



EPIGENEOUS BROMODOMAIN ASSAY: BRD4(1)

TECHNICAL NOTE

ABSTRACT Bromodomains (BRDs) are protein interaction modules that specifically recognize epsilon-N-lysine acetylation motifs, a key event in the reading process of epigenetic marks. Bromodomain BRD4(1) assay measures the interaction of BRD4(1) with [Lys(5,8,12,16)Ac] H4(1-21) peptide and allows interaction inhibitor study.

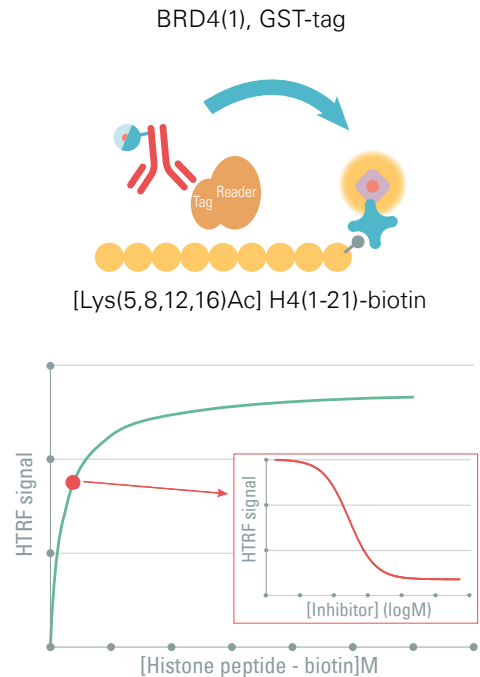
This HTRF assay uses a BRD4(1), GST-tag bromodomain protein, [Lys(5,8,12,16)Ac] H4(1-21) biotinylated peptide, and two HTRF detection reagents: donor cryptate labeled anti GST antibody and red acceptor conjugated streptavidin. HTRF signal is proportional to the amount of BRD4(1), GST-tag / [Lys(5,8,12,16)Ac] H4(1-21)-biotin peptide in interaction.

Bromodomain	BRD4(1), GST-tag [BRD4(49-170) ; HUNK1 ; MCAP]
Histone peptide	[Lys(5,8,12,16)Ac] H4(1-21)-biotin SGRG-K(Ac)-GG-K(Ac)-GLG-K(Ac)-GGA-K(Ac)-RHRKVGG-K(Biotin)
Detection reagents	EPIgeneous Binding Domain Kit A

BRD4(1) / HISTONE PEPTIDE INTERACTION ASSAY AND REAGENTS

REAGENT	PROVIDER	REFERENCE
EPIgeneous Binding Domain Kit A	Cisbio Bioassays	# 62BDAPEG
BRD4(1), GST-Tag	Cisbio Bioassays	# RD-11-157
[Lys(5,8,12,16)Ac] H4(1-21)-biotin	AnaSpec	# 64989
[Lys(5,8,12,16)Ac] H4(1-25)	AnaSpec	# AS-65421
(+)-JQ1	Tocris	# 4499

Data shown on this application note has been obtained using Greiner # 784075, 384-well white microplates. For more information on the white plates, please visit www.cisbio.com/htrf-microplate-recommendations



ASSAY PROTOCOL

- Dilute the anti GST-Donor Ab 50-fold with Binding Domain Detection Buffer #1 to obtain the working solution ready to be dispensed.
- The peptide-biotin / streptavidin-acceptor ratio must be equal to 8/1 final in the well (e.g. Peptide-biotin used at 4 nM final in the well, SA-Acceptor must be used at 0.5 nM final in the well). Prepare the SA-Acceptor solution in Binding Domain Detection Buffer #1 to get a 4X working solution depending on the final optimal concentration in the well.

Prepare working solutions of protein and biotin-peptide in assay buffer just prior to use.

- We recommend using the GST-tagged binding domain at 5nM final concentration in the well. Prepare the working solution at 5X depending on the final concentration in the well in Binding Domain diluent buffer (here 25 nM).
- Prepare the peptide-biotin at optimal concentration (referenced in table Optimal experimental conditions) in Binding Domain Diluent Buffer to get a 5X working solution depending on the final optimal concentration in the well.
- Prepare supplemented Binding Domain Diluent Buffer with DMSO to get a constant percentage throughout the inhibitor titration. Dilute the compound in this solution to get a 10X working solution depending on final concentration in the well.

DMSO may act as an inhibitor of GST-binding domain and the biotinylated peptide interaction. This can lead to a decrease of the assay window as DMSO % increases. We recommend the use of compatible DMSO % (See table "Optimal experimental conditions" for DMSO tolerance associated with BRD4(1)).

- Add to a 384-well small volume plate in the following order:
 - 4 µL of BRD4(1), GST-tag (5X)
 - 2 µL of assay buffer (w/ or w/o DMSO)
 - 4 µL of [Lys(5,8,12,16)Ac] H4(1-21)-biotin (5X)
 - 5 µL of SA-Acceptor (4X)
 - 5 µL of anti GST-Donor Ab (4X)
- Cover the plate with a plate sealer and incubate 3h at room temperature.
- *Remark: Signal remains stable after Over Night incubation.*
- Remove plate sealer and read fluorescence emission at 665nm and 620nm wavelengths on an HTRF compatible reader *.

	PEPTIDE TITRATION		TEST OF INHIBITORS		
	POSITIVE SIGNAL	NEGATIVE CONTROL	INHIBITOR	POSITIVE CONTROL	NEGATIVE CONTROL
BRD4(1), GST-TAG	4 µL	-	4 µL	4 µL	-
INHIBITOR	-	-	2 µL	-	-
BINDING DOMAIN DILUENT BUFFER	2 µL	6 µL	-	2 µL	6 µL
BIOTIN-PEPTIDE	4 µL	4 µL	2 µL	4 µL	4 µL
STREPTAVIDIN-ACCEPTOR	5 µL	5 µL	5 µL	5 µL	5 µL
ANTI GST-DONOR AB	5 µL	5 µL	5 µL	5 µL	5 µL

* For more information on HTRF compatible reader, please visit www.cisbio.com/htrf-compatible-readers.

OPTIMAL EXPERIMENTAL CONDITIONS

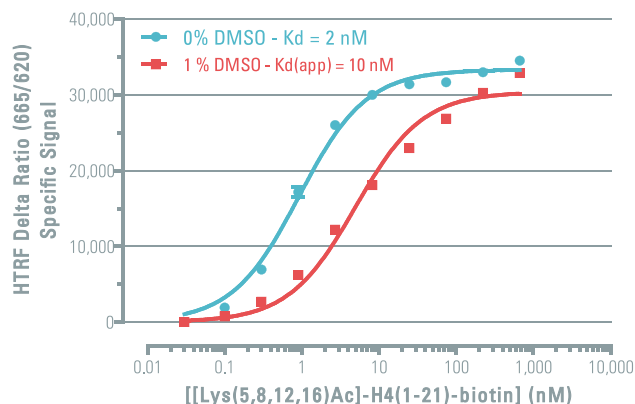
BINDING DOMAIN	RECOMMENDED PEPTIDE CONCENTRATION (FINAL IN THE WELL)	DMSO TOLERANCE
BRD4(1)	0% DMSO: 2 nM - 0.1-1% DMSO: 3 nM	0 - 2%

DATA REDUCTION

- The TR-FRET signal is treated as HTRF Ratio = Acceptor signal (665nm) / Donor Signal (620nm) x 10⁴
- HTRF Delta Ratio = Ratio (Positive) – Ratio (Negative) where Negative control is performed without reader-protein.
- Assay window = S/B = Ratio (Positive) / Ratio (Negative)

RESULTS

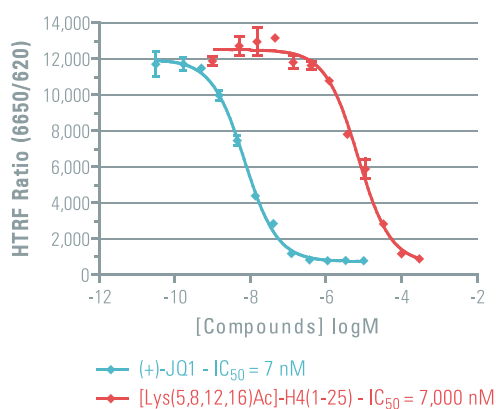
1. PEPTIDE-BIOTIN TITRATION



Measurement of BRD4(1) / histone H4 peptide interaction and DMSO effect

The GST-BRD4(1) concentration was fixed at 5 nM while the peptide-biotin was serially diluted. The HTRF Delta Ratio is proportional to the specific interaction measured between GST-BRD4(1) and [Lys(5,8,12,16)Ac]-H4(1-21)-biotin peptide. The 2nM K_d value is determined from this experiment using a one-site specific binding regression. A shift of apparent K_d is observed while DMSO% increases. This is due to the competitive inhibitor nature of the DMSO on the BRD4(1)/H4 peptide interaction (already described: Philpott et al. Mol. BioSyst., 2011).

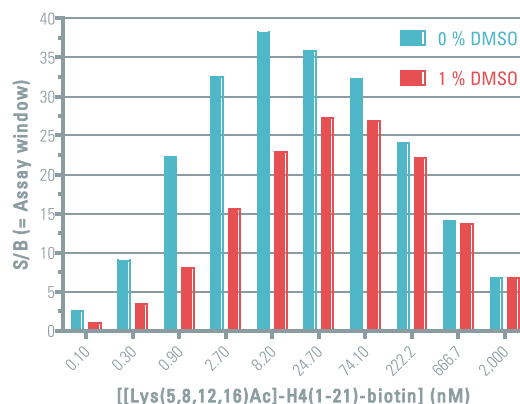
3. INHIBITOR TITRATION



BRD4(1) HTRF inhibition assay was validated using reference inhibitors

The HTRF assay was performed using 3 nM peptide-biotin, 5 nM GST-BRD4(1) and 1% DMSO set constant throughout the inhibitor titration. The IC_{50} of (+)-JQ1 and H4 tetra-acetylated peptide are in good agreement with published data (Philpott et al. Mol. BioSyst., 2011 / Filippakopoulos and Knapp, FEBS Letters) and with the ITC reference experiment (K_d (+)-JQ1 = 27nM, data not shown).

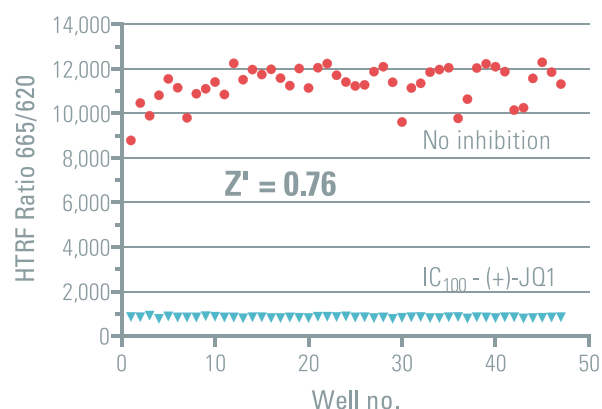
2. DMSO EFFECT ON ASSAY WINDOW



Selection of optimal peptide-biotin concentration depending on DMSO % used

Due to the competitive nature of DMSO, the assay window decreases as the DMSO percentage increases. The assay window can then be recovered by increasing the peptide-biotin concentration. The optimal peptide-biotin concentration is selected (between real K_d and EC100 obtained on the titration without DMSO) with a compromise between assay window and assay sensitivity for inhibitor studies. Note that the higher the peptide-biotin concentration, the higher the inhibitor IC_{50} . For further study of inhibitors, 1% DMSO and 3nM peptide-biotin conditions were selected.

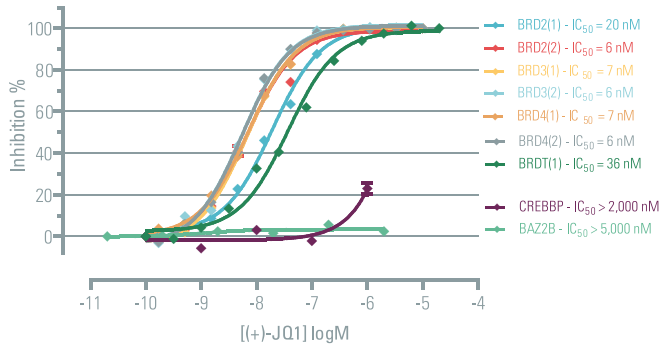
4. Z' FACTOR



Assay robustness demonstrated through Z' factor determination

The assay was performed using 3 nM peptide-biotin, 5 nM GST-BRD4(1) and 1% DMSO. The 0.76 Z' factor underlines the robustness of the assay and its suitability for HTS.

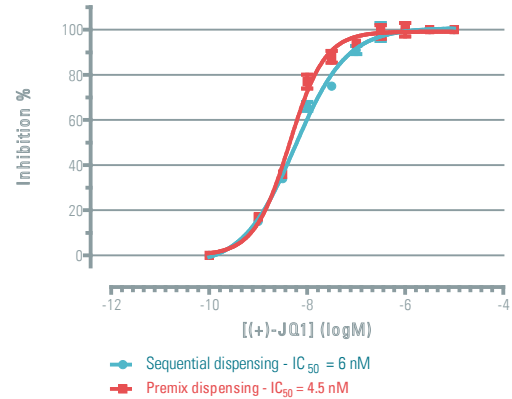
5. COMPOUND PROFILING



Compound selectivity can be assessed over a broad range of validated reader domain assays.

(+)-JQ1 compound was profiled on the BET bromodomain family, CREBBP and BAZ2B bromodomains. As already described (Filippakopoulos et al. Nature 2010), (+)-JQ1 is a non selective inhibitor over the BET family but displays selectivity over non BET bromodomains (CREBBP and BAZ2B).

6. PREMIX OF REAGENTS



Reagents can be premixed to make dispensing protocol easier.

The classical sequential dispensing protocol was compared to premix dispensing. The premix dispensing protocol was the sequential dispensing of 2 µl of inhibitor ; 8 µl of GST-BRD4(1) / Peptide-biotin premix ; 10 µl of anti GST-donor Ab / SA-acceptor premix. The assay was performed using 3 nM peptide-biotin, 5 nM GST-BRD4(1) and 1% DMSO set constant all through the inhibitor titration. The two dispensing protocols display the same IC50 for (+)-JQ1.

For more information, please visit us at www.cisbio.com/epigenetic-binding-domain

RELATED INFORMATION

Enabling epigenetics studies from HTS to SAR: a novel HTRF® platform to identify and characterize reader domain inhibitors

Roux T, Badol M, Douayry N, Sergeant L, Trinquet E, Degorce F, Milhas S, Betzi S, Derviaux C, Eydoux C, Letienne J, Lugari A, Collette Y, Guillemot J-C, Morelli X. - Cisbio Bioassays Codolet, France | CRCM, CNRS UMR7258, INSERM U1068, AMU UM105, Institut Paoli-Calmettes, Marseille, France | AFMB, UMR7257, Univ. Aix Marseille-CNRS, Marseille, France

How do HTRF® epigenetic binding domain assays perform compared to other technologies?

Thomas Roux, Najim Douayry, Laurent Sergeant, François Degorce and Eric Trinquet.
Cisbio Bioassays Codolet, France

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