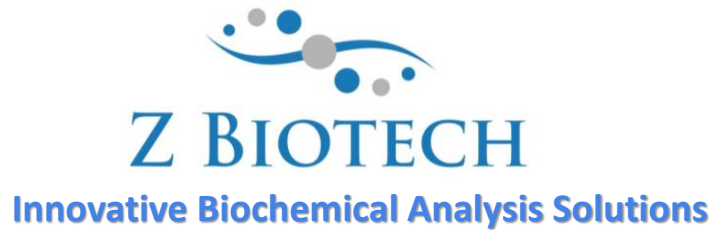


# Glycosphingolipid Glycan Array User Manual



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## Introduction

The cells of the nervous system communicate and are identified by the variety of sialylated glycosphingolipids (GSLs) called gangliosides presented on their surface membranes. The species of gangliosides expressed by each cell are incredibly important for brain function and go through dramatic changes during brain development. The expression of specific types of glycosphingolipids correlates with sensory and motor coordination, nerve regeneration, maintaining neuropsychological balance, and many other crucial neurological functions. Aberrant changes such as truncation, over- or under-expression of these gangliosides is involved in neurodegenerative diseases, Tay-Sachs disease, and tumor growth.

These findings emphasize how important the study of these molecules is to the medical research community. Understanding the effects and immunological interactions of aberrantly expressed glycolipids may be key to the development of therapeutic medicines for cancer and neurological disorders. Recently, researchers have begun to recognize the therapeutic potential of administering natural and semisynthetic gangliosides for cancer immunotherapy and neurodegenerative diseases. Many new immunotherapies have been using tumor-related gangliosides as promising cancer targets, such as anti-GD2 antibody Dinutuximab for neuroblastoma and anti-Neu5GcGM3 antibody Racotumomab for melanoma. These developments are supported by the emergence of new tools for glycobiology research, including glycan microarrays.

Z Biotech presents a new, sensitive research tool specifically for investigating glycosphingolipids. Our Glycosphingolipid Glycan Array features 58 glycan epitopes representing a variety of glycosphingolipid structures presented on healthy and abnormal cells. On each array slide are 8 or 16 identical subarrays so that as many samples can be analyzed simultaneously, providing sensitive and high-throughput glycan-binding information for antibodies, cells, or other proteins of interest.

This manual is provided as a comprehensive guide to help the researcher acquire clear results from the assay. Please read through carefully before starting your experiment.

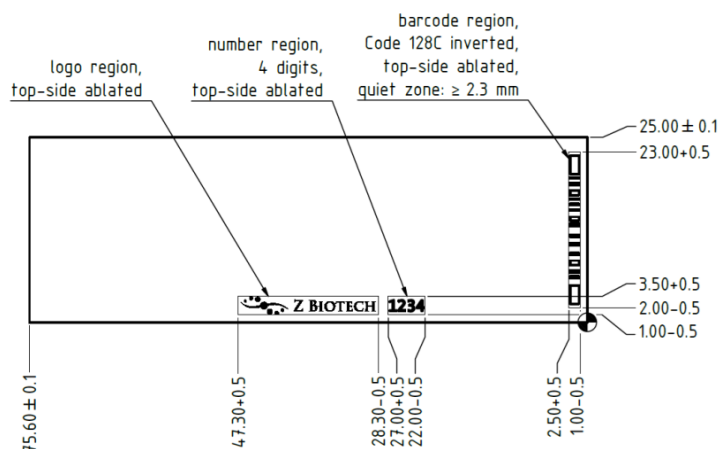
## Handling and Storage

Store the bag of slides and any buffers in a 4°C refrigerator if they are to be assayed within 3 weeks upon receipt. For long term storage keep the bag of slides at -20°C. Avoid freezing and thawing multiple times. Purchased slides and buffers should be used within 6 months.

Allow the bag of slides to equilibrate to room temperature at least 20 minutes before opening. After opening, re-seal any unused slides in the moisture barrier bag with a desiccant inside and refreeze.

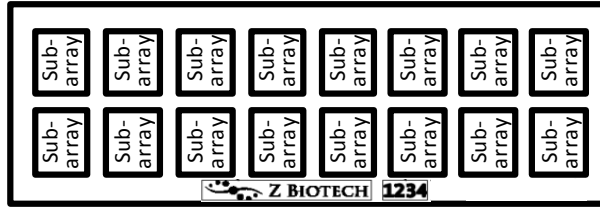
## Array Map/Schematic

Glycosphingolipid Glycan Array slides have either 8 or 16 subarrays. Arrays are printed on the side with the “Z Biotech” label and 4-digit number ID facing upward. The “Z Biotech” label is located on the bottom center from a landscape view. The number ID is consistent with the barcode ID on the bottom from a portrait view. Dimensions and array maps are shown below.



Array Map (16-subarray slides):

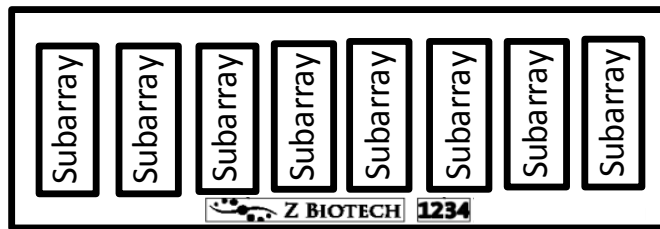
16-subarray Slide



G1	G1	G1	G1	G2	G2	G2	G2	G3	G3	G3	G3	G4	G4	G4	G4
G5	G5	G5	G5	G6	G6	G6	G6	G7	G7	G7	G7	G8	G8	G8	G8
G9	G9	G9	G9	G10	G10	G10	G10	G11	G11	G11	G11	G12	G12	G12	G12
G13	G13	G13	G13	G14	G14	G14	G14	G15	G15	G15	G15	G16	G16	G16	G16
G17	G17	G17	G17	G18	G18	G18	G18	G19	G19	G19	G19	G20	G20	G20	G20
G21	G21	G21	G21	G22	G22	G22	G22	G23	G23	G23	G23	G24	G24	G24	G24
G25	G25	G25	G25	G26	G26	G26	G26	G27	G27	G27	G27	G28	G28	G28	G28
G29	G29	G29	G29	G30	G30	G30	G30	G31	G31	G31	G31	G32	G32	G32	G32
G33	G33	G33	G33	G34	G34	G34	G34	G35	G35	G35	G35	G36	G36	G36	G36
G37	G37	G37	G37	G38	G38	G38	G38	G39	G39	G39	G39	G40	G40	G40	G40
G41	G41	G41	G41	G42	G42	G42	G42	G43	G43	G43	G43	G44	G44	G44	G44
G45	G45	G45	G45	G46	G46	G46	G46	G47	G47	G47	G47	G48	G48	G48	G48
G49	G49	G49	G49	G50	G50	G50	G50	G51	G51	G51	G51	G52	G52	G52	G52
G53	G53	G53	G53	G54	G54	G54	G54	G55	G55	G55	G55	G56	G56	G56	G56
G57	G57	G57	G57	G58	G58	G58	G58	NC	NC	NC	NC	PC1	PC1	PC1	PC1
PC2	PC2	PC2	PC2	PC3	PC3	PC3	PC3	PC4	PC4	PC4	PC4	M	M	M	M

Array Map (8-subarray slides):

8-subarray Slide



G1	G1	G1	G1	G1	G1	G2	G2	G2	G2	G2	G2	G3	G3	G3	G3	G3	G4	G4	G4	G4	G4	G5	G5	G5	G5	G5	G5	G6	G6	G6	G6	G6	G6
G7	G7	G7	G7	G7	G7	G8	G8	G8	G8	G8	G8	G9	G9	G9	G9	G9	G10	G10	G10	G10	G10	G11	G11	G11	G11	G11	G11	G12	G12	G12	G12	G12	G12
G13	G13	G13	G13	G13	G13	G14	G14	G14	G14	G14	G14	G15	G15	G15	G15	G15	G16	G16	G16	G16	G16	G17	G17	G17	G17	G17	G17	G18	G18	G18	G18	G18	G18
G19	G19	G19	G19	G19	G19	G20	G20	G20	G20	G20	G20	G21	G21	G21	G21	G21	G22	G22	G22	G22	G22	G23	G23	G23	G23	G23	G24	G24	G24	G24	G24	G24	
G25	G25	G25	G25	G25	G25	G26	G26	G26	G26	G26	G26	G27	G27	G27	G27	G27	G28	G28	G28	G28	G28	G29	G29	G29	G29	G29	G30	G30	G30	G30	G30	G30	
G31	G31	G31	G31	G31	G31	G32	G32	G32	G32	G32	G32	G33	G33	G33	G33	G33	G34	G34	G34	G34	G34	G35	G35	G35	G35	G35	G36	G36	G36	G36	G36	G36	
G37	G37	G37	G37	G37	G37	G38	G38	G38	G38	G38	G38	G39	G39	G39	G39	G39	G40	G40	G40	G40	G40	G41	G41	G41	G41	G41	G42	G42	G42	G42	G42	G42	
G43	G43	G43	G43	G43	G43	G44	G44	G44	G44	G44	G44	G45	G45	G45	G45	G45	G46	G46	G46	G46	G46	G47	G47	G47	G47	G47	G48	G48	G48	G48	G48	G48	
G49	G49	G49	G49	G49	G49	G50	G50	G50	G50	G50	G50	G51	G51	G51	G51	G51	G52	G52	G52	G52	G52	G53	G53	G53	G53	G53	G54	G54	G54	G54	G54	G54	
G55	G55	G55	G55	G55	G55	G56	G56	G56	G56	G56	G56	G57	G57	G57	G57	G57	G58	G58	G58	G58	G58	NC	NC	NC	NC	NC	NC	PC1	PC1	PC1	PC1	PC1	PC1
PC2	PC2	PC2	PC2	PC2	PC2	PC3	PC3	PC3	PC3	PC3	PC3	PC4	PC4	PC4	PC4	PC4	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank	M	M	M	M	M	M	

## Glycosphingolipid Glycan Identification List:

Type	ID	Glycan Structure	Abbreviation
Ganglioside	G1	Neu5Aca2-3Galβ1-4Glc	Ac-GM3
	G2	Neu5Gca2-3Galβ1-4Glc	Gc-GM3
	G3	Kdna2-3Galβ1-4Glc	Kdn-GM3
	G4	Neu5Ac8Mea2-3Galβ1-4Glc	Ac8Me-GM3
	G5	Neu5Aca2-3(GalNAcβ1-4)Galβ1-4Glc	Ac-GM2
	G6	Neu5Gca2-3(GalNAcβ1-4)Galβ1-4Glc	Gc-GM2
	G7	Kdna2-3(GalNAcβ1-4)Galβ1-4Glc	Kdn-GM2
	G8	Neu5Aca2-3(Galβ1-3GalNAcβ1-4)Galβ1-4Glc	Ac-GM1
	G9	Neu5Gca2-3(Galβ1-3GalNAcβ1-4)Galβ1-4Glc	Gc-GM1
	G10	Kdna2-3(Galβ1-3GalNAcβ1-4)Galβ1-4Glc	Kdn-GM1
	G11	Neu5Aca2-8Neu5Aca2-3Galβ1-4Glc	Ac-Ac-GD3
	G12	Neu5Aca2-8Neu5Gca2-3Galβ1-4Glc	Ac-Gc-GD3
	G13	Neu5Aca2-8Kdna2-3Galβ1-4Glc	Ac-Kdn-GD3
	G14	Neu5Gca2-8Neu5Aca2-3Galβ1-4Glc	Gc-Ac-GD3
	G15	Neu5Gca2-8Neu5Gca2-3Galβ1-4Glc	Gc-Gc-GD3
	G16	Kdna2-8Neu5Aca2-3Galβ1-4Glc	Kdn-Ac-GD3
	G17	Kdna2-8Neu5Gca2-3Galβ1-4Glc	Kdn-Gc-GD3
	G18	Kdna2-8Kdna2-3Galβ1-4Glc	Kdn-Kdn-GD3
	G19	Neu5Aca2-8Neu5Aca2-3(GalNAcβ1-4)Galβ1-4Glc	Ac-Ac-GD2
	G20	Neu5Aca2-8Neu5Gca2-3(GalNAcβ1-4)Galβ1-4Glc	Ac-Gc-GD2
	G21	Neu5Gca2-8Neu5Aca2-3(GalNAcβ1-4)Galβ1-4Glc	Gc-Ac-GD2
	G22	Neu5Gca2-8Neu5Gca2-3(GalNAcβ1-4)Galβ1-4Glc	Gc-Gc-GD2
	G23	Kdna2-8Neu5Aca2-3(GalNAcβ1-4)Galβ1-4Glc	Kdn-Ac-GD2
	G24	Kdna2-8Neu5Gca2-3(GalNAcβ1-4)Galβ1-4Glc	Kdn-Gc-GD2
	G25	Kdna2-8Kdna2-3(GalNAcβ1-4)Galβ1-4Glc	Kdn-Kdn-GD2
	G26	Neu5Aca2-3Galβ1-3GalNAcb1-4(Neu5Aca2-3)Galβ1-4Glc	Ac-Ac-GD1a
	G27	Neu5Aca2-8Neu5Aca2-3(Galβ1-3GalNAcβ1-4)Galβ1-4Glc	Ac-Ac-GD1b
	G28	Neu5Gca2-8Neu5Gca2-3(Galβ1-3GalNAcβ1-4)Galβ1-4Glc	Gc-Gc-GD1b
	G29	Kdna2-8Neu5Gca2-3(Galβ1-3GalNAcβ1-4)Galβ1-4Glc	Kdn-Gc-GD1b
	G30	Neu5Aca2-8Neu5Aca2-3Galβ1-3GalNAcβ1-4(Neu5Aca2-3)Galβ1-4Glc	Ac-Ac-Ac-GT1a
	G31	GalNAcβ1-4(Neu5Aca2-8Neu5Aca2-8Neu5Aca2-3)Galβ1-4Glc	Ac-Ac-Ac-GT2
	G32	Neu5Aca2-8Neu5Aca2-8Neu5Aca2-3Galβ1-4Glc	Ac-Ac-Ac-GT3
Lacto- and Neolacto-series	G33	GlcNAcβ1-3Galβ1-4Glc	Lc <sub>3</sub>
	G34	Galβ1-3GlcNAcβ1-3Galβ1-4Glc	Lc <sub>4</sub> (LNT)
	G35	Galβ1-4GlcNAcβ1-3Galβ1-4Glc	nLc <sub>4</sub> (LNT)
	G36	Galβ1-4(Fuca1-3)GlcNAcβ1-3Galβ1-4Glc	Fuc-nLc <sub>4</sub>
	G37	Neu5Aca2-3Galβ1-4GlcNAcβ1-3Galβ1-4Glc	Ac-nLc <sub>4</sub>
	G38	Neu5Gca2-3Galβ1-4GlcNAcβ1-3Galβ1-4Glc	Gc-nLc <sub>4</sub>
	G39	Kdna2-3Galβ1-4GlcNAcβ1-3Galβ1-4Glc	Kdn-nLc <sub>4</sub>
	G40	Neu5Ac8Mea2-3Galβ1-4GlcNAcβ1-3Galβ1-4Glc	8MeAc-nLc <sub>4</sub>
	G41	Neu5Aca2-3Galβ1-3GlcNAcβ1-3Galβ1-4Glc	Ac-Lc <sub>4</sub>
	G42	Neu5Gca2-3Galβ1-3GlcNAcβ1-3Galβ1-4Glc	Gc-Lc <sub>4</sub>
	G43	Kdna2-3Galβ1-3GlcNAcβ1-3Galβ1-4Glc	Kdn-Lc <sub>4</sub>
	G44	Neu5Ac8Mea2-3Galβ1-3GlcNAcβ1-3Galβ1-4Glc	8MeAc-Lc <sub>4</sub>
	G45	Neu5Gca2-3Galβ1-4(Fuca1-3)GlcNAcβ1-3Galβ1-4Glc	Gc-Fuc-nLc <sub>4</sub>
	G46	Kdna2-3Galβ1-4(Fuca1-3)GlcNAcβ1-3Galβ1-4Glc	Kdn-Fuc-nLc <sub>4</sub>
Globo- and Isoglobo-series	G47	Galα1-4Galβ1-4Glc	Gb <sub>3</sub>
	G48	Galα1-3Galβ1-4Glc	iGb <sub>3</sub>
	G49	GalNAcβ1-3Galα1-4Galβ1-4Glc	Gb <sub>4</sub>
	G50	GalNAcβ1-3Galα1-3Galβ1-4Glc	iGb <sub>4</sub>
	G51	Galβ1-3GalNAcβ1-3Galα1-4Galβ1-4Glc	Gb <sub>5</sub> (SSEA-3)
	G52	Galβ1-3GalNAcβ1-3Galα1-3Galβ1-4Glc	iGb <sub>5</sub>
	G53	Fuca1-2Galβ1-3GalNAcβ1-3Galα1-4Galβ1-4Glc	Globo-H
	G54	Neu5Gca2-3Galβ1-3GalNAcβ1-3Galα1-4Galβ1-4Glc	Gc-Gb <sub>5</sub>
	G55	Kdna2-3Galβ1-3GalNAcβ1-3Galα1-4Galβ1-4Glc	Kdn-Gb <sub>5</sub>
	G56	Neu5Aca2-3Galβ1-3GalNAcβ1-3Galα1-3Galβ1-4Glc	Ac-iGb <sub>5</sub>
	G57	Neu5Gca2-3Galβ1-3GalNAcβ1-3Galα1-3Galβ1-4Glc	Gc-iGb <sub>5</sub>
	G58	Kdna2-3Galβ1-3GalNAcβ1-3Galα1-3Galβ1-4Glc	Kdn-iGb <sub>5</sub>

## Controls

NC: Negative control, Print Buffer

PC1: Positive control 1, a biotinylated probe (0.01 mg/ml)

PC2: Postitive control 2, Human IgG (0.1 mg/ml)

PC3: Postitive control 3, Mouse IgG (0.1 mg/ml)

PC4: Postitive control 4, Rabbit IgG (0.1 mg/ml)

Array Marker: Anti-Human IgG, Cy3 (0.01 mg/ml) and anti-Human IgG, Alexa555 (0.01 mg/ml)

## Materials Required

- Arrayed glass slides
- 16 or 8 cassettes
- Glycan Array Blocking Buffer (GABB, Item #10106), add 1% BSA (10 mg/ml) if needed
- Glycan Array Assay Buffer (GAAB, Item #10107), add 1% BSA (10 mg/ml) if needed
- Laser fluorescence scanner (able to scan at the wavelength of your fluorophore)
- Coplin jar
- Adhesive slide cover film

### Preparation of assay samples:

Prepare glycan-binding protein samples or secondary antibodies of interest in a centrifuge tube by diluting with the Glycan Array Assay Buffer. We recommend a range of 50  $\mu\text{g/ml}$  to 0.1  $\mu\text{g/ml}$  concentration for protein samples, although some experimentation may be required to establish the concentration that will provide the highest binding signals with the lowest background fluorescence. This is often accomplished by applying a different dilution of samples to different wells of the array. For the fluorescently labelled streptavidin we recommend a concentration of 1  $\mu\text{g/mL}$ . Calculate the volume of sample needed depending on how many slides and subarrays are to be assayed. **We recommend using 100  $\mu\text{L}$  volume of sample per well for 16 subarray cassettes and 200  $\mu\text{L}$  for 8 subarray cassettes to ensure full and even coverage of the printed area throughout incubation for every step of the assay.** If necessary, the assay can be done successfully with a minimal volume of 60  $\mu\text{L}$  per well for 16 subarray cassettes and 80  $\mu\text{L}$  for 8 subarray cassettes. We caution that using a minimal volume in the wells has an increased risk of the array drying out during the assay and may also cause unequal distribution of the sample across the arrayed surface which may result in signal variation. Please ensure each sample is homogeneous and thoroughly mixed.

## Assay Protocol

### Considerations Before Starting the Experiment

1. **Preparation of Buffers:**
  - Ensure that Glycan Array Blocking Buffer (GABB) and Glycan Array Assay Buffer (GAAB) are ready for glycan microarray analysis.
2. **BSA Addition:**
  - If needed, add BSA to GAAB or LAAB to reduce non-specific binding.

- Prepare a 1% BSA assay buffer by adding BSA to GAAB or LAAB and filter through a 0.2  $\mu\text{m}$  PVDF membrane filter.
- 3. **Avoiding Dryness:**
  - The array surface is extremely sensitive to dryness. Ensure the array does not dry at any point during the assay.
  - Avoid handling multiple subarrays simultaneously to prevent drying out.
- 4. **Array Formats and Volumes:**
  - Common array formats: 8, 16, or 24 subarrays.
    - For 8-subarray format: Use 200  $\mu\text{L}$  per subarray.
    - For 16-subarray format: Use 100  $\mu\text{L}$  per subarray.
    - For 24-subarray format: Use 50-80  $\mu\text{L}$  per subarray.
  - Minimal volumes: 60  $\mu\text{L}$  per well for 16-subarray cassettes and 80  $\mu\text{L}$  for 8-subarray cassettes.
  - Caution: Using minimal volumes increases the risk of drying out and may cause signal variation. Ensure samples are homogeneous and thoroughly mixed.
- 5. **Sample Preparation:**
  - Dilute glycan-binding protein samples or secondary antibodies in Glycan Array Assay Buffer.
  - Recommended concentration range for protein samples: 50  $\mu\text{g}/\text{mL}$  to 0.1  $\mu\text{g}/\text{mL}$ . Experiment to find the optimal concentration for highest binding signals with the lowest background.
  - For fluorescently labeled streptavidin, use a concentration of 0.2  $\mu\text{g}/\text{mL}$ .
- 6. **Storage of Microarray Slides and Buffers:**
  - Store microarray slides and buffers at 4°C if assayed within 24 hours of receipt.
  - For long-term storage, keep microarray slides at -20°C. Avoid multiple freeze-thaw cycles.
  - Use slides and buffers within 12 months. Allow slides to equilibrate to room temperature for at least 20 minutes before opening.
  - After opening, reseal unused slides in a moisture barrier bag with a desiccant and refreeze. Handle slides in a dust-free environment, wearing gloves and holding slides by the edges.
  - When adding samples, avoid touching the pipette tip to the array surface. When removing samples, gently touch the pipette tip to the corner of the well and tip the slide.

## Analyzing Biological Samples with Glycan Microarray

### Part 1: Blocking

Handle the slide in a clean, dry environment. Use gloves and avoid touching the slide surface.

1. Let the microarray slide equilibrate to room temperature (20-30 minutes) before opening the moisture barrier bag.
2. Assemble the slide into a hybridization chamber device.
3. Add the Glycan Array Blocking Buffer (GABB) to each subarray well of the assembled hybridization chamber device:
  - 100  $\mu\text{L}$  for each subarray of a 16-subarray chamber device
  - 200  $\mu\text{L}$  for each subarray of an 8-subarray chamber device
4. Cover the hybridization chamber device with adhesive film to prevent evaporation and incubate the slide on a shaker at 80 rpm for 30 minutes. Ensure the orbital shaker is completely flat to avoid variations in binding and detection. Longer incubation times are acceptable but not necessary.
5. After 30 minutes, add 100  $\mu\text{L}$  of Glycan Array Assay Buffer (GAAB) to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device). Aspirate the liquid out from each well, ensuring that some liquid remains to cover the surface.
6. Add another 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device). Incubate at room temperature for 5 minutes at 80 rpm on a shaker.

7. After incubation, aspirate all the liquid out from each well. Then add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device). Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
8. After incubation, aspirate all the liquid out from each well. Then add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device). Incubate at room temperature for 5 minutes at 80 rpm on a shaker.

## Part 2: Binding Assay

1. Unless the glycan-binding protein sample of interest is bacteria or cells, centrifuge samples briefly to avoid adding irrelevant particles to the array.
2. Remove the blocking buffer from each well by gently touching a pipette tip to the corner of the well. We recommend doing this one subarray at a time, not handling multiple subarrays simultaneously to avoid drying out the microarray slide surface.
3. Immediately apply the glycan-binding protein sample of interest to each well.
4. Seal the wells with adhesive film to prevent evaporation. If the sample is fluorescently labeled, cover it with aluminum foil to keep it in the dark.
5. Incubate on the shaker for 1 hour at 80 rpm. Longer incubation times may increase the binding signal, especially for weakly binding samples. Avoid allowing the slides to dry out at any point during the assay, especially during long incubation times. Make sure the adhesive film is sealed around each well.
6. If your glycan-binding protein samples are fluorescently labeled, go directly to Part 6 – Final Wash and Dry.

## Part 3: Wash

We recommend doing the following procedure using a multi-channel pipette.

1. **Initial Wash:**
  - After incubating the samples for 1 hour at room temperature, use a multi-channel pipette to add 100  $\mu\text{L}$  of Glycan Array Assay Buffer (GAAB) to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device).
  - Aspirate the liquid out using a multi-channel aspirating needle device from each well, ensuring not all the liquid is aspirated out, leaving enough liquid to cover the surface.
  - Repeat the addition and aspiration of GAAB three times. For each repetition, add 100  $\mu\text{L}$  (or 200  $\mu\text{L}$  for an 8-subarray device) of GAAB, aspirate, and ensure some liquid remains to cover the surface. Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
2. **Subsequent Washes:**
  - After the initial wash and incubation, aspirate all the liquid out from each well using a multi-channel aspirating needle device.
  - Add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device).
  - Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
3. **Final Wash:**
  - After the second incubation, aspirate all the liquid out from each well using a multi-channel aspirating needle device.
  - Add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device).
  - Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
4. **Proceed to the Next Step:**
  - If your glycan-binding sample is biotinylated, go directly to Part 5 – Fluorescent Staining.

#### **Part 4: Binding of Biotinylated Antibody (Sandwich Assay Format)**

- 1. Adding Secondary Antibody:**
  - After removing all the GAAB using a multi-channel aspirating needle device, immediately add the secondary biotinylated antibody to each well using a multi-channel pipette.
- 2. Incubation:**
  - Seal the wells with adhesive film and incubate on the shaker for 1 hour at 80 rpm. Longer incubation times are acceptable but not necessary.

#### **Part 5: Fluorescent Staining**

- 1. Adding Streptavidin:**
  - After completely removing the GAAB using a multi-channel aspirating needle device, immediately add the fluorescently labeled streptavidin sample using a multi-channel pipette.
- 2. Incubation:**
  - Seal the wells with adhesive film and shield the wells from light with aluminum foil. Incubate on the shaker at 80 rpm for 1 hour. Longer incubation times are acceptable but not necessary.

#### **Part 6: Final Wash and Dry**

- 1. Initial Wash:**
  - After incubating the secondary antibody or streptavidin for 1 hour at room temperature, use a multi-channel pipette to add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device).
  - Aspirate the liquid out using a multi-channel aspirating needle device from each well, ensuring not all the liquid is aspirated out, leaving enough liquid to cover the surface.
  - Repeat the addition and aspiration of GAAB three times. For each repetition, add 100  $\mu\text{L}$  (or 200  $\mu\text{L}$  for an 8-subarray device) of GAAB, aspirate, and ensure some liquid remains to cover the surface. Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
- 2. Subsequent Washes:**
  - After the initial wash and incubation, aspirate all the liquid out from each well using a multi-channel aspirating needle device.
  - Add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device).
  - Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
- 3. Final Wash:**
  - After the second incubation, aspirate all the liquid out from each well using a multi-channel aspirating needle device.
  - Add 100  $\mu\text{L}$  of GAAB to each subarray well of a 16-subarray chamber device (or 200  $\mu\text{L}$  of GAAB to each subarray well of an 8-subarray chamber device).
  - Incubate at room temperature for 5 minutes at 80 rpm on a shaker.
- 4. Disassembling the Hybridization Chamber:**
  - Disassemble the hybridization chamber device from the slide. For the provided cassette, this can be done by holding the slide with one hand at the top and bottom edges and sliding out the cassette clips one by one with the other hand. If your provided cassette has metal clips, they can be removed by rotating the clip outwards from the bottom of the slide. When the clips have been removed, place the slide on the table and hold a small outer edge of the slide to the table as you gently peel the cassette off.



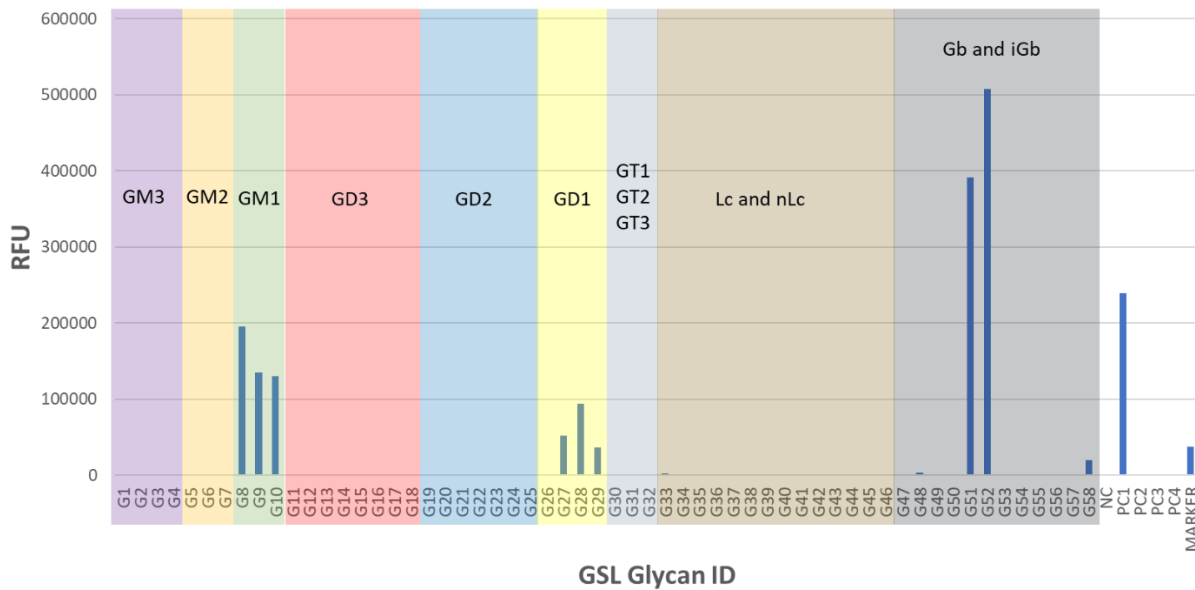
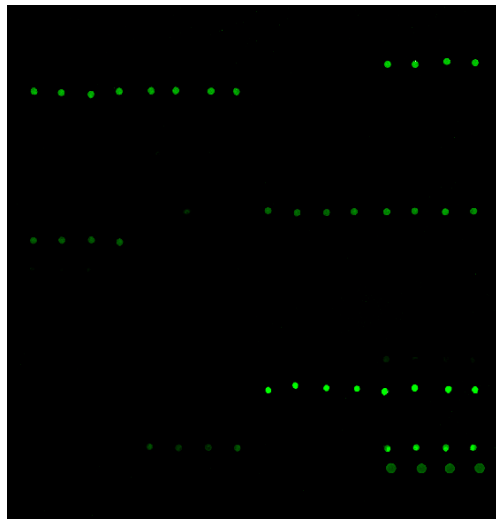
5. **Immersing the Slide:**
  - Immediately immerse the slide in a Coplin jar full of GAAB. Do not touch the surface of the array or allow the array surface to touch the sides of the beaker or jar. Place the jar or beaker on a shaker at 80 rpm for 10 minutes.
6. **Rinsing with Water:**
  - Decant the buffer from the jar while holding the slide in place (only touch the edge of the slide) and then add sterile de-ionized water to immerse the slide. Place the jar on the shaker at 80 rpm for 5 minutes.
7. **Repeat Rinsing:**
  - Decant the water from the jar. Repeat once more with fresh de-ionized water.
8. **Drying the Slide:**
  - Allow the slide to dry by using a microarray slide centrifuge completely in a clean, dust-free environment before scanning.

## Part 7: Data Acquisition and Analysis

1. **Scanning the Slide:**
  - Scan the slide in a laser fluorescence scanner at the wavelength of emission for the fluorophore used. Adjust the laser power and PMT to obtain the highest possible signals without being saturated (saturated positive control signal is okay).
2. **Analyzing Data:**
  - Analyze data with microarray analysis software. If there is specific binding, the signal intensity should be higher than the background signal (the area where there are no printed spots). The fluorescent signal due to specific binding to your sample of interest should be dose-dependent with your sample dilution (unless the sample concentration range is too high and glycan-binding is saturated) and should have a positive binding signal after the signal from control assays has been subtracted.
3. **Quantifying Signal Intensities:**
  - Our standard method of comparing signal intensities is to quantify the median signal intensity data and subtract the background intensity. Subtracting signals from negative control spots as well as the same spots on a negative control assay (assay with only detection antibodies and fluorophore) will give more accurate specific binding data.
4. **Interpreting Control Signals:**
  - **Negative Control (Print Buffer):** The negative control should produce a signal close to the intensity of the background. Since there is no binding involved with the negative control, any other signals around the negative control's intensity are also not binding.
  - **Marker:** The array marker should show a fluorescence signal regardless of the assay. It is there primarily to aid with the orientation of the array map during analysis.
  - **Biotinylated Mannose (PC1):** This positive control will bind directly to the fluorescent-labeled streptavidin. If your glycan-binding protein sample is already fluorescently labeled, or in any case where the addition of fluorescently labeled streptavidin to the array was not performed (Part 5 – Fluorescent Staining), this positive control will not be reactive.
  - **IgG (PC2, PC3, PC4):** IgG is an antibody found in the blood that is a primary component of humoral immunity. If the glycan-binding or secondary antibody sample is an anti-IgG from a human, rabbit, or mouse, it should bind to the respective IgG control.

### Typical Binding Assay Result from the Glycosphingolipid Glycan Microarray

Example 1: Glycosphingolipid Glycan Microarray on 16 subarray formats. A subarray assayed with biotinylated PNA lectin (10 µg/ml), followed by streptavidin-Cy3 (1 µg/ml). The array was scanned with InnoScan 710 microarray scanner (XDR mode) at 1 PMT and 100% laser power at 532nm wavelength. The positive control 1 shows binding as expected.



## Troubleshooting

Condition	Possible Causes	Potential Solutions
High Background	<ul style="list-style-type: none"> <li>• Concentration of protein samples is too high</li> <li>• Concentration of fluorescent samples is too high</li> <li>• Arrays are not thoroughly washed.</li> <li>• Slide drying out during assay</li> <li>• Excessive particles in the samples due to sample aggregation, dust, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Use a lower concentration range of samples. Consider a wider range if you are unsure where the detection limit is. Use control assays to determine which sample is causing high background.</li> <li>• Apply longer times for washing steps and use a higher shaking rate</li> <li>• Make sure wash buffer and sample is completely removed before the next step</li> <li>• Make sure adhesive film fully seals the wells to avoid evaporation</li> <li>• Centrifuge the samples prior to assay to avoid adding irrelevant particles. Make sure buffers are filtered.</li> <li>• If you think that the protein is aggregating during incubation, try shaking at a higher speed</li> </ul>
Signal Variation	<ul style="list-style-type: none"> <li>• Slide drying out during assay</li> <li>• Binding samples are not equally distributed in the wells</li> <li>• Glycan-binding protein aggregation during incubation</li> <li>• Bubbles during incubation</li> </ul>	<ul style="list-style-type: none"> <li>• Make sure wells are sealed to prevent evaporation during incubation</li> <li>• Apply a larger volume of sample to each well to ensure equal distribution</li> <li>• Use a higher shaking rate during incubation</li> <li>• Make sure samples are homogeneous, mixed thoroughly, and do not leave bubbles on the array surface</li> </ul>
Unexpected Binding	<ul style="list-style-type: none"> <li>• Cross contamination between wells or other sources</li> <li>• Sample contamination</li> </ul>	<ul style="list-style-type: none"> <li>• Make sure to use sterilized pipette tips and tubes used for sample application and preparation</li> <li>• Ensure cassette is pressed firmly to the slide so that there are no gaps to allow leaking between wells</li> <li>• Be careful not to cross contaminate samples when applying to the wells, even during wash steps</li> </ul>