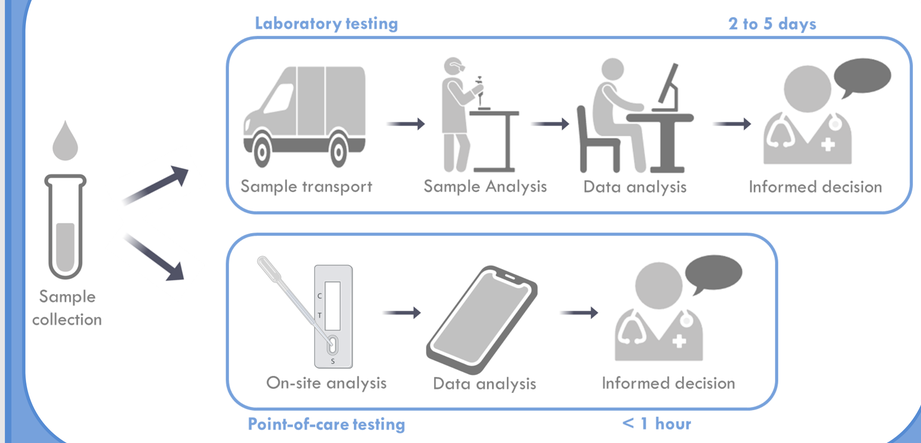
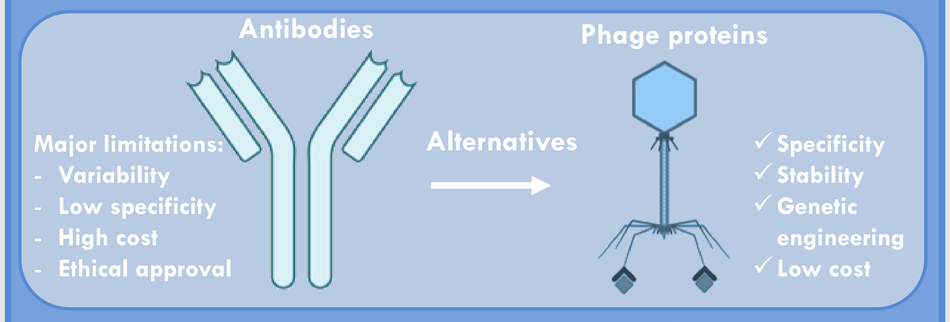
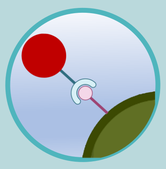
INTRODUCTION

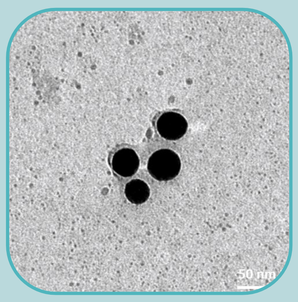
INCREASING NEED FOR POINT-OF-NEED DIAGNOSTICS





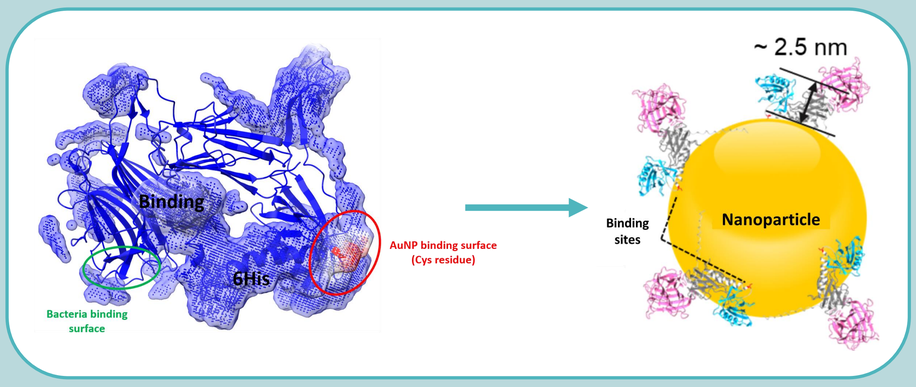
DETECTION BIORECEPTOR

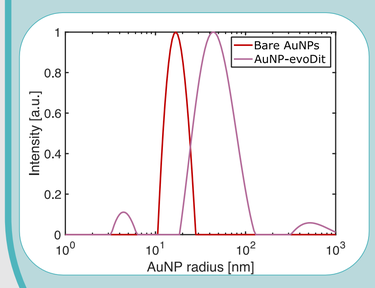




Good coating of gold nanoparticles with phage proteins

Which parts of the protein are involved in binding the nanoparticles and bacteria?





The structure of the detection bioreceptor (nanoparticle coating) was predicted by AlphaFold2 with high confidence. The most important force driving the conjugation of gold nanoparticles is the dative binding resulting from the irreversible oxidation of cysteine residues through chemisorption. The use of an algorithm combining both amino acid affinity scale and surface-area pinpointed one cysteine residue within the hexa-histidine tag as the most probable site for binding to gold nanoparticle, which leaves the binding module free for interaction with bacteria.

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USING BACTERIOPHAGE-BINDING PROTEINS FOR THE RAPID AND SPECIFIC DETECTION OF PATHOGENS WITH LATERAL FLOW ASSAY

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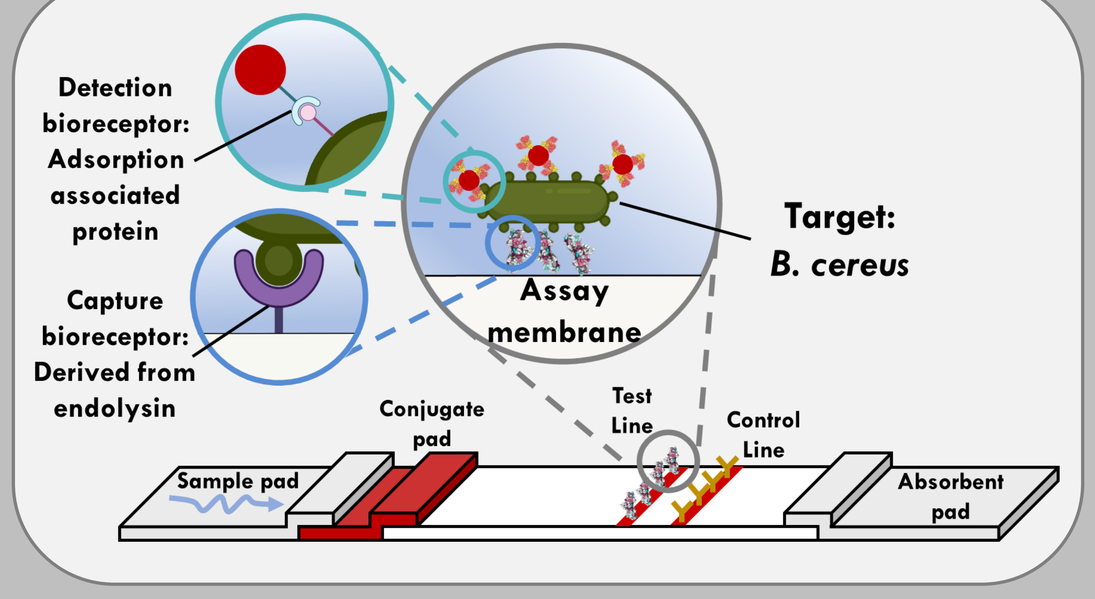
Lateral flow assay (LFA) are inexpensive, rapid and specific paper-based biosensors (e.g. Covid self-test). LFAs rely on the accumulation of gold nanoparticles at the test line resulting from specific interactions between a target contaminant and bioreceptors used as capture agents.
Here, phage binding proteins are used as bioreceptors for the specific detection of *Bacillus cereus*.



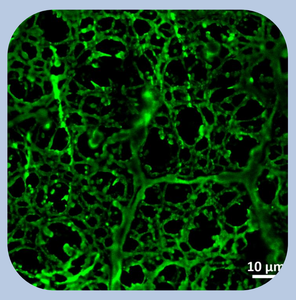
Adsorption = phage specific recognition of sensitive bacteria
Endolysin = phage peptidoglycan-degrading proteins used to lyse bacteria

CONCLUSION

- ✓ Phage binding proteins offer new opportunities to conventional antibodies in LFA
- ✓ Recent advances in Bioinformatics (including AlphaFold2 structure prediction) enable fine microstructural characterization of bioreceptors that are no longer used as « black boxes »

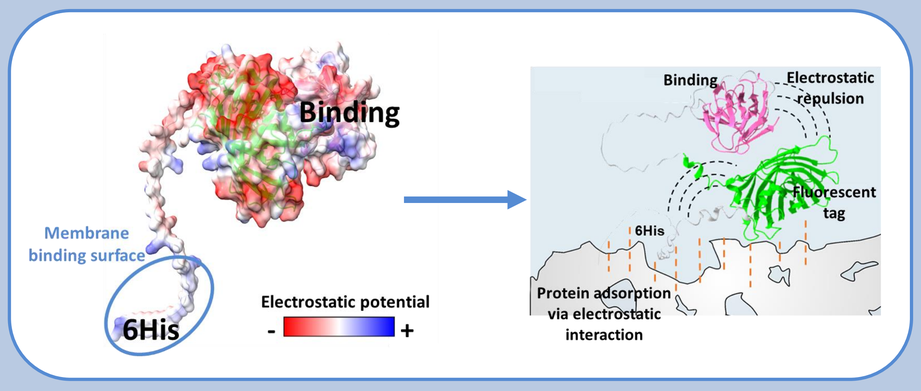
I am also participating to the agar art competition!

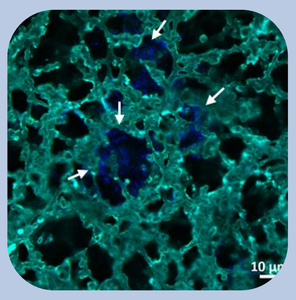
CAPTURE BIORECEPTOR



Good coating of assay membrane with fluorescent protein

Which parts of the protein is involved in binding to membrane and bacteria?





Effective binding of bacteria by functionalized membrane

The structure of the capture bioreceptor (used at the test line) was predicted by AlphaFold2 with high confidence.
The adsorption of the capture bioreceptor on the assay membrane is mainly driven by electrostatic interactions. The positive hexa-histidine protein tag is likely to interact with the strong negative dipole of the assay membrane. Furthermore, the negatively charged fluorescent tag is thought to repulse the binding domain, being free to interact with bacterial cells.