Optimer®-enabled small molecule detection and analysis

Optimer binders can be developed against a range of small molecule targets.

- ✓ **Medicines**
- ✓ **Vitamins**
- ✓ **Toxins**
- ✓ **Heavy metals**
- ✓ **Hormones**
- ✓ **Metabolites**
- ✓ **Pesticides**
- ✓ **Drugs of abuse**

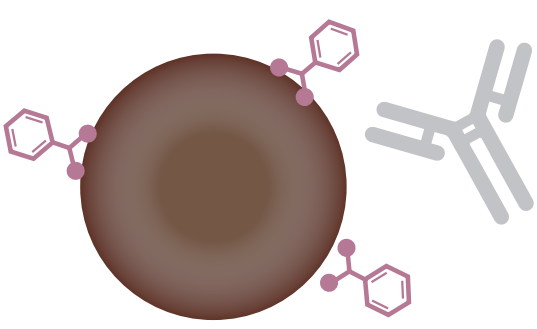
Optimer binders have proven success in supporting applications from drug and environmental monitoring to affinity chromatography.

Amplify your success in small molecule analysis with Optimer

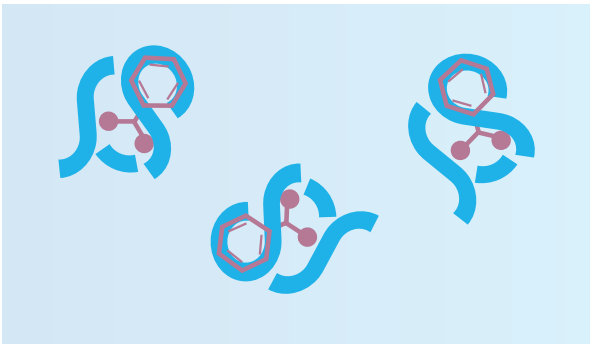
Developing affinity reagents against small molecule targets can be challenging using traditional approaches – standard development approaches using immobilised targets can change the target's chemical characteristics and sterically hinder interaction sites.

The Optimer platform incorporates a specific discovery process for small molecule targets that employs solution-based selection for:

- Increased availability of chemical groups
- Increased potential for discovery success



Immobilisation of small molecules for Optimer selection can reduce availability of functional groups or sterically hinder potential binding sites.



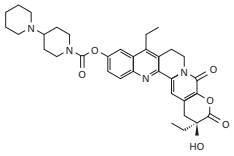
Solution-based selection, used as part of the Optimer development platform, increases the available functional groups for improved success in discovery.

Chemotherapeutic monitoring

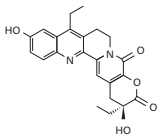
Irinotecan

Chemotherapy remain a major pillar of cancer treatment. Optimer binders were developed against specific chemotherapeutic agents to enable point-of-care therapeutic drug monitoring for a clinical cancer research centre partner.

(i) Irinotecan

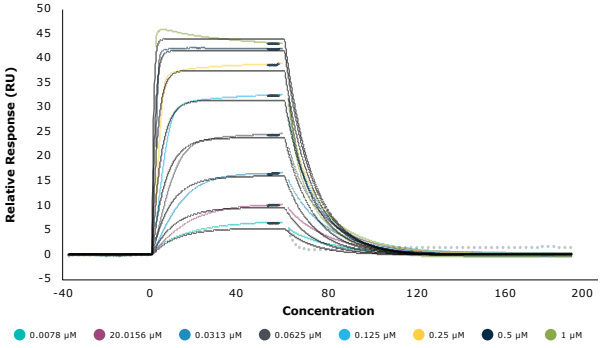


(ii) SN-38

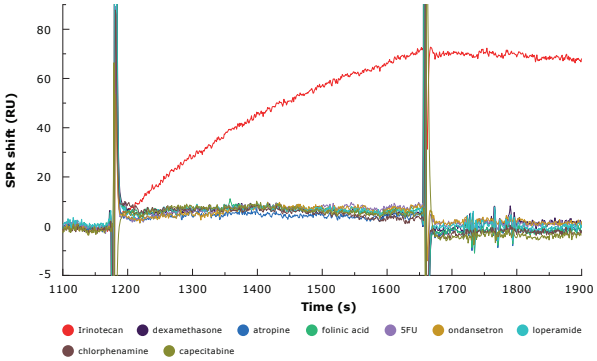


Optimer binders were developed with specificity to either (i) irinotecan, or (ii) the active metabolite SN-38, and (i & ii) binders that show cross-reactivity to both compound, for complete analysis of the drug.

Irinotecan-specific Optimer binders show dose-dependent binding and excellent target specificity by surface plasmon resonance (SPR) for accurate chemotherapeutic monitoring.



Irinotecan-specific Optimer binders show dose-dependent binding by SPR. Biotinylated Optimer binders were immobilised on streptavidin sensor chips and target solutions injected over the surface at the range of concentrations shown.



Irinotecan-specific Optimer binders show no cross-reactivity with common co-medications. Blank subtracted SPR response of irinotecan at 1 µg/mL and co-medication (all 10 µg/mL) spiked in human plasma.

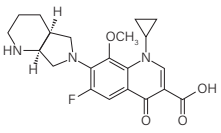
Puscasu et al. (2021) Anal Bioanal Chem 413, 1225–1236

Antibiotic measurement

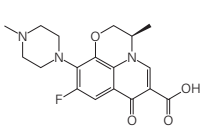
Moxifloxacin

The increasing use of antibiotics is associated with emergence of resistant bacterial strains. Optimer binders were developed against moxifloxacin for application across both therapeutic drug monitoring of patient doses and environmental monitoring of antibiotic residues.

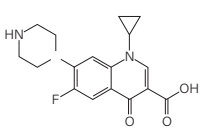
(i) Moxifloxacin



(ii) Levofloxacin

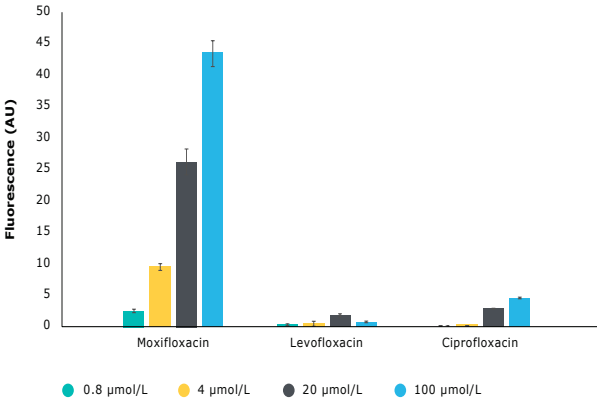


(iii) Ciprofloxacin

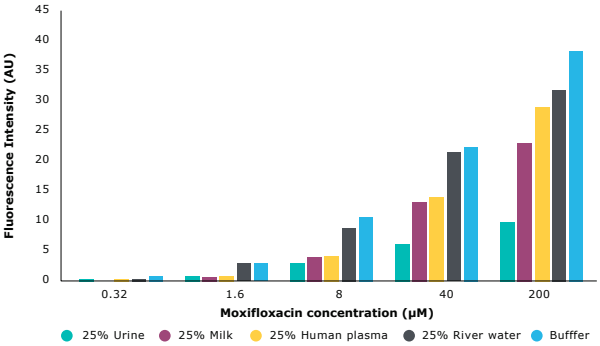


Optimer binders were developed that are specific for (i) moxifloxacin, and show minimal crossreactivity with (ii) levofloxacin or (iii) ciprofloxacin.

The moxifloxacin-specific Optimer binders show excellent specificity, with minimal cross-reactivity with homologous antibiotic targets, and demonstrate dose-dependent responses in a diverse range of matrices.



Moxifloxacin-specific Optimer binders show target-specific binding by ELISA-like assay. ELISA plates were coated with 50 pM fluoresceinlabelled Optimer, washed and incubated with the relevant antibiotic, prior to quantification of the fluorescent signal.



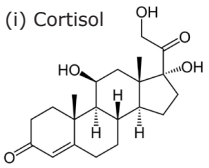
Moxifloxacin-specific Optimer binders exhibit dose-dependent responses by ELISA-like assay, across multiple clinical and environmental sample matrices.

Steroid hormone detection

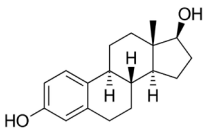
Cortisol

Cortisol is a stress biomarker found in sweat, saliva, blood, urine, and interstitial fluid. Current immunoassays exhibit cross-reactivity with endogenous steroids and show inter-assay variability. Optimer binders were developed to cortisol with the potential to improve diagnostic accuracy and sensitivity.

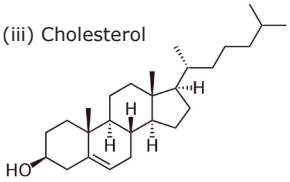
(i) Cortisol



(ii) Estradiol

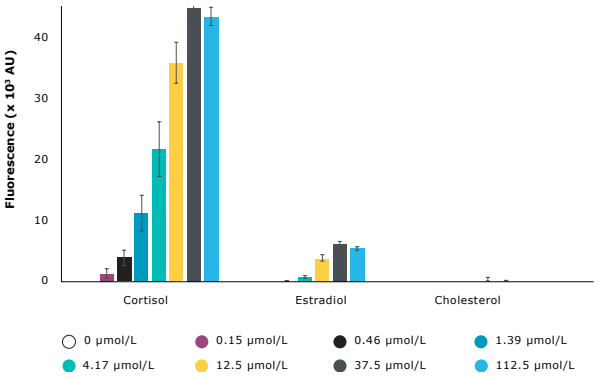


(iii) Cholesterol

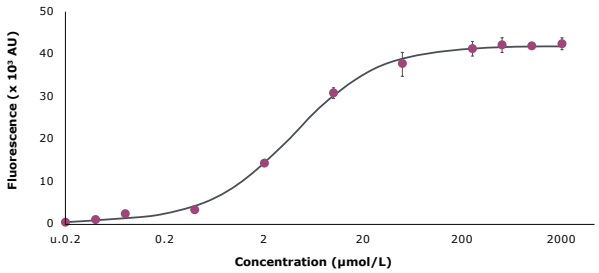


Specific Optimer binders were developed against the steroid hormone (i) cortisol, and showed minimal cross-reactivity with (ii) estradiol or the parent molecule, (iii) cholesterol.

The cortisol-specific Optimer binder shows excellent specificity to the hormone target, and minimal crossreactivity with estradiol and no interaction with the parent molecule cholesterol.The dynamic range of the Optimer-based ELISA-like assay covers the clinical concentration range of cortisol for reliable and sensitive analysis.



Cortisol-specific Optimer binders show dose-dependent binding, target selectivity, and minimal cross-reactivity with alternative steroid hormones, by ELISA-like assay.



Cortisol Quantifiable Range		
Buffer	LLOQ	40 ± 0.005 nmol/L
	ULOQ	2250 ± 54 nmol/L

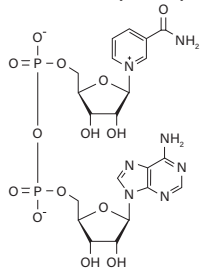
Optimer binders show sensitive detection of the cortisol hormone target over a clinically relevant concentration range by ELISA-like assay. (a) An example calibration curve demonstrates specific capture of the steroid hormone target over a clinically relevant concentration range, and (b) calibration curve performance parameters show a good quantifiable range for the cortisol Optimer.

Metabolite studies

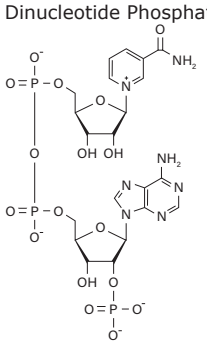
Nicotinamide adenine dinucleotide

Nicotinamide adenine dinucleotide (NAD) is a coenzyme that acts as a fundamental metabolite and cofactor throughas an electron carrier. Optimer binders were developed to the reduced form, NADH, that show no interaction with the highly homologous oxidised triphosphate form, NADP.

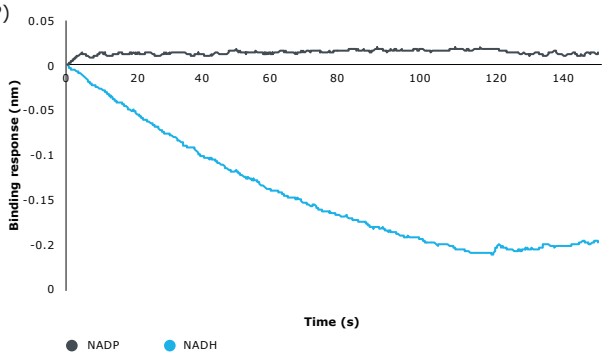
(i) Nicotinamide Adenine Dinucleotide (NADH)



(ii) Nicotinamide Adenine Dinucleotide Phosphate (NADP)



Specific Optimer binders were developed against the reduced metabolite, NADH (i), that show no binding to the oxidised phosphate form, NADP (ii).



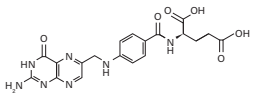
NADH-specific Optimer binders show specific binding to the metabolite target with no cross-reactivity to NADP by biolayer interferometry.

Vitamin Quantification

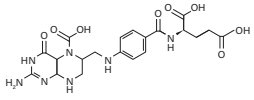
Natural folates

Adequate folate intake and metabolism are critical to biochemical processes that underlie functions such as cell proliferation, mitochondrial respiration, and epigenetic regulation. Supplementation and fortification of foods to support this process is often required. Optimer binders specific to the natural folates were developed to support analytical and affinity purification applications.

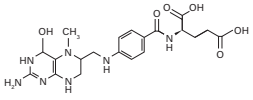
(i) Folic acid



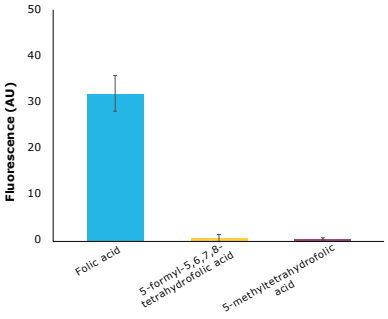
(ii) 5-formyl-5,6,7,8-tetrahydrofolic acid



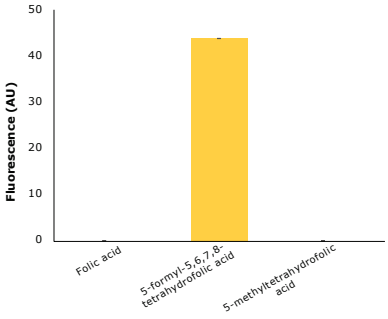
(i) 5-methyltetrahydrofolic acid



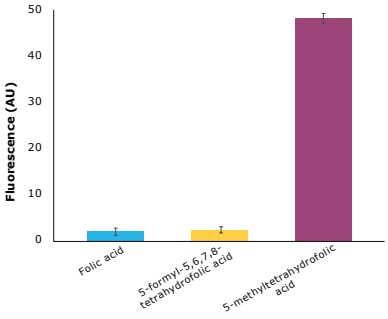
Specific Optimer binders were developed against each of the natural folates, (i) folic acid, (ii) 5-formyl-5,6,7,8-tetrahydrofolic acid and (iii) 5-methyltetrahydrofolic acid.



Folic acid-specific Optimer binders show target specific binding by ELISA-like assay, and minimal cross-reactivity with 5-formyl-5,6,7,8-tetrahydrofolic acid or 5-methyltetrahydrofolic acid.



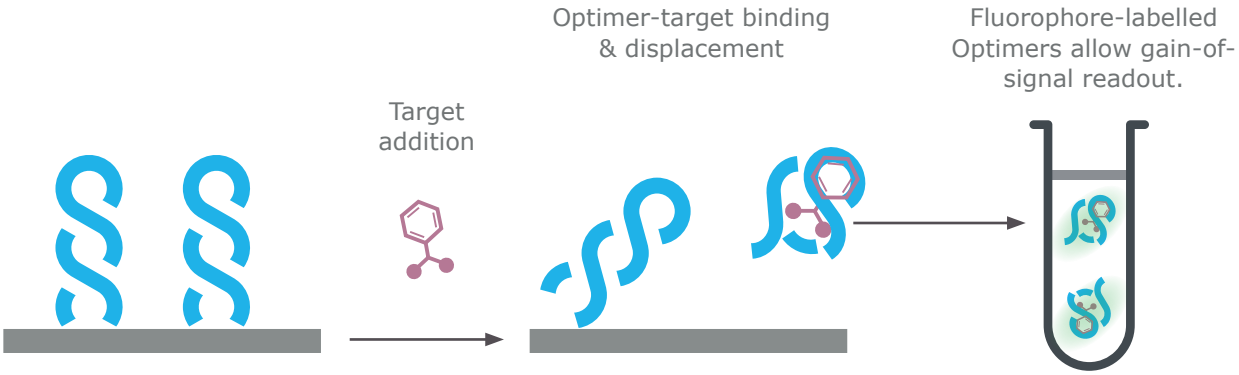
5-formyl-5,6,7,8-tetrahydrofolic acid-specific Optimer binders show target-specific binding by ELISA-like assay, and no cross-reactivity with folic acid or 5-methyltetrahydrofolic acid.



5-methyltetrahydrofolic acid-specific Optimer binders show target-specific binding by ELISA-like assay, and no cross-reactivity with folic acid or 5-formyl-5,6,7,8-tetrahydrofolic acid.

Single reagent Optimer assays for sensitive analysis of small molecule targets

Accurate and sensitive detection of small molecules can be challenging. Difficulties in developing matched pairs against small molecules can limit their application. Alternatively, commonly used competition assays, using one reagent, give loss-of-signal results, which suffer from reduced sensitivity.



Aptamer Group's small molecule displacement assay uses a gain-of-signal readout with a single Optimer reagent to:

- Overcome the need for sandwich pairs.
- Avoid sensitivity issues with loss-of-signal assays.
- Assay can be adapted to multiple platforms and applications.