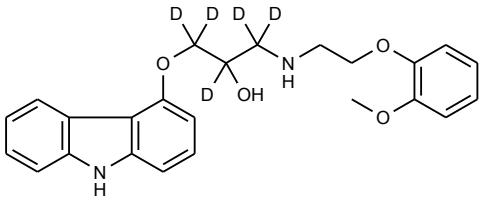
BDG SYNTHESIS

Certificate of Analysis

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

Barry Dent

Barry R. Dent, PhD, Director
15 July 2008

Name:	**Carvedilol-d_5**
CAS Number:	72956-09-3 (unlabelled)
Structure:	
Molecular Weight:	$C_{24}H_{21}D_5N_2O_4$ = 411.51
Lot Number:	BDG 4456.3
Appearance:	White, crystalline powder
Purity By HPLC:	98.7 %
Isotopic Purity:	Under 0.5 % d_0
Re-test Date:	15 July 2013

Storage and Handling:

Temperature:	ambient laboratory temperature; may be refrigerated.
Humidity:	not believed to be hygroscopic; may be handled in normal laboratory atmosphere.
Light:	store in an amber vial and protect from bright light.
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 absent, compared with the spectrum of unlabelled material, indicating clean deuteration.
Residual Solvents: a trace (under 0.1 % *w/w*) of ethyl acetate is observed.
Impurities: no significant impurities are evident in the spectrum.

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 (FAB+)

Found *m/z* 412.2290. $C_{24}H_{22}D_5N_2O_4$ $[M+H]^+$ requires *m/z* 412.2285. The deviation of 1.3 ppm is within normally accepted limits for the establishment of identity by HRMS. No signal for d_0 material was seen (detection limit about 0.5 %).

HPLC

A sharp, symmetrical peak is observed (98.7 %). 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 69.86, H 5.10, D 2.43, N 6.85 %
$C_{24}H_{21}D_5N_2O_4$	Requires:	C 70.05, H 5.14, D 2.45, N 6.81 %

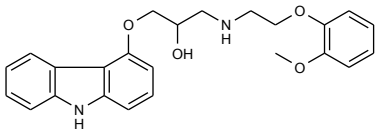
The elemental analyses fall within generally accepted limits for establishing the molecular formula given. The results may also be taken to imply the absence of significant quantities of water or inorganic salts (which have not been elsewhere tested for because of sample size limitations).

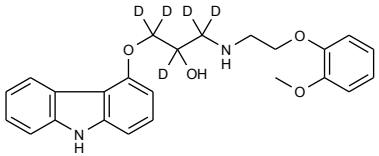
The available quantity of custom-synthesised material is always small, and this limits the extent and type of analytical data which can be obtained. This Certificate is presented in descriptive format for use by analytical chemists who are trained in the use of custom-synthesised materials. Custom materials 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 Carvedilol (top) and Carvedilol-d_5 (bottom) in DMSO-d_6

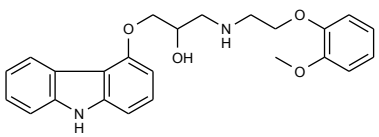


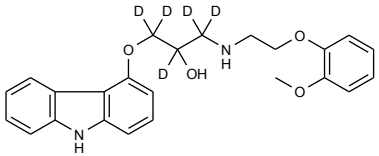


Lot Number: BDG 4456.3

BDG SYNTHESIS

Carbon-13 NMR Spectrum of Carvedilol (top) and Carvedilol-d_5 (bottom) in DMSO-d_6





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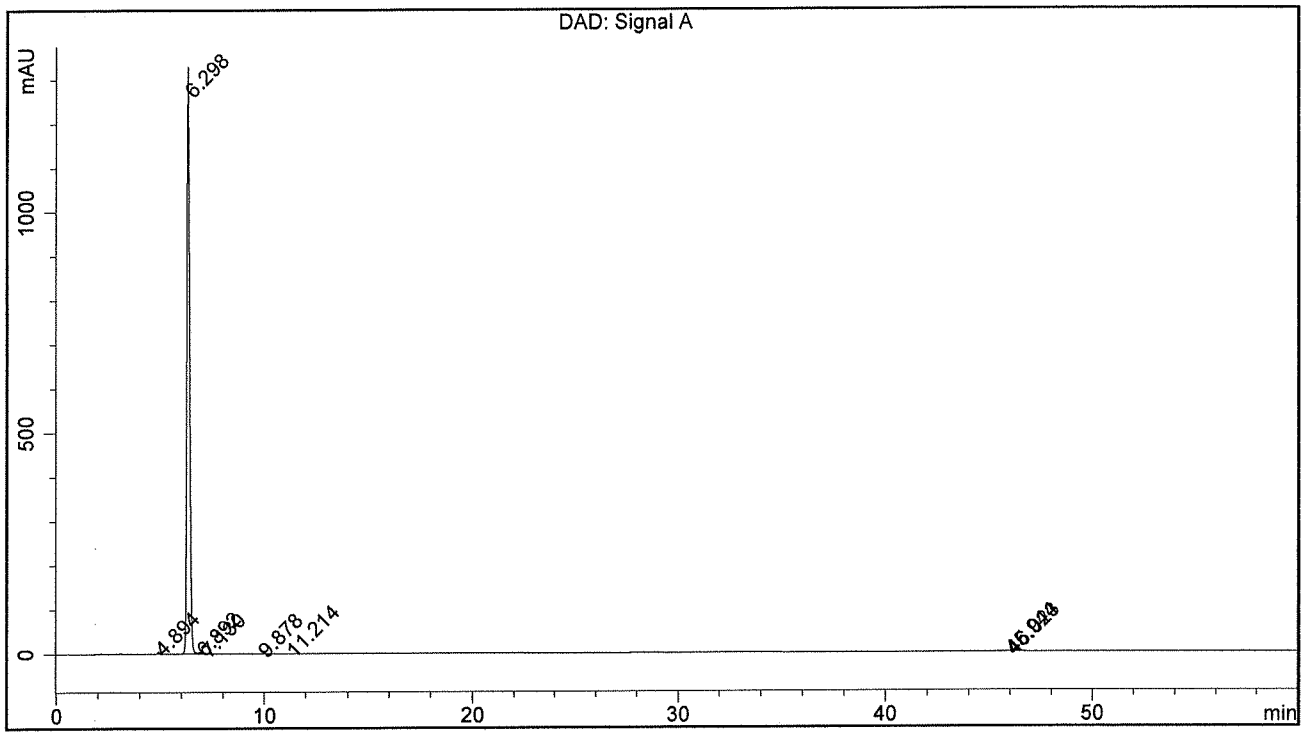
BDG - Analysis of Carvedilol-d5

Column : Phenomenex Luna C18(2) 5um 250 x 4.6 mm
Guard : Phenomenex Security Guard C18 RP 4 x 3 mm
Mobile Phase : 65:35 20mM KH2PO4 pH=2.0 (H3PO4) : Acetonitrile
Flow Rate : 1.0 mL/min
Sample Solvent : Mobile Phase
Column Temperature : 55C
Injection Volume : 10 uL
Detection : UV at 240 nm

Sample Name	BDG 4456.3	**Instrument**	AnalyticalLC01
Acquisition	15/07/2008, 15:14:16	**Method (rev.)**	LC10274a (2)
Sequence	BDG_15Jul2008a	**Vial Position**	2
Operator	solvation010\cerityadmin	**Injection**	1 of 1



Area Percent Report

Peak#	RT	Peak Height	Peak Area	Width	Area %
1	4.89 min	4.4198	28.0582	0.0981 min	0.227 %
2	6.30 min	1329.7545	12214.1345	0.1392 min	98.736 %
3	6.89 min	3.9509	55.9875	0.1933 min	0.453 %
4	7.13 min	1.5162	31.6804	0.2778 min	0.256 %
5	9.88 min	0.2075	2.4472	0.1556 min	0.020 %
6	11.21 min	0.4905	16.5777	0.4043 min	0.134 %
7	45.94 min	0.3650	10.6738	0.3472 min	0.086 %
8	46.02 min	0.3664	10.9181	0.3617 min	0.088 %