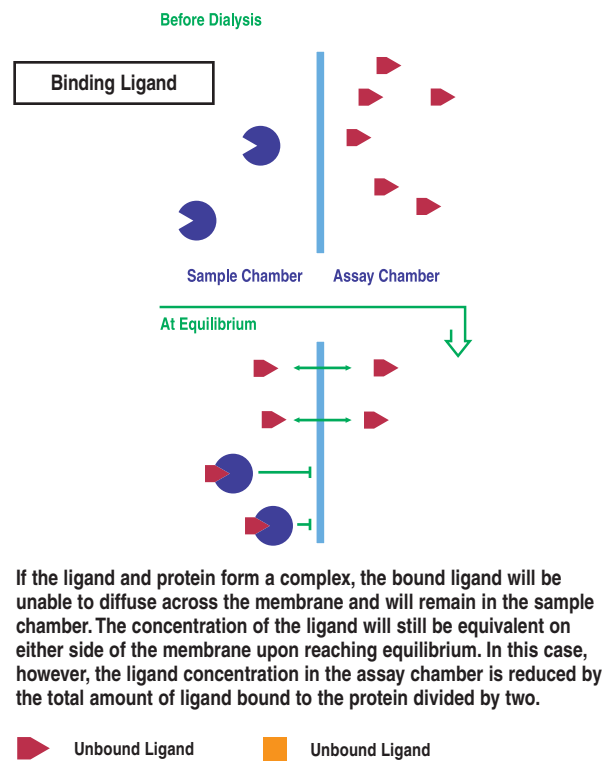
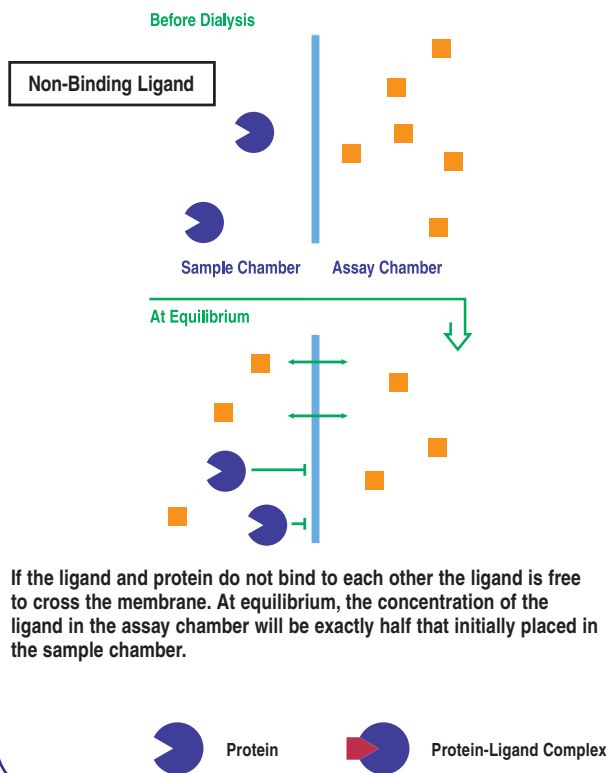


Equilibrium Dialysis

Introduction to Equilibrium Dialysis

How Does Equilibrium Dialysis Work?



Applications:

- Protein-drug binding assays
- Receptor binding assays
- Ligand binding assays
- Protein-protein interactions
- Protein-DNA interactions
- Serum protein binding

Equilibrium dialysis is a specific application of dialysis that is important for the study of the binding of small molecules and ions by proteins. It is one of several methods available for this purpose, and its attractive feature continues to be its physical simplicity. Another attractive feature of equilibrium dialysis is the ability to perform interaction studies without the use of fluorescent or radiolabeled tags.

Generally, the objective of an equilibrium dialysis experiment is to measure the amount of a ligand bound to a macromolecule. This is typically done through an indirect process because in any mixture of the ligand and macromolecule, it is difficult to distinguish between the bound and free ligand. If, however, the free ligand can be dialyzed through a membrane, until its concentration across the membrane is at equilibrium, the free ligand concentration can be measured easily. Data obtained under different experimental conditions then provides information on various binding parameters of the compounds such as the binding constants and the number of binding sites or binding capacity.

Harvard Apparatus offers five types of Equilibrium DIALYZERS™. These products can meet virtually all of your bind-interaction application requirements:

Multi-Equilibrium DIALYZER™ - Reusable

For simultaneous and highly reproducible equilibrium dialysis of up to 20 samples with volumes from 0.25 to 5 ml, see page N39.

Micro-Equilibrium DIALYZER™ - Reusable

The Micro-Equilibrium DIALYZER is available as 2- or 3-chamber systems. It is used to study interactions between biomolecules such as the binding of a ligand to a protein. For sample volumes from 25 μ l to 500 μ l, see page N40.

Fast Micro-Equilibrium DIALYZER - Reusable

A reusable Micro-Equilibrium DIALYZER suitable for 25 μ l samples for quicker equilibration times using membranes with larger surface areas, see page N41.

DispoEquilibrium DIALYZER™ - Single Use

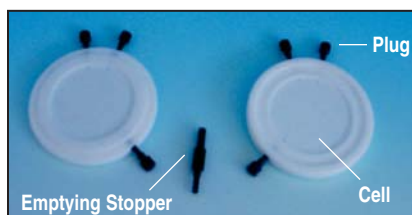
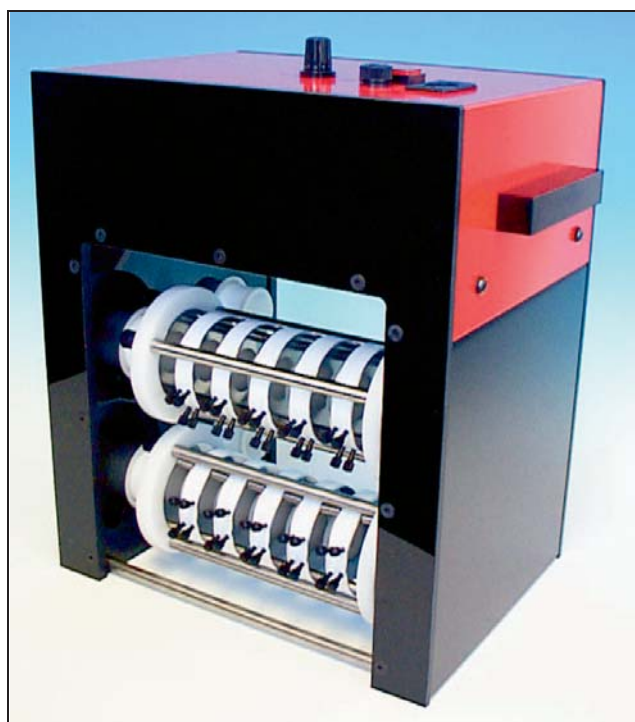
A disposable version of the Micro-Equilibrium DIALYZER suitable for samples from 25 to 75 μ l, see page N41.

96-Well Equilibrium DIALYZER™ - Single Use

A 96-well disposable equilibrium DIALYZER for high throughput interaction studies. For samples up to 50 μ l to 200 μ l, see page N42.

Contact Harvard Apparatus to receive a free copy of our 'Guide to Equilibrium Dialysis'.

Multi-Equilibrium DIALYZER™ - Samples from 0.25 ml to 5 ml (Reusable)



Advantages:

- Easy to use
- Leak-proof
- Reproducible
- Fast dialysis times
- Available for a range of sample sizes
- Up to 20 parallel, simultaneous assays
- Autoclavable
- Low protein binding
- High sample recovery
- Made of Teflon – totally inert

Applications:

- Protein binding assays
- Protein-drug binding assays
- Receptor binding assays
- Ligand binding assays
- Protein-protein interactions
- Protein-DNA interactions

The Harvard Apparatus Multi-Equilibrium DIALYZER provides highly standardized equilibrium dialysis conditions for up to 20 parallel assays. The instrument offers outstanding uniformity of: membrane area, sample volume, degree of agitation.

The advantages of this system are that up to 20 cells can be used simultaneously for rapid dialysis under standardized conditions. Experiments conducted using the Multi-Equilibrium DIALYZER are extremely reproducible and leak-proof and can be performed at a constant temperature.

The DIALYZER cells are made of Teflon, an extremely inert material, and will not interfere with the samples. Multiple cell systems are available (5, 10, 15, 20 cells) at various cell volumes (0.2, 1.0, 2.0 and 5.0 ml). The unit can be sterilized by autoclaving and the cells can be filled easily with a filling clamp. Custom systems with alternate chamber sizes, membranes and power supply are available.

Catalog No.	\$	Description
Multi-Equilibrium DIALYZER Systems		
BS4 74-1800		Complete Multi-Equilibrium DIALYZER System <ul style="list-style-type: none"> • Ready-to-Use Teflon Macro Dialysis Cells (1 ml) with Large Surface Area and plugs, pkg. of 20 • Variable Speed Drive Unit (12 x 12 x 7.5 in) for 20 Cells, and 110V power supply, pkg. of 1 • Stand, pkg. of 1 • Filling Clamp, pkg. of 1 • Carriers for 5 Teflon Dialysis Cells, pkg. of 4 • Emptying Stoppers, pkg. of 20 • Macro Spacers, pkg. of 24 • Dialysis Membranes, MWCO 10,000 Daltons, pkg. of 200 • Power Supply Adapter (110 V)
Membranes for Multi-Equilibrium DIALYZER		
BS4 74-2100		MWCO 5,000 Daltons, pkg. of 200
BS4 74-2102		MWCO 10,000 Daltons, pkg. of 200

Catalog No.	\$	Description
Multi-Equilibrium DIALYZER Individual Components		
BS4 74-1903		Macro Teflon Dialysis Cells (1 ml) , pkg. of 5
BS4 74-1904		Macro Teflon Dialysis Cells (2 ml), pkg. of 5
BS4 74-1905		Macro Teflon Dialysis Cells (5 ml), pkg. of 5
BS4 74-1906		Macro Teflon Dialysis Cells, Large Surface Area (1 ml), pkg. of 5
BS4 74-1909		Macro Spacer, pkg. of 1
BS4 74-1911		Macro Cell Carrier, pkg. of 1
BS4 74-1907		Micro Teflon Dialysis Cells (0.25 ml), pkg. of 5
BS4 74-1908		Micro Spacer, pkg. of 1
BS4 74-1910		Micro Cell Carrier, pkg. of 1
BS4 74-1912		Power Supply Adapter (110 V)
BS4 74-1912A		Power Supply Adapter (220 V)
BS4 74-1913		Filling Clamp, pkg. of 1
BS4 74-1914		Black Stoppers, pkg. of 32
BS4 74-1901		Emptying Stoppers, pkg. of 5
BS4 74-1919		Tank with Fittings (14.5 x 9.5 x 8.25 in), pkg. of 1

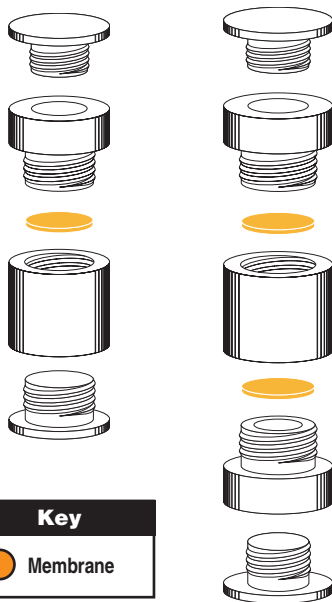
Equilibrium Dialysis

MicroEquilibrium DIALYZER - Samples from 25 µl to 500 µl (Reusable)



2-Chamber System

3-Chamber System



Key

 Membrane

The binding and ligand elements are placed in one chamber (the sample chamber) while the other chamber (the assay chamber) contains an equivalent volume of the same buffer without either element. When equilibrium has been reached the concentration of the ligand in the assay chamber can be measured and analyzed to obtain the results of the assay.

When the ligand is free in solution it can readily pass through the membrane, but when complexed, it is too large and is retained by the membrane.

For additional Membrane ordering information, see pages N43 to N44.

Membrane ordering information is color coded to assist you in selecting the appropriate membrane:

Pink shaded membranes are for products with sample sizes up to 200 µl

Purple shaded membranes are for products with sample sizes ranging from 250 µl to 1,500 µl

Green shaded membranes are for products with sample sizes ranging from 3,000 µl to 5,000 µl

Advantages:

- Easy to use
- Leak-proof
- Reusable
- Available for a range of sample sizes
- Membranes available with MWCO's to suit almost any application
- Autoclaveable
- Low protein binding
- High sample recovery
- Made of Teflon – totally inert

Applications:

- Protein binding assays
- Protein-drug binding assays
- Receptor binding assays
- Ligand binding assays
- Protein-protein interactions
- Protein-DNA interactions

The Micro-Equilibrium DIALYZER is a unique equilibrium dialysis chamber for small samples (25 to 500 µl). Two chambers of equivalent volume are joined together with a membrane between them, as shown. When dialysis is complete the chambers can be opened at each end to extract the sample for analysis. The entire system can also be placed in a thermostat for temperature-controlled dialysis. Includes two chambers (body plus link) and two solid caps.

The Micro-Equilibrium DIALYZER can also be used with three chambers instead of two by adding an additional link chamber. One of the main advantages of using this configuration is that the results can be obtained without waiting for equilibrium to be reached, thus reducing the assay time.

This is achieved by placing the assay compound in the central chamber; the binding component in one of the terminal chambers and control buffer, containing neither component, in the remaining chamber. Comparing the concentration of the assay compound in the two terminal chambers will then yield information on the binding characteristics of the assay components.

Micro-Equilibrium DIALYZERS

Volume per Chamber (µl)	Total Volume (µl)	Qty. of 1	\$	Qty. of 5	\$
2-Chamber System					
25	50	BS4 74-1606		BS4 74-1600	
50	100	BS4 74-1607		BS4 74-1601	
100	200	BS4 74-1608		BS4 74-1602	
250	500	BS4 74-1609		BS4 74-1603	
500	1,000	BS4 74-1610		BS4 74-1604	

Additional Chambers for 3-Chamber System (to add to the 2-chamber system)

25	–	BS4 74-1619		BS4 74-1620	
50	–	BS4 74-1611		BS4 74-1615	
100	–	BS4 74-1612		BS4 74-1616	
250	–	BS4 74-1613		BS4 74-1617	
500	–	BS4 74-1614		BS4 74-1618	

Ultra-Thin Membranes for Micro-Equilibrium DIALYZERS

Membrane MWCO (Daltons)	Qty. of 24	\$	Qty. of 96	\$
For Use with 25 µl, 50 µl and 100 µl Volume Chambers				
5,000	BS4 74-1704		BS4 74-1700	
10,000	BS4 74-1705		BS4 74-1701	
For Use with 250 µl and 500 µl Volume Chambers				
5,000	BS4 74-1706		BS4 74-1702	
10,000	BS4 74-1707		BS4 74-1703	

NEW Fast MicroEquilibrium DIALYZER™

Samples of 25 µl (Reusable)



Advantages:

- Designed for 25 µl sample volumes
- High membrane area/sample volume ratio
- Faster equilibration
- High sample recovery
- Low protein binding
- Made of Acetal (Delrin® by DuPont); reusable
- Membranes available with MWCO's
- Suits almost any application

Applications:

- Protein binding assays
- Protein-drug binding assays
- Receptor binding assays
- Ligand binding assays
- Protein-protein interactions
- Protein-DNA interactions

Harvard Apparatus introduces to our equilibrium dialysis product line a new 25 µl Fast MicroEquilibrium DIALYZER using membranes and chambers

with high surface area to sample volume ratios. The high ratio and short diffusion distances provide faster equilibration. The Fast MicroEquilibrium DIALYZER includes Delrin® sample and dialysate chambers, anodized aluminum clamping nut, four Delrin® plug-fittings and two chemically compatible o-rings. The dialysate chamber is separated from the sample chamber by a large membrane that is tightly secured by the two o-rings, all sealed and held together with a threaded clamping nut.

The Fast MicroEquilibrium DIALYZER is simple to use. The sample and buffer are loaded into respective chambers through their inlet ports and sealed by screw plug-fittings. The dialyzer assembly is rotated along the membrane axis from time to time. The entire assembly can be placed in a thermostatted chamber if temperature control is required. After dialysis is complete, the dialysed sample is aspirated from the dialysate/buffer chamber through a port.

Fast MicroEquilibrium DIALYZERS

Volume per Chamber (µl)	Qty. of 1	Qty. of 5
25	BS4 74-1621	BS4 74-1622
\$		

Ultra-Thin Membranes for Fast MicroEquilibrium DIALYZERS

Membrane MWCO (Daltons)	Qty. of 24	Qty. of 96
5,000	BS4 74-1706	BS4 74-1702
\$		
10,000	BS4 74-1707	BS4 74-1703
\$		

DispoEquilibrium DIALYZER™

Samples from 25 µl to 75 µl (Single use)



Advantages:

- Easy to use & disposable
- Small sample volumes: 25 µl to 75 µl each chamber
- Rapid dialysis due to ultra-thin membrane
- High-quality regenerated cellulose membranes with MWCO's of 5,000 and 10,000 Daltons
- Leak-proof

Applications:

- Protein and Protein-drug binding assays
- Receptor binding assays
- Ligand binding assays
- Protein-protein and Protein-DNA interactions

Harvard Apparatus DispoEquilibrium DIALYZER is a single use product for interaction studies and is currently the only such device on the market. The DispoEquilibrium DIALYZER is leak-proof and provides high sample recovery (almost 100 percent). This system is designed for one-time use with samples such as radiolabeled compounds, avoiding the hassle associated with cleaning the DIALYZER after use.

Each chamber has a capacity of 25 to 75 µl. The DispoEquilibrium DIALYZER utilizes high-quality regenerated cellulose membranes with MWCO's of 5,000 or 10,000 Daltons. Sample recovery is very easy through centrifugation or via removal with micropipettes. Includes two caps (one black, one white), two 0.65 ml sample tubes per chamber and two pipette tips for delivery/recovery.

DispoEquilibrium DIALYZERS

Membrane MWCO (Daltons)	Qty. of 25	Qty. of 50	Qty. of 100
5,000	BS4 74-2204	BS4 74-2200	BS4 74-2201
\$			
10,000	BS4 74-2205	BS4 74-2202	BS4 74-2203
\$			

Other MWCO available upon request

Extra Loading Pipette Tips, pkg. of 100	BS4 74-2222
\$	

Equilibrium Dialysis

96-Well Equilibrium DIALYZER™ Samples from 50 µl to 200 µl (Single use)



Advantages:

- Patented
- 96-well format
- Individual membrane for each well
- Small sample volumes: 50 µl to 200 µl
- Ultra-thin regenerated cellulose membranes
- Membranes are free of sulfur and heavy metal contamination
- High well-to-well reproducibility
- Excellent sample recovery (>95%)

Applications:

- Protein and Protein-drug binding assays
- Receptor binding assays
- Ligand binding assays
- Protein-protein and Protein-DNA interactions

The single use, 96-Well Equilibrium DIALYZER is a novel product for the simultaneous assay of 96 samples. Each well in this system has a separate membrane and thus eliminates the possibility of sample cross-contamination. Reproducibility is

very high across the different wells of the Equilibrium DIALYZER and sample recovery is excellent. Wells 96-Well are sealed with 8-cap strips. Twelve top 8-caps strips and twelve bottom 8-cap strips are included. Thus a row of wells or all 96 wells can be used depending on the specifications of the experiment. The 96-Well Equilibrium DIALYZER utilizes high-quality regenerated cellulose membranes available with MWCO's of 5,000 or 10,000 Daltons. Rotator is required.

Single and Dual Plate Rotators

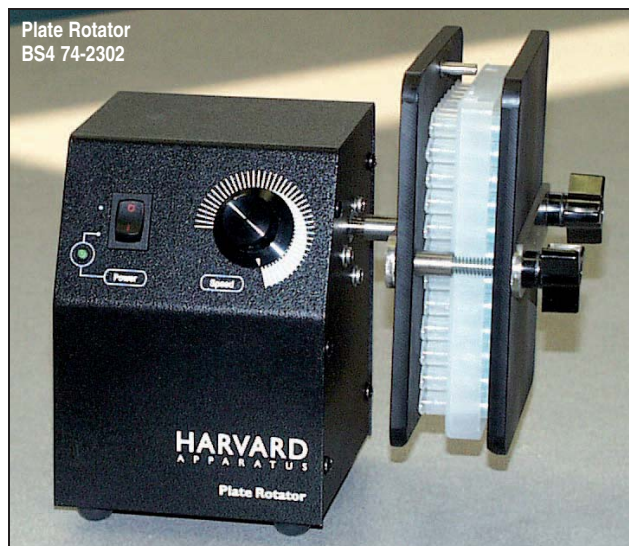
A Single or Dual Plate Rotator with variable rotation rates is available for use with the Harvard Apparatus 96-Well Equilibrium DIALYZER. The Rotator speeds up the equilibrium dialysis process by keeping the sample in constant motion thereby ensuring higher reproducibility of results.

8-Plate Rotator Oven

The 8-Plate Rotator Oven is used for temperature controlled studies in the 96-Well Equilibrium DIALYZER. The Rotator oven consists of the Big SHOT Hybridization Oven (BS4 68-0770) on page N130 and a special carousel (BS4 72-4909) to hold up to 8 plates simultaneously.

see *Microcentrifuges* pages N95-N103

Catalog No.	\$	Description
BS4 74-2300		96-Well Equilibrium DIALYZER Plate, Membrane MWCO 5,000 Daltons, pkg. of 1
BS4 74-2301		96-Well Equilibrium DIALYZER Plate, Membrane MWCO 10,000 Daltons, pkg. of 1
BS4 74-2302		Single Plate Rotator, pkg. of 1



Catalog No.	\$	Description
BS4 74-2334		Dual Plate Rotator, pkg. of 1
BS4 74-2335		8 Plate Rotator Oven, 110 V, pkg. of 1
BS4 74-2336		8 Plate Rotator Oven, 220 V, pkg. of 1
BS4 74-2324		Strip (8-Cap), (blue) Bottom, pkg. of 12
BS4 74-2325		Strip (8-Cap), (opaque) Top, pkg. of 12