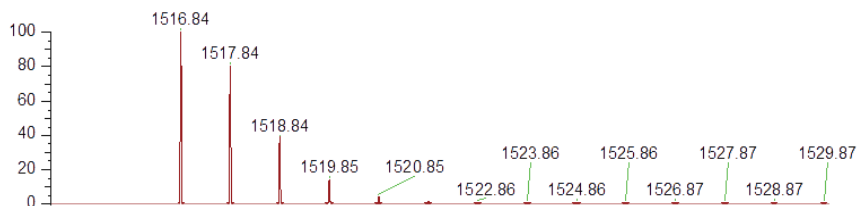


New Deuterium-labeled Glycosphingolipids

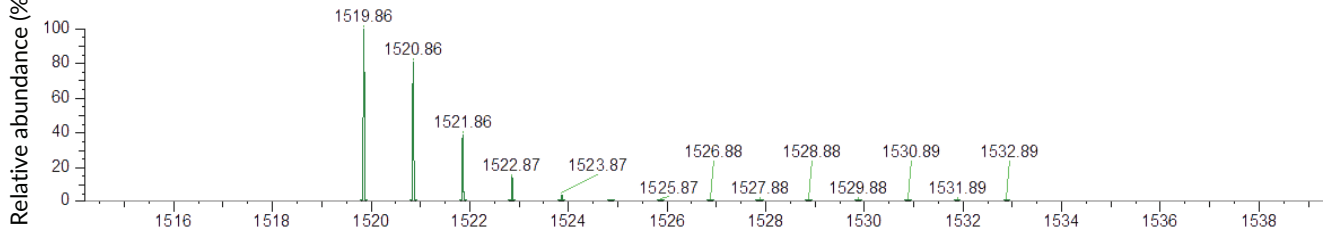
High-purity deuterated glycosphingolipids are ideal for the identification and quantification of gangliosides in samples and biological systems using mass spectrometry techniques. While a variety of D₃-labeled glycosphingolipids have long been available in our catalog, we have synthesized a new set of D₉-labeled gangliosides and a globotriaosylceramide that enable improved separation of the labeled *m/z* from the naturally occurring material and its abundant isotopes. With a better means for separation, this improves the quantitation of these compounds in biological samples by LC-MS/MS methods.

For example, consider the natural isotopic abundance of GM₁ in the top of the figure below compared to the D₃-labeled (middle spectrum) and D₉-labeled (bottom spectrum) versions.

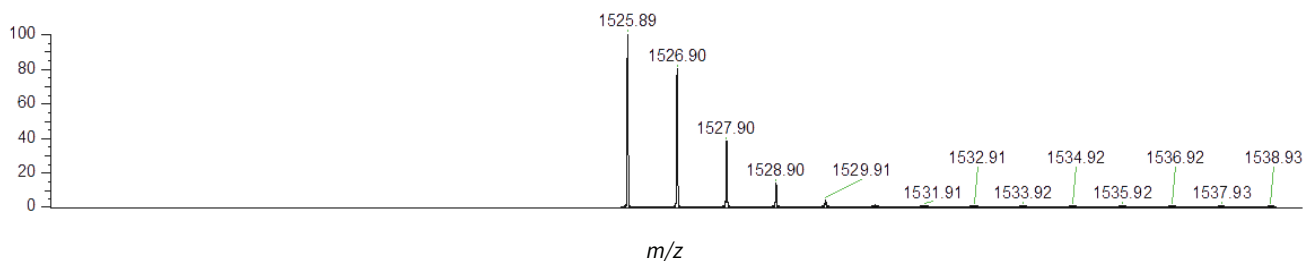
N-Hexadecanoyl monosialoganglioside GM₁



N-*omega*-CD₃-Hexadecanoyl monosialoganglioside GM₁



N-Hexadecanoyl-D₉ (13,13,14,14,15,15,16,16,16)-monosialoganglioside GM₁



INSIDE THIS ISSUE

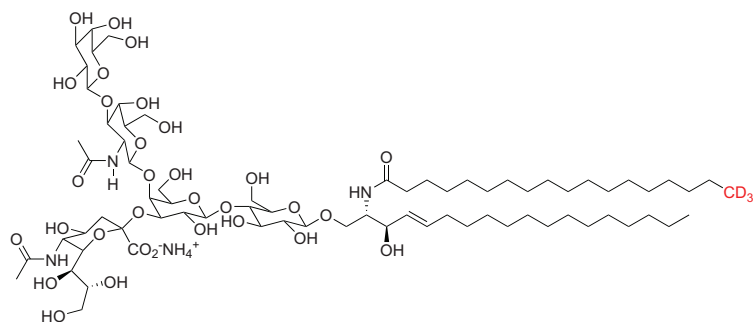
PAGES 1-2 Deuterium-labeled Glycosphingolipids

PAGE 3 MS Quantification of GM₃ Deficiency

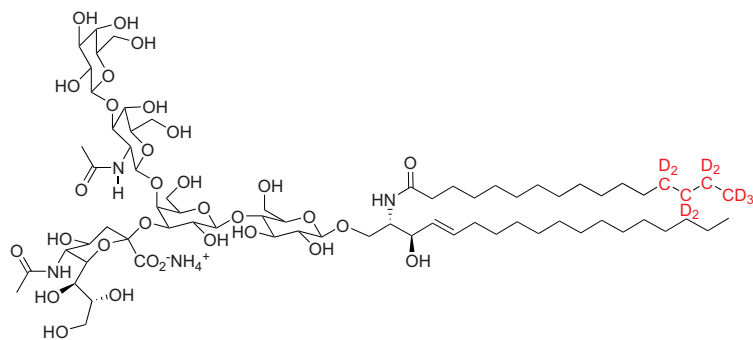
PAGES 4-5 Expansion of Our Ganglioside Line

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Because this compound has a large molecular weight with multiple carbon atoms, the ^{13}C abundance is quite high—up to the M+5 isotope. Indeed, the M+3 isotope (1519.85 m/z) is very significant at 14.4%. This is the portion of natural GM_1 that contains three ^{13}C atoms, and it has approximately the same mass as $\text{GM}_1\text{-D}_3$, which is 1519.86 m/z . This natural M+3 isotope can contribute to variability in the isotopically labeled internal standard response as GM_1 levels vary from sample to sample and can negatively impact quantification of GM_1 . A standard labeled with nine deuterium atoms overcomes this problem because the natural abundance of GM_1 with nine ^{13}C atoms is effectively zero. That is, the natural isotopes will not interfere with the $\text{GM}_1\text{-D}_9$ signal.



N- ω - CD_3 -Octadecanoyl monosialoganglioside GM_1 (NH_4^+ salt)
Catalog No. 2050



N-Hexadecanoyl- D_9 (13,13,14,14,15,15,16,16,16)-monosialoganglioside GM_1 (NH_4^+ salt)
Catalog No. 2057

Available D_9 -Labeled Glycosphingolipids

Catalog No.	Product Name	Formula Weight	Purity
2057	N-Hexadecanoyl- D_9 (13,13,14,14,15,15,16,16,16)-monosialoganglioside GM_1 (NH_4^+ salt)	1528 + NH_3	98+%
2058	N-Hexadecanoyl- D_9 (13,13,14,14,15,15,16,16,16)-monosialoganglioside GM_2 (NH_4^+ salt)	1366 + NH_3	98+%
2059	N-Hexadecanoyl- D_9 (13,13,14,14,15,15,16,16,16)-monosialoganglioside GM_3 (NH_4^+ salt)	1163 + NH_3	98+%
1551	N-Hexadecanoyl- D_9 (13,13,14,14,15,15,16,16,16)-ceramide trihexoside	1033	98+%

Available D_3 -Labeled Glycosphingolipids

Catalog No.	Product Name	Formula Weight	Purity
2050	N- ω - CD_3 -Octadecanoyl monosialoganglioside GM_1 (NH_4^+ salt)	1550 + NH_3	98+%
2051	N- ω - CD_3 -Octadecanoyl monosialoganglioside GM_2 (NH_4^+ salt)	1388 + NH_3	98+%
2052	N- ω - CD_3 -Octadecanoyl monosialoganglioside GM_3 (NH_4^+ salt)	1185 + NH_3	98+%
2054	N- ω - CD_3 -Octadecanoyl disialoganglioside GD_3 (NH_4^+ salt)	1476 + 2 NH_3	98+%
1537	N- ω - CD_3 -Octadecanoyl-ceramide trihexoside	1055	98+%

If you cannot find a particular deuterated ganglioside in our catalog, please contact us for a custom synthesis estimate at rdcustomsynthesis@matreya.com

MS Quantification of GM₃ Deficiency

The enzyme ST3GAL5 controls the sialylation of lactosylceramide to produce GM₃, the important precursor for downstream a- and b-series glycosphingolipids (GSLs), including all major, complex gangliosides in neural tissue. Damaging mutations of *ST3GAL5* have been linked to systemic ganglioside deficiency in old order Amish, African-American, French, and Korean populations. In humans, glycosphingolipid deficiency contributes to neonatal hearing loss, stagnant brain growth, epileptic encephalopathy, and cortical visual impairment.¹⁻⁵

A research team consisting of Aoki, Heaps, Strauss, and Tiemeyer developed an elegant technique for mass spectrometric quantification of plasma GSL in human GM₃ ganglioside deficiency from Amish community members with biallelic mutations of *ST3GAL5* (c.694C > T) as well as heterozygous siblings and wild-type controls.⁶ With this method, they identified in *ST3GAL5* (c.694C > T) homozygotes a complete absence of GM₃ and GD₃ and marked accumulation of lactosylceramide with a limited shift in ceramide composition toward higher mass species with longer chain length and alternative saturation. Such structural changes likely alter membrane fluidity and lipid-protein interactions.

We at Matreya produce quality GM₃ that can be used for this quantitation and have a complete line of gangliosides and several mass spectrometry standards for disease biomarkers.

Related Products

Catalog No.	Product Name	Size	Purity
1503	Monosialoganglioside GM ₃ (NH ₄ ⁺ salt)	1 mg	98+%
1504	Disialoganglioside GD ₃ (NH ₄ ⁺ salt)	5 mg	98+%
1504-25	Disialoganglioside GD ₃ (NH ₄ ⁺ salt)	25 mg	98+%
2052	N- <i>omega</i> -CD ₃ -Octadecanoyl monosialoganglioside GM ₃ (NH ₄ ⁺ salt)	250 µg	98+%

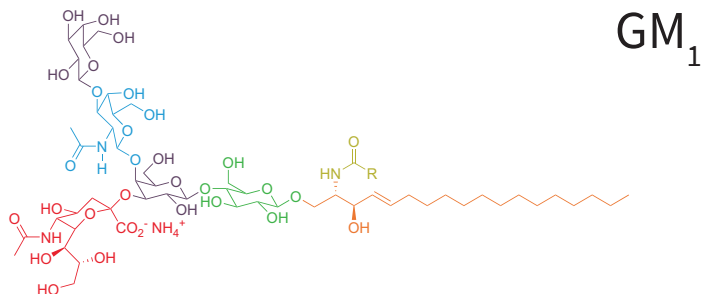
View Matreya's full list of GM₃ analogs and other ganglioside standards at www.matreya.com

References

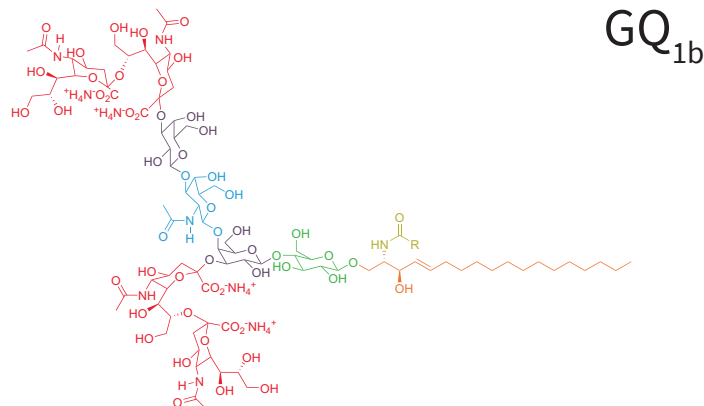
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5. Wang, H., Bright, A., Xin, B., *et al.* Cutaneous dyspigmentation in patients with ganglioside GM3 synthase deficiency. *Am. J. Med. Genet. A* **161A**(4), 875-879 (2013).
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Expansion of Our Ganglioside Line

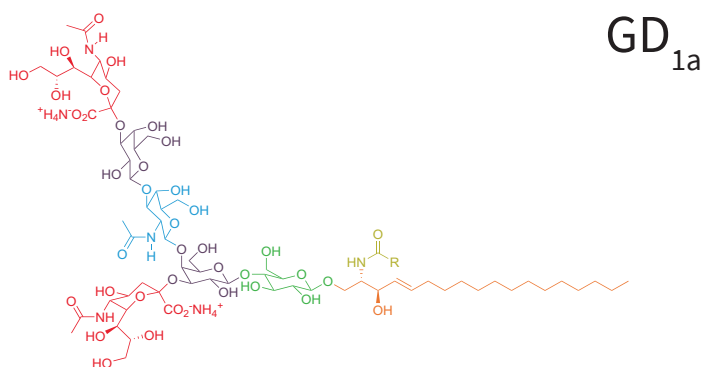
Matreya is a dedicated company in the field of glycolipid chemistry for the past 25 years. Our gangliosides are well known throughout the world. Our products are used in academic, clinical, and industrial laboratories. We feel privileged to continue developing new products to support ganglioside research. In this edition of our newsletter, we are proud to introduce gangliosides from the brains of ovine and porcine in addition to our source of regular bovine brain.



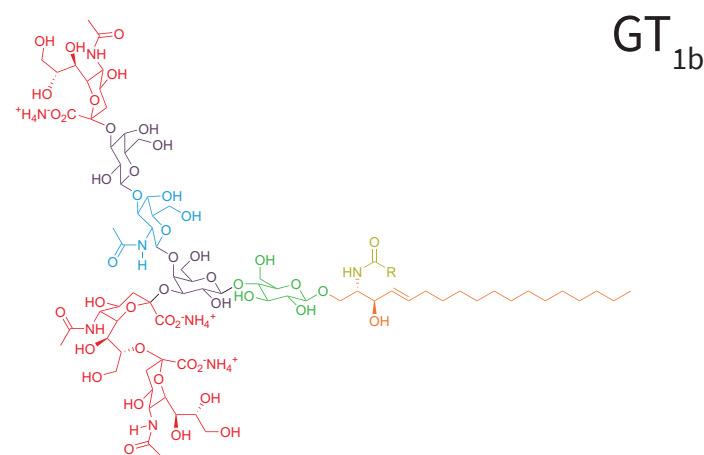
Source: porcine and ovine
Catalog Nos.: 1545 and 1544



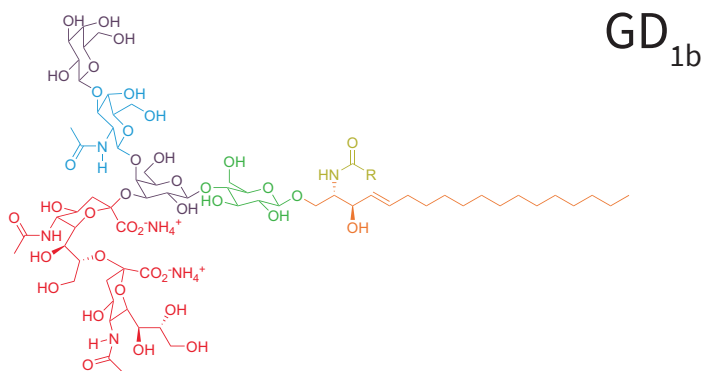
Source: porcine and bovine
Catalog Nos.: 1549 and 1516



Source: porcine and bovine
Catalog No.: 1546 and 1062



Source: porcine and bovine
Catalog No.: 1548 and 1063



Source: porcine and bovine
Catalog No.: 1547 and 1501

- Galactose
- Sphingosine
- N-Acetyl-galactose
- Glucose
- Acyl Chain
- NANA/N-Acetylneuraminic Acid/
Sialic Acid

New Ganglioside Standards

Catalog No.	Product Name	Size	Purity
1544	Monosialoganglioside GM ₁ (NH ₄ ⁺ salt), ovine	5 mg	98+%
1544-50	Monosialoganglioside GM ₁ (NH ₄ ⁺ salt), ovine	50 mg	98+%
1545	Monosialoganglioside GM ₁ (NH ₄ ⁺ salt), porcine	5 mg	98+%
1545-50	Monosialoganglioside GM ₁ (NH ₄ ⁺ salt), porcine	50 mg	98+%
1546	Disialoganglioside GD _{1a} (NH ₄ ⁺ salt), porcine	5 mg	98+%
1547	Disialoganglioside GD _{1b} (NH ₄ ⁺ salt), porcine	1 mg	98+%
1549	Tetrasialoganglioside GQ _{1b} (NH ₄ ⁺ salt), porcine	100 µg	98+%
1549-001	Tetrasialoganglioside GQ _{1b} (NH ₄ ⁺ salt), porcine	1 mg	98+%
1516-001	Tetrasialoganglioside GQ _{1b} (NH ₄ ⁺ salt), bovine – <i>new size and reduced price!</i>	1 mg	98+%
1548	Trisialoganglioside GT _{1b} (NH ₄ ⁺ salt), porcine	5 mg	98+%

DIVERSE APPLICATIONS OF MATREYA'S GANGLIOSIDES

To effectively study the effects and pathologies of the highly versatile group of gangliosides, it is important to have an arsenal of suitable and well-defined standards. In response to requests from numerous researchers, Matreya's chemists have produced ganglioside standards for the specific research that is currently underway. With the use of natural and stable isotope-labeled ganglioside standards, researchers can probe the mechanisms of ganglioside functions and metabolism.

For example, Matreya's standards can be used to study...

- GD₂ and GD₃ expression in cancers where it plays a role in tumor cell attachment to ECM.
- Mutations in the *B4galnt1* gene involved in GM₂, GD₂, and GA₂ biosynthesis.
- Anti-GD₂ antibody activity against neuroblastoma.
- Neuroprotective GM₁ and pro-apoptotic GD₃ involvement in neurodegenerative diseases.
- GM₁ and GT_{1b} promotion of neuronal differentiation and dendrite generation.
- GM₁, GD_{1a}, and GT_{1b} inhibition of EGFR, FGR, HGF, and PDGFR signaling in cancer cell membranes.
- GT_{1b} as a receptor for various toxins, which recognize its oligosaccharide structure.
- GD_{1b}, GT_{1b}, and GQ_{1b} inhibition of adenylate cyclase activity to enhance Th1 cytokine production.

View Matreya's full list of ganglioside standards at www.matreya.com