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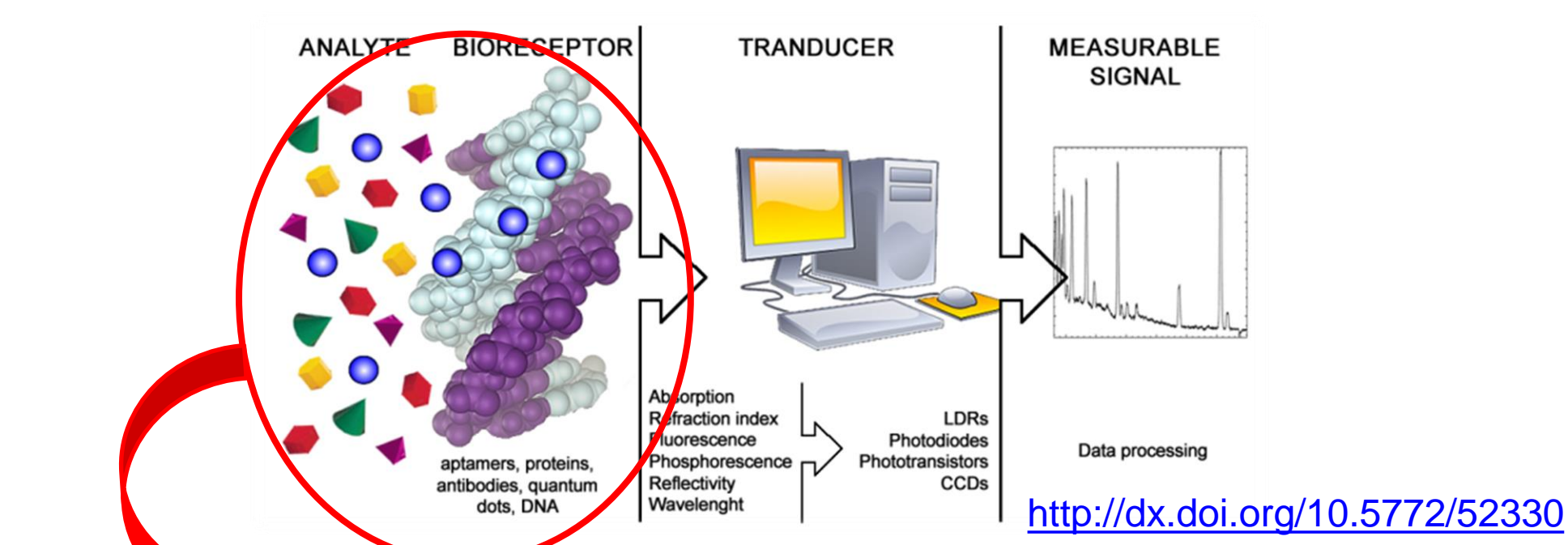
Peptide-based Receptor Development for Potential Integration into Wearable Bio-sensors

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Objectives

Developing Biosensors for the Future Warfighter



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Molecular Recognition is the Heart of the Biosensor

- Meeting requirements for:
- Robust functionality under environmental extremes
 - Suitability for new and emerging threats
 - Capability for rapid development and production

WILL PROVIDE

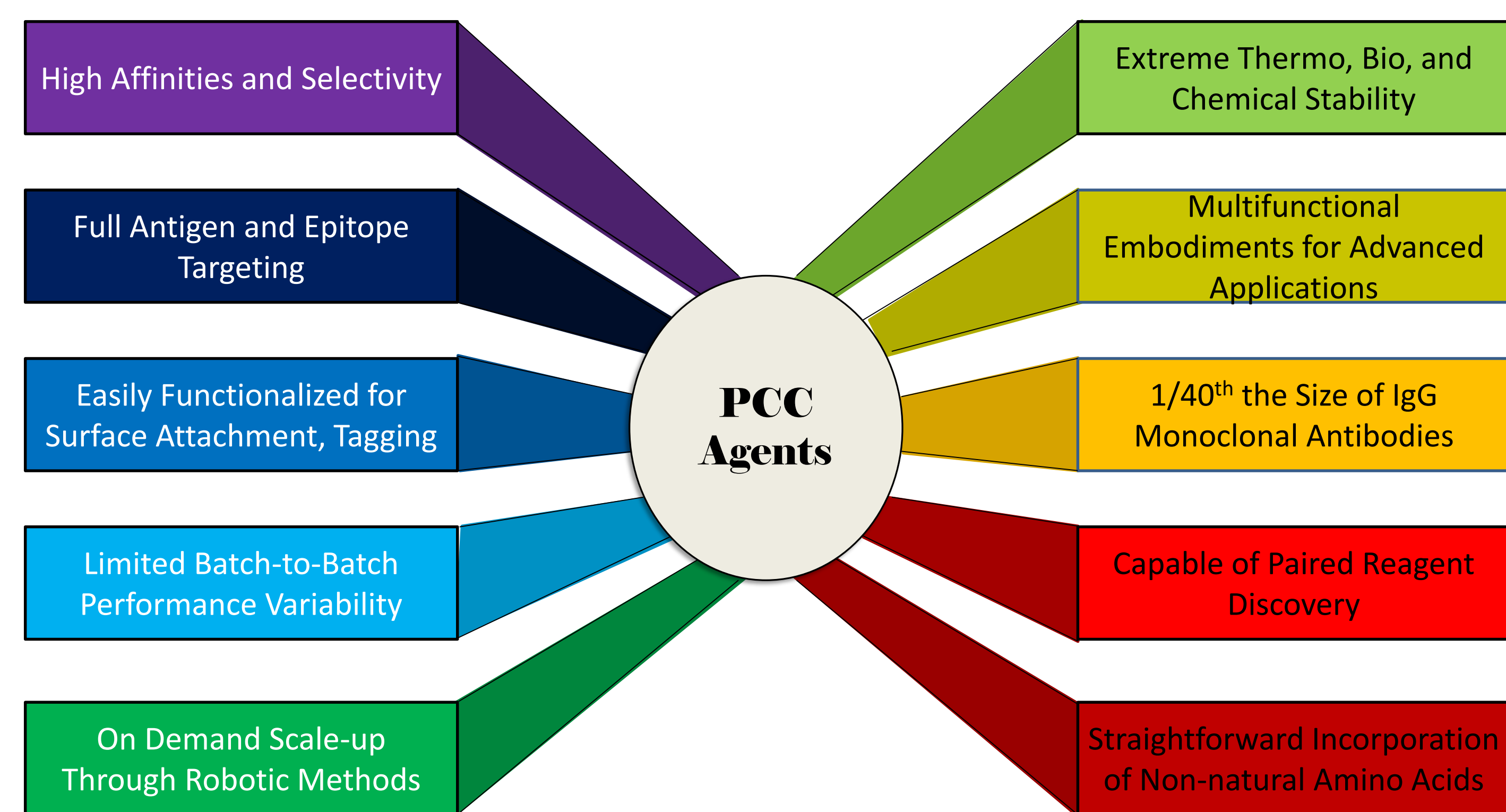
- Technology to support:
- Water and food defense
 - Individual soldier protection
 - Collective protection
 - Soldier health monitoring



Soldier wearables

In the multifaceted operational environments of future wars, Army forces will need to be more adaptive and optimized for execution. The development and production of ruggedized biosensors can provide real-time feedback for soldier health, performance, and biothreats.

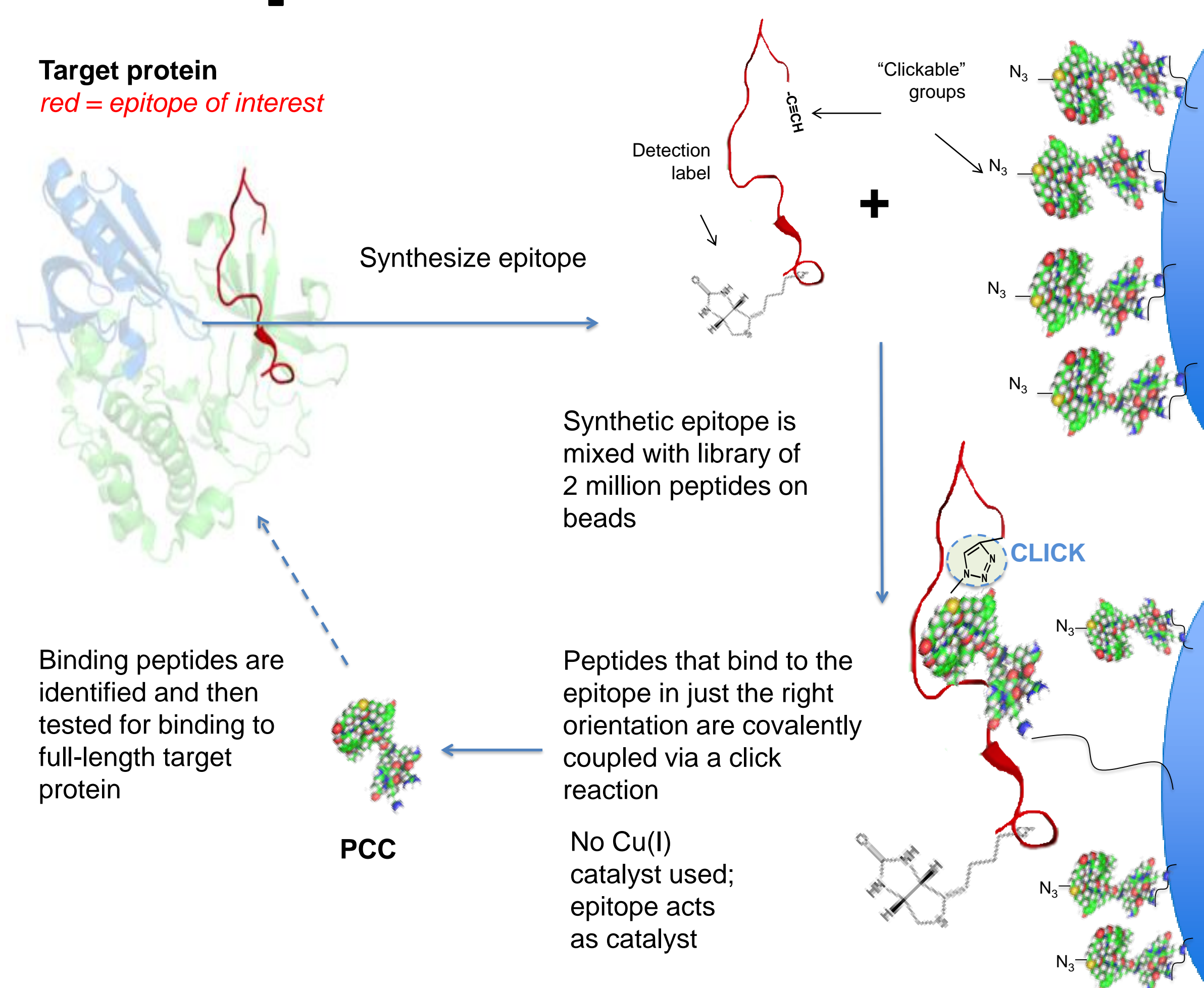
Advantages of Protein Catalyzed Capture Agents (PCCs) based Receptors



Targets: Toxins, biothreats, performance and health biomarkers

- IL-17: an inflammation-associated interleukin
- IL-6: inflammation and infection responses
- IL-10: an immunosuppressive cytokine
- IL-11: a signaling molecule improving platelet recovery after chemotherapy
- UCHL-1: a human biomarker signaling traumatic brain injury (TBI)
- CHIKV E2: virus for high fever
- TNF α : Tumour Necrosis Factor alpha
- IFN γ : Interferon gamma, inhibit viral replication

Epitope-targeted PCCs Development Procedures

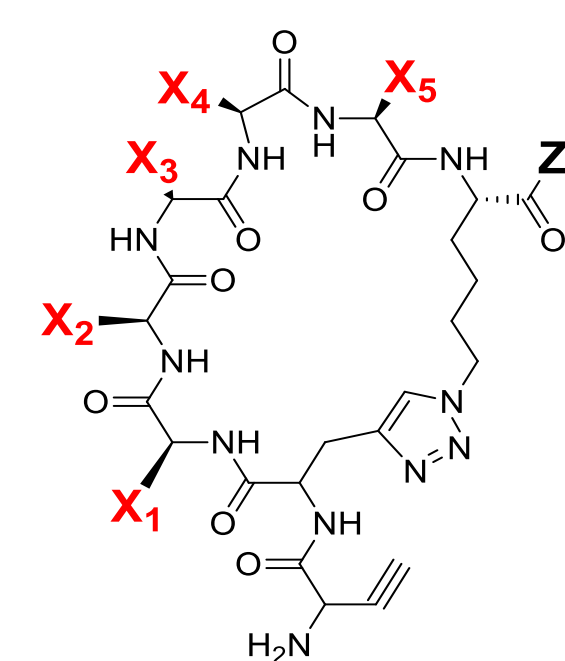


Multiple epitopes can be targeted and the resulting PCCs can be tethered to exploit cooperativity. The bi/tri-ligands show strong affinity (pM) and high selectivity for the target.

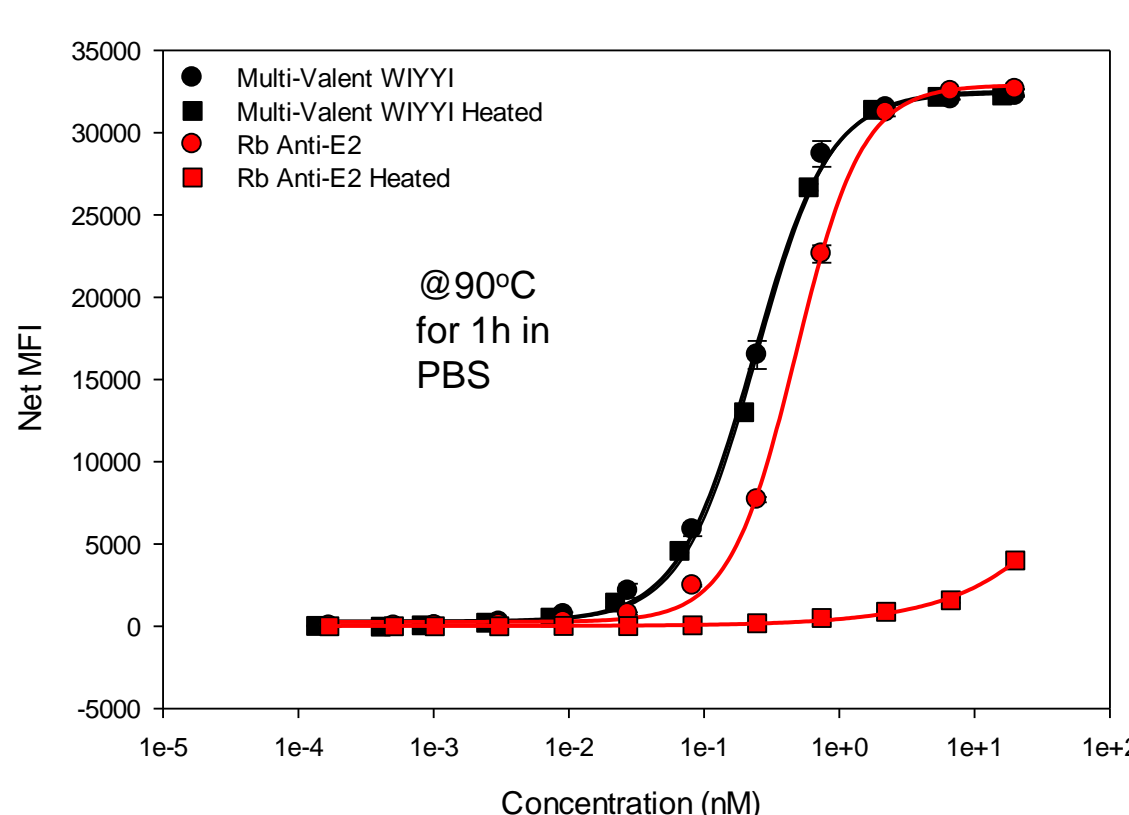
Cyclic PCC Stability

CHIKV E2 ligand: WIYYI

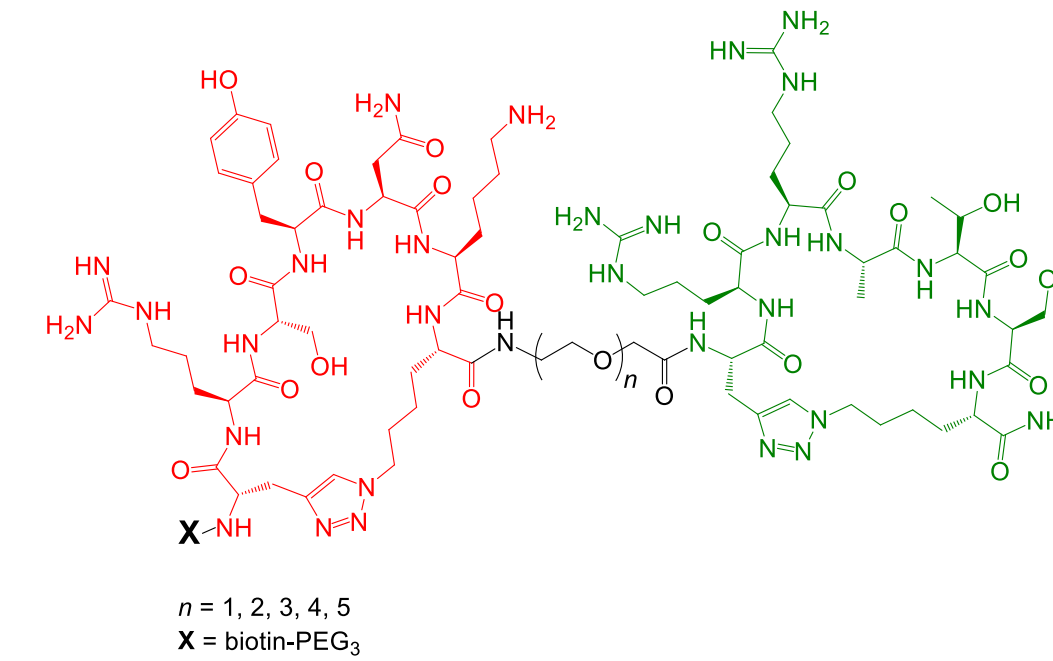
IL-17F biligands Bi-L_F



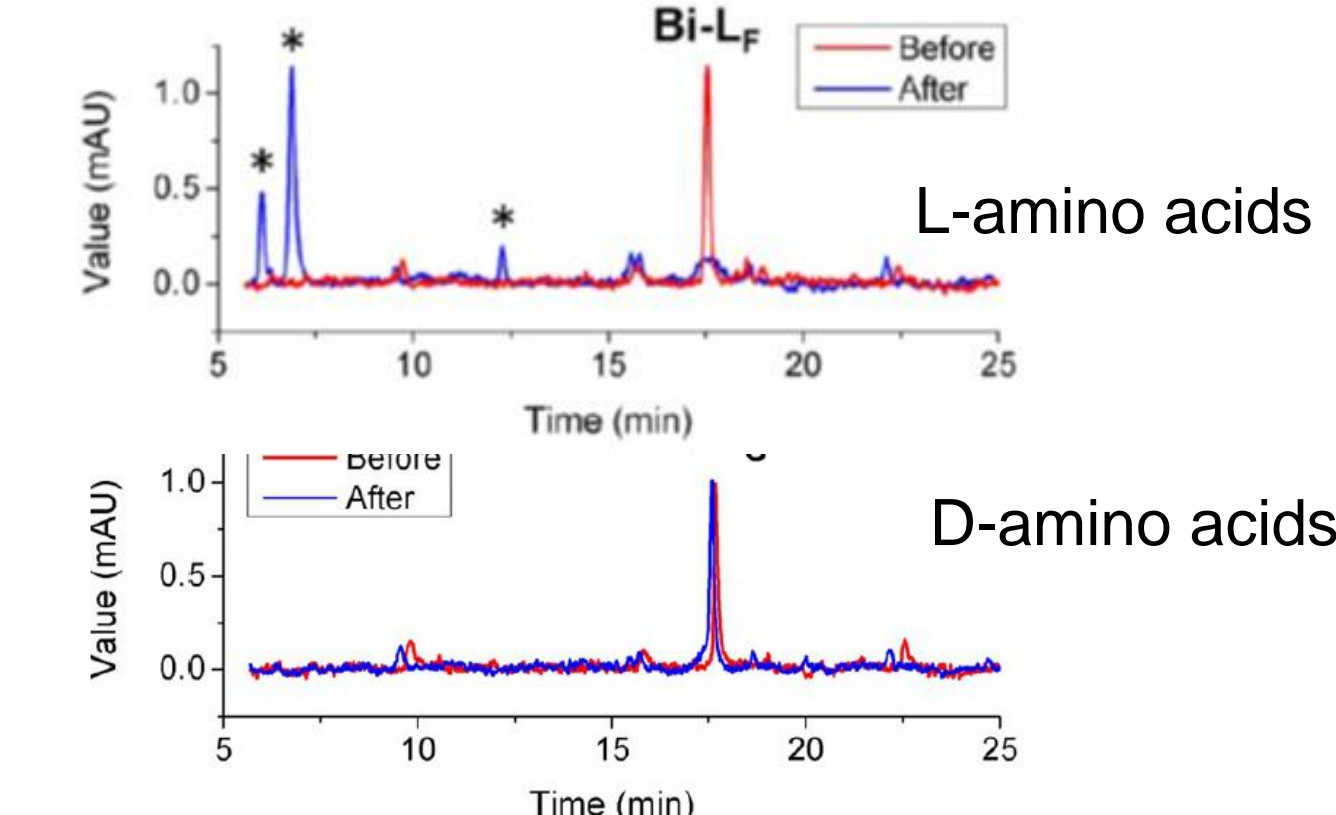
Thermal Stability



Luminex assay of the binding affinity of PCCs before and after heating at 90 °C for 1 h. Rb Anti-E2: antibody



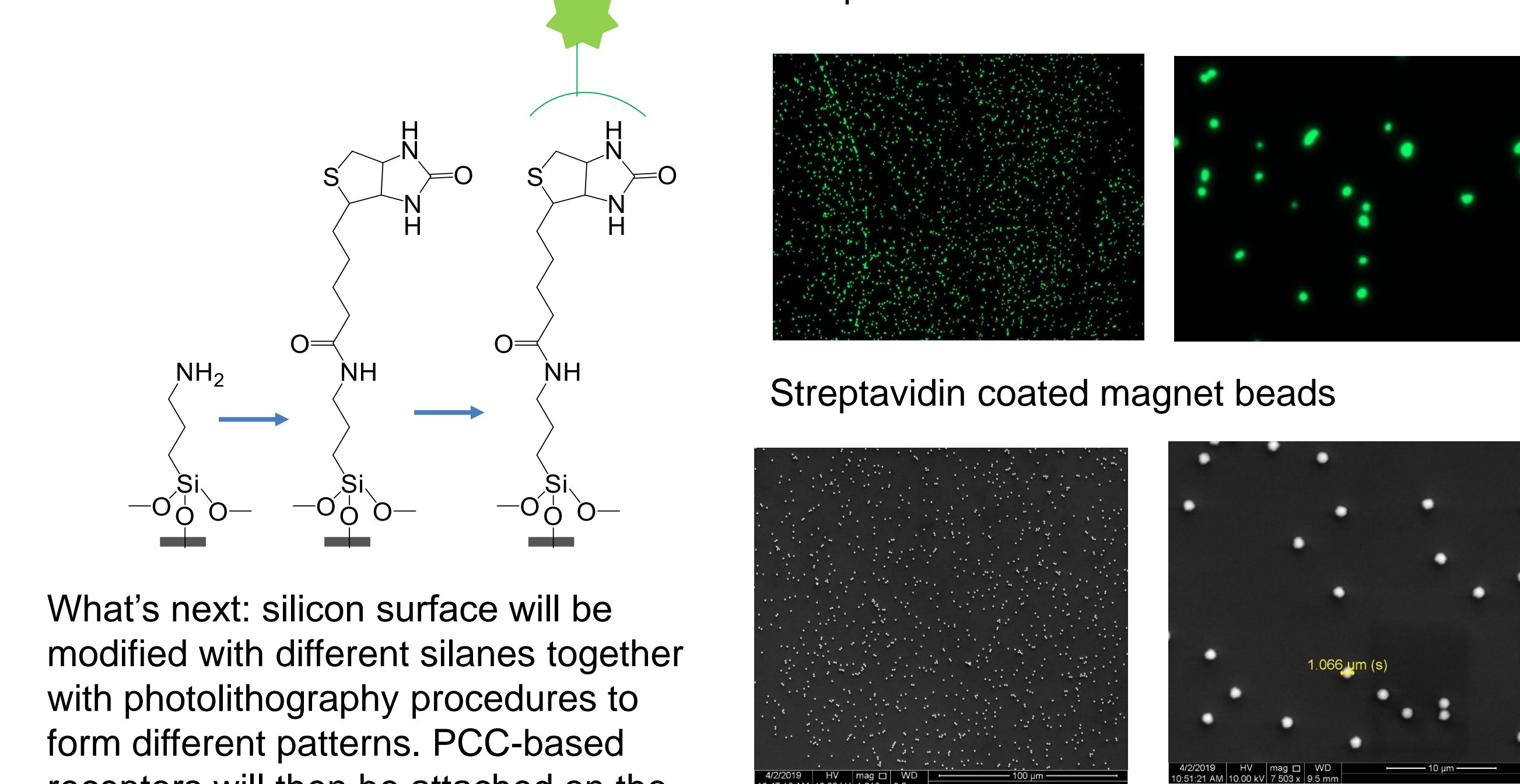
Biological Stability



HPLC data for Bi-L_F before and after treatment with trypsin for 1h at 37 °C * - Degradation products

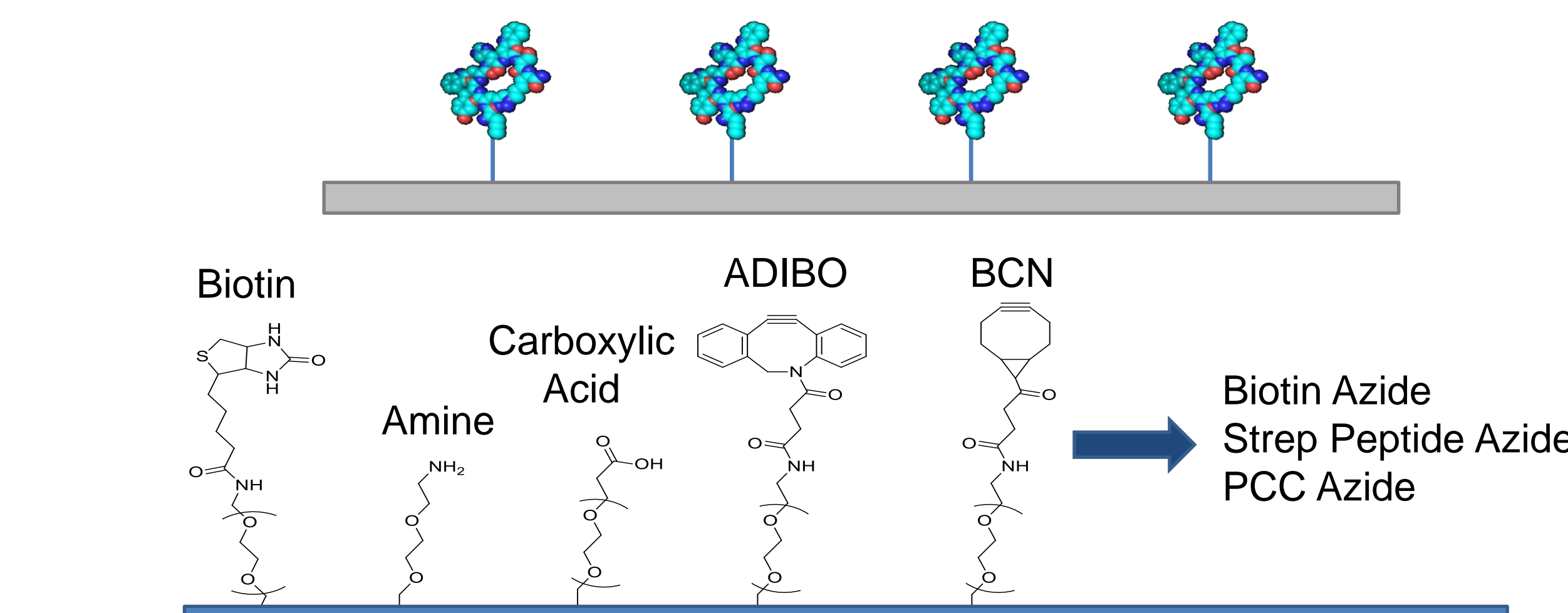
Cyclic PCCs showed much higher thermal and biological stability compared to antibodies

Surface Modification on Silicon Wafer



What's next: silicon surface will be modified with different silanes together with photolithography procedures to form different patterns. PCC-based receptors will then be attached on the Si-wafer surface.

Applications: PCCs will be integrated into silicon-based PIC (photonic integrated circuits) sensors to provide multiplex detection with true portability and high accuracy for DoD relevant applications.



Conclusions

- Peptide-based receptors fulfill the need for alternative antibodies by addressing critical gaps in adaptability, manufacturability, and stability.
- PCCs can be integrated into multiple platforms for real-time monitoring of biothreats and soldier health/performance
- Universal, wearable, disposable, and low cost

References

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