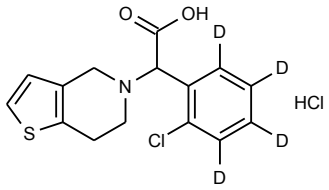
BDG SYNTHESIS

Certificate of Analysis

BDG Synthesis certifies that this reference material meets or exceeds the specifications stated herein.

Neil Beare, PhD, Director
28 October 2016

Name:	**Clopidogrel Acid-d_4 HCl**
CAS Number:	144750-42-5 (unlabelled)
Structure:	
Molecular Weight:	$C_{15}H_{10}D_4ClNO_2S \cdot HCl = 348.28$
Lot Number:	BDG 7838.1
Appearance:	White, crystalline solid
Corrected Purity:	99.5 % (HPLC) - 1.1 % (acetone) = 98.4 %
Isotopic Purity:	Under 0.5 % d_0
Re-test Date:	28 October 2021

Storage and Handling:

Temperature:	refrigerate for prolonged storage; may be handled and shipped at ambient temperature.
Humidity:	not believed to be hygroscopic; may be handled in normal laboratory atmosphere.
Light:	protect from strong sunlight.
Caution:	only experienced laboratory personnel should handle the material.

Identity and Purity

Proton NMR Spectrum

Identity: the signals are consistent with the proposed structure and in accord with literature where available.
Isotopic Labelling: signals at the sites of deuteration are greatly diminished, compared with the spectrum of unlabelled material, indicating clean deuteration.
Residual Solvents: a small amount of acetone (1.1 % *w/w*) and a trace (under 0.1 % *w/w*) of ethyl acetate are observed.
Impurities: traces of unidentified impurities are seen in the baseline.

Carbon-13 NMR Spectrum

Identity: the signals are consistent with the proposed structure and in accord with literature where available.
Isotopic Labelling: signals at the sites of deuteration have collapsed to small multiplets compared with the spectrum of unlabelled material, indicating clean deuteration.

High-resolution Mass Spectrum (ESI+)

Found *m/z* 312.0763. $C_{15}H_{11}D_4{}^{35}ClNO_2S$ $[M+H]^+$ requires *m/z* 312.0760. The deviation of 0.0 ppm is within normally accepted limits for the establishment of identity by HRMS. Small M-1 and M-2 peaks are observed, but any M-4 peak is at approximately the background level of 0.5%.

HPLC

A sharp, symmetrical peak is observed (99.5 %). Note: in the absence of reference materials for preparing calibration curves, it is assumed that all peaks have the same detector response. Where possible, the conditions of analysis follow a pharmacopeial or literature method, or have been adapted from same.

Elemental Analysis

	Found:	C 51.82, H 3.45, D 2.51, N 3.91 %
$C_{15}H_{10}D_4ClNO_2S{\cdot}HCl$	Requires:	C 51.73, H 3.18, D 2.31, N 4.02 %

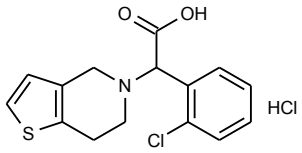
The elemental analyses fall within generally accepted limits for establishing the molecular formula given. The results may also be taken to imply the absence of significant quantities of water or inorganic salts (which have not been elsewhere tested for because of sample size limitations).

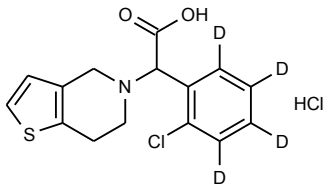
The available quantity of custom-synthesised material is always small, and this limits the extent and type of analytical data which can be obtained. This Certificate is presented in descriptive format for use by analytical chemists who are trained in the use of custom-synthesised materials. Custom materials often contain higher levels of residual solvents and/or water, and we urge you to use the corrected purity where needed rather than the raw HPLC purity. This compound is intended for use as an analytical reference material and it is not for human administration. Structures are shown with relative stereochemistry unless otherwise specified.

The re-test date is assigned from experience gained with the material in the laboratory and/or on storage. It is not possible to perform formal storage studies because of the small amount of material available.

BDG SYNTHESIS

Proton NMR Spectrum of Clopidogrel Acid HCl (top) and Clopidogrel Acid-d_4 HCl (bottom) in DMSO-d_6

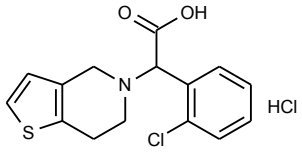




Lot Number: BDG 7838.1

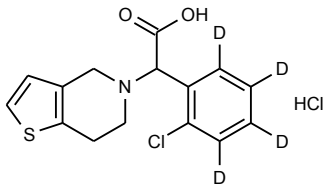
BDG SYNTHESIS

Carbon-13 NMR Spectrum of Clopidogrel Acid HCl (top) and Clopidogrel Acid-d_4 HCl (bottom) in DMSO-d_6



4xC+6xCH

NMR Solvent



2xCH

Lot Number: BDG 7838.1

4xC+ 4xCD

NCH

2xNCH$_2$

CH$_2$

CO$_2$H

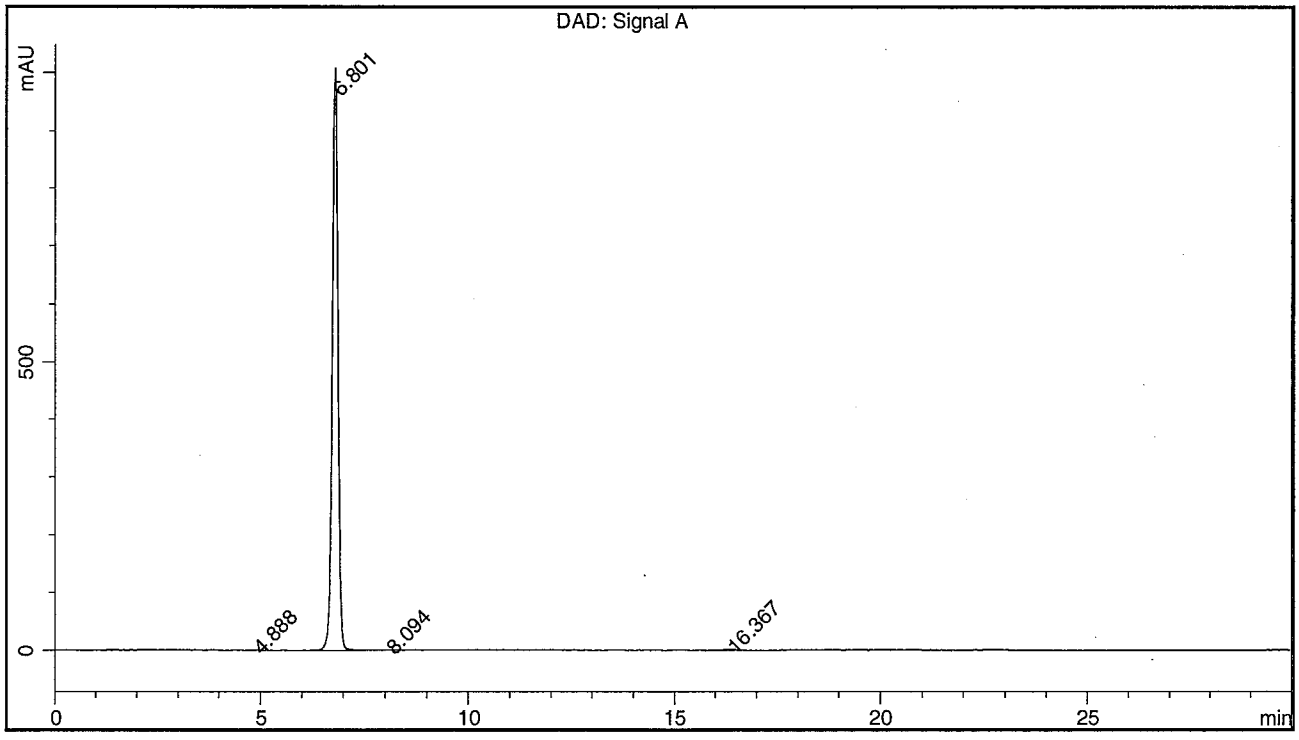
Acetone

200 175 150 125 100 75 50 25

BDG - Analysis of Clopidogrel acid-d4 HCl

Column : Phenomenex Luna C18(2) 5um 250 x 4.6 mm
Guard : Phenomenex Security Guard C18 RP 4 x 3 mm
Mobile Phase : 75:25 50 mM Potassium diHydrogen Phosphate pH=3.0 : Acetonitrile
Flow Rate : 1.0 mL/min
Sample Solvent : Mobile Phase
Column Temperature : 20 C
Injection Volume : 10 uL
Detection : UV at 240 nm

Sample Name	BDG 7838.1	Instrument	AnalyticalLC01
Acquisition	28/10/2016, 20:24:52	Method (rev.)	LC10185b (3)
Sequence	BDG_28Oct2016d	Vial Position	12
Operator	solvation010\cerityadmin	Injection	1 of 1



Area Percent Report

Peak#	RT	Peak Height	Peak Area	Width	Area %
1	4.89 min	0.5835	4.8160	0.1283 min	0.050 %
2	6.80 min	1009.7789	9548.6233	0.1443 min	99.468 %
3	8.09 min	0.2197	3.1454	0.1730 min	0.033 %
4	16.37 min	2.2263	43.1556	0.2642 min	0.450 %