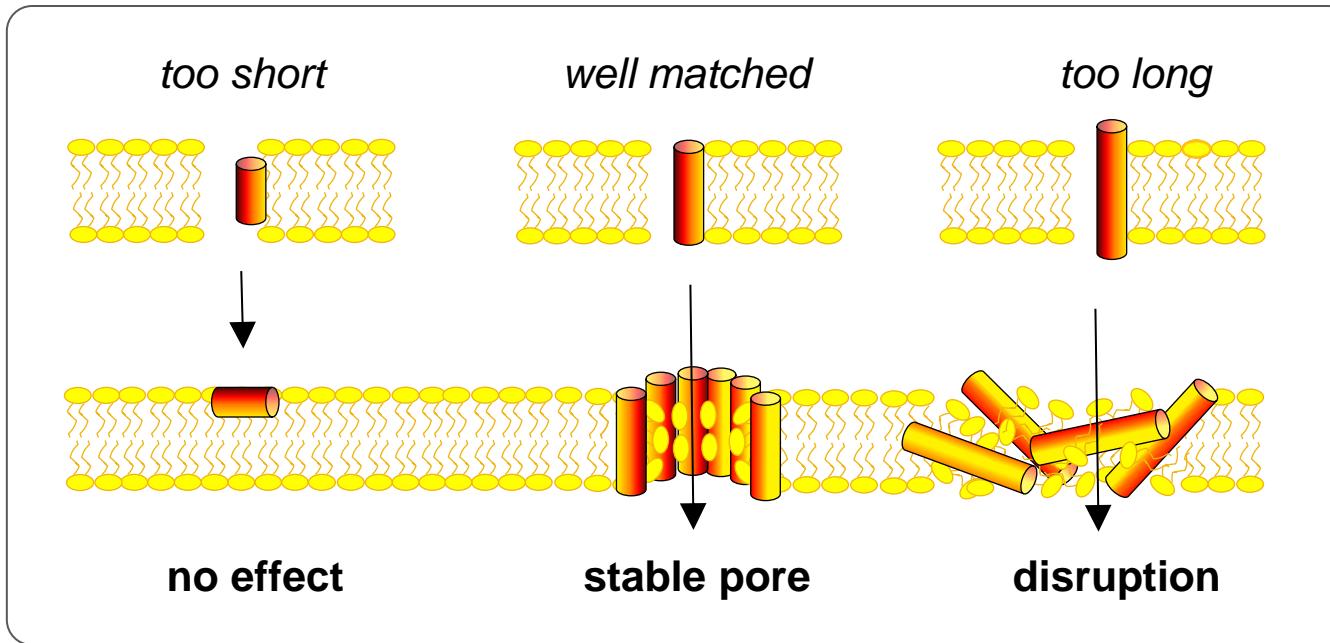
KIA28



*misaligned lipid*



# Helix length $\leftrightarrow$ membrane thickness



**Calibrate thresholds** for vesicle leakage with different bilayer thicknesses.

Deduce thickness in living cells by antimicrobial/hemolysis assays:

*E. coli* < *S. aureus*  $\approx$  *P. aeruginosa* < *E. faecalis*  $\approx$  red blood cell

24 Å

30 Å

30 Å

34 Å

34 Å