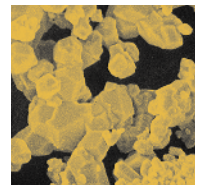
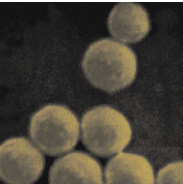


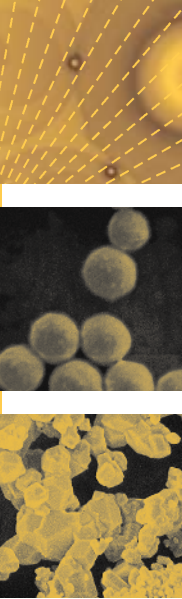


# Biolistic Delivery Systems



Get Right on Target With  
Precise Gene Delivery Systems





# Biolistic Particle Delivery Systems

Helios Gene Gun System

## Helios® Gene Gun System

- Transfection of mammalian cells in vivo
- Easy-to-use, portable handheld device
- Simple, rapid, versatile technique



### Biolistic Applications of the Helios Gene Gun System

#### Transformation Factors

Experimental conditions	In situ, in vitro, in vivo, ex vivo
Sample location	External and exposed internal aspects of target organism
Target area	Small (2 cm <sup>2</sup> )
Target membrane structure	In vivo
Pressure range	100–600 psi
Targets	<p><b>Animals:</b> Any material exposed to gun barrel — intact tissue (skin, organs); cell, explant, or organ culture</p> <p><b>Plants:</b> Field and greenhouse use, plant cell culture, explants</p> <p><b>Microbes:</b> Yeast, bacteria, other</p>

Biolistic technology, also called particle bombardment, is a direct physical method of introducing nucleic acids into cells. Nucleic acids or other biological molecules are coated onto high-density gold or tungsten microparticles (microcarriers), which are then accelerated to high velocity by a helium pulse and driven through cell walls and membranes into the target. The physical nature of this technology makes it extremely versatile and easy to use. It can be applied to a wide range of targets, including cell cultures, tissues, organs, plants, animals, and bacteria, as well as organelles. Bio-Rad offers two types of biolistic instruments, the Helios gene gun and PDS-1000/He systems. For more information, visit us on the Web at [www.bio-rad.com/genetransfer/](http://www.bio-rad.com/genetransfer/)

Choose the system that's right for you.

## PDS-1000/He™ System

- Highly reproducible transfection
- Transfection of a large area
- Hepta™ adaptor further increases transfection area (transforms 7–10 times more cells than standard system)
- 7 sizes of microparticles available

### Biolistic Applications of the PDS-1000/He System

#### Transformation Factors

Experimental conditions	In vitro, ex vivo, in vivo (plants)
Sample location	Evacuated chamber
Target area	Large (40 cm <sup>2</sup> )
Target membrane structure	Fragile to robust
Pressure range	450–2,200 psi
Targets	<b>Animals:</b> Cell and organ culture <b>Plants:</b> Small intact plants, cultures, explants <b>Microbes:</b> Yeast, bacteria <b>Organelles:</b> Chloroplasts, mitochondria



PDS-1000/He System

# Helios Gene Gun System

The Helios gene gun uses a low-pressure helium pulse to sweep microcarriers from the inner wall of a small plastic cartridge and propel them into the target. The advanced design of the handheld device eliminates the need for vacuum-assisted microcarrier acceleration and dramatically lowers the helium pressure required for transformation. Consequently, the Helios gene gun may be used in a wide variety of gene transfer applications, including in vivo mammalian transformation.

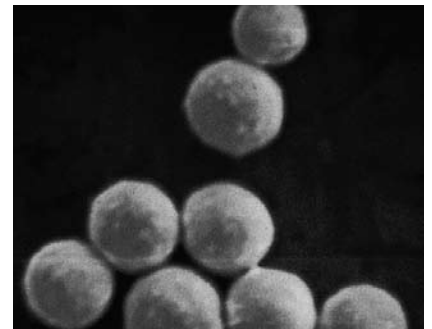
## How the Helios Gene Gun Works

Transfer of nucleic acids using the Helios gene gun is fast and effective: simply load sample cartridges with DNA- or RNA-coated microcarriers, point the nozzle, and fire the device.

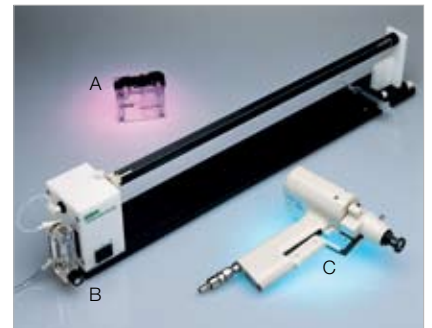
- First, DNA or RNA is precipitated onto gold microparticles — any ratio of different plasmids can be coprecipitated onto one particle
- The microcarriers are then coated along the inside of plastic tubing, which is cut into small cartridges
- The gene gun is fired simply by pressing a trigger button; a helium pulse then travels down the barrel of the gun, enters a cartridge cylinder, and sweeps the microcarriers from the inside wall of the cartridge
- The barrel geometry dissipates the helium flow, while the particles maintain a high velocity and are propelled over an area approximately 2.25 cm (0.5") in diameter into the target
- The adjustable helium pulse can deliver up to 12 samples in rapid succession

## System Components and Accessories

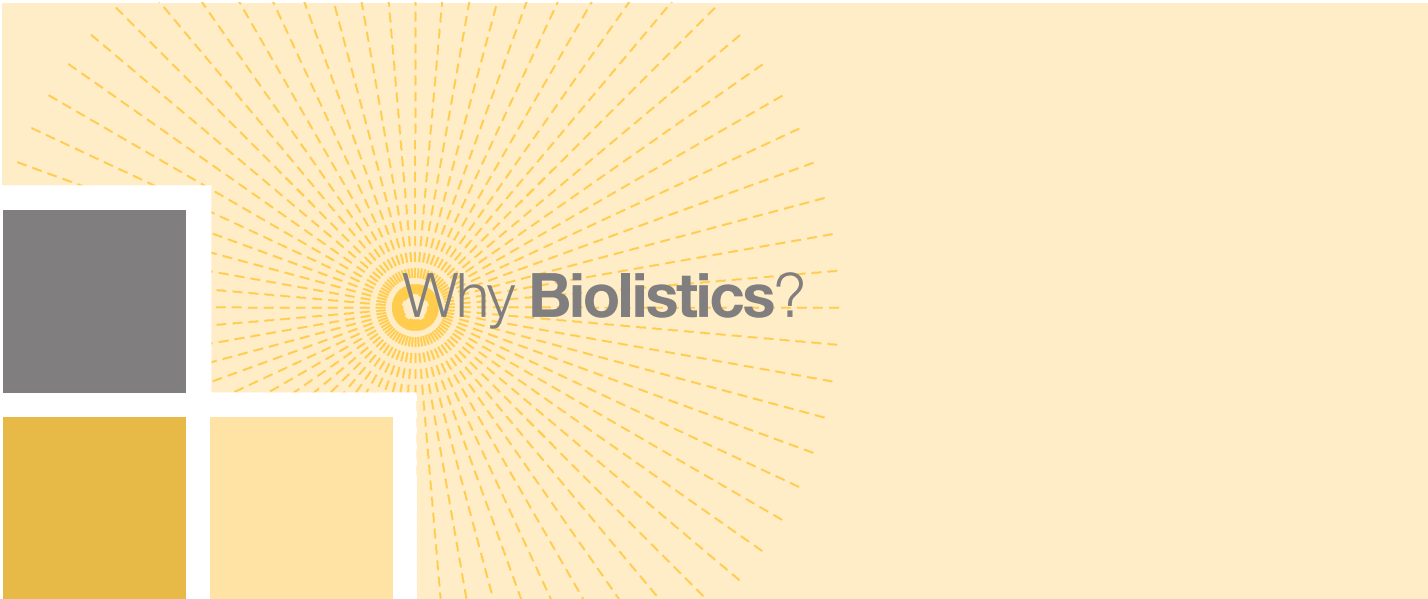
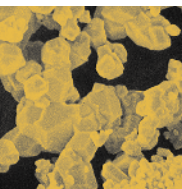
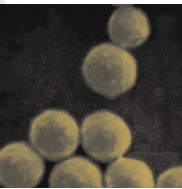
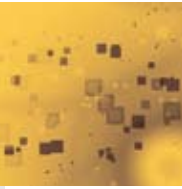
The Helios gene gun system includes all components needed to prepare nucleic acid-coated microcarriers, apply the microcarriers to the inner surface of the GoldCoat™ tubing, cut the tubing into cartridges, and propel the microcarriers into cells. Additional microcarriers, cartridge kits, and other accessories are also available.



Microscopic nucleic acid-coated gold particles.



Components of Helios gene gun system. A, tubing cutter, B, tubing prep station, C, Helios gene gun.



## Why Biolistics?

Of all the transformation methods available, biolistic particle bombardment can be applied to the widest range of cell and tissue types. Both the size of the microcarriers and the helium pressure can be selected to optimally penetrate different targets with minimal damage. Mammalian cells do not need to be trypsinized to remove them from their support when biolistic delivery is used, and thus cell morphology is maintained. Even intracellular organelles have been successfully transformed using biolistics.

### **Biolistic bombardment:**

- Is the most powerful method for introducing nucleic acids into plants, because the helium pressure can drive microcarriers through cell walls
- Is much easier and less time consuming than microinjecting nucleic acids into plant cells or embryos
- Allows transformation of animal cells that have unique growth requirements and that are not amenable to gene transfer using any other method
- Requires less DNA and fewer cells than other methods, and can be used for either transient or stable transformation

### Advantages of particle bombardment for in vitro and in vivo gene transfer:

- Method is easy to use, rapid, and versatile
- Transient or stable expression is possible
- Small amounts of nucleic acid and few cells are required for efficient transformation
- No carrier DNA is needed and no extraneous genes or proteins are delivered
- Codelivery of multiple plasmids and high levels of cotransformation are possible
- Large DNA fragments may be transferred as well as small interfering RNAs (siRNAs) for gene silencing
- Many cell types can be transfected, including nondividing cells and plants
- Potentially toxic treatments (such as from viruses or chemical- and lipid-based systems) are avoided

### Applications

#### Plant Systems

Biolistic technology is especially useful for cells and tissues that are refractory to other transformation methods, such as the agriculturally important monocotyledonous plants. Seedlings, embryos, cultured cells, leaves, epidermal tissues, apical meristems, and floral tissues are among the many targets that have been transformed.

#### Animal Systems

Particle bombardment has been used successfully for the transformation of intact animal tissues, animal cells in culture, and animal embryos. Particle delivery is a convenient method for transforming these sensitive cells since little pre- or postbombardment manipulation is necessary.

#### Other Biological Systems

Biolistic technology has been applied to targets as diverse as chloroplasts, mitochondria, bacteria, fungi, algae, and pollen.

The Helios gene gun has been used to further our understanding of cancer, infectious disease, and wound healing; to generate immune responses in animals; and to assay gene expression and regulation both in vivo and in vitro.

For more information on biolistic applications and protocols, visit us on the Web at [www.bio-rad.com/biolistics/](http://www.bio-rad.com/biolistics/)

For a current list of articles citing biolistic technology, visit the citations library on Bio-Rad's Gene Expression Gateway at [www.bio-rad.com/genomics/citations/](http://www.bio-rad.com/genomics/citations/)

## PDS-1000/He System

The PDS-1000/He system uses a high-pressure helium pulse and a partial vacuum to propel coated microparticles toward target cells in a bombardment chamber. The vacuum reduces the frictional drag of the particles as they are accelerated, while the use of rupture disks that burst at a defined helium pressure provides safe, reproducible, and clean particle acceleration. Using this system, thousands of cells can be transformed simultaneously.

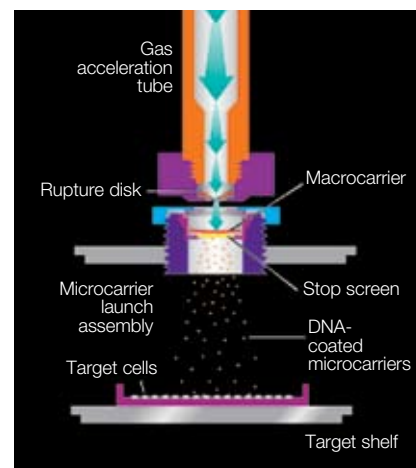
### How the PDS-1000/He System Works

- The sample to be transformed is placed in the bombardment chamber, which is evacuated to subatmospheric pressure
- The instrument is fired; helium flows into the gas acceleration tube and is held until the specific pressure of the rupture disk is reached
- The disk bursts, and the ensuing helium shock wave drives the macrocarrier disk (which carries the coated microparticles) a short distance toward the stopping screen
- The stopping screen retains the macrocarrier, while the microparticles pass through the screen into the bombardment chamber and penetrate the target cells

The launch velocity of microcarriers depends on a number of adjustable parameters: the helium pressure (rupture disk selection, 450–2,200 psi), the amount of vacuum, the distance from the rupture disk to the macrocarrier, the distance from the microcarrier launch assembly to the stopping screen, and the distance between the stopping screen and target cells. Adjusting these parameters allows you to produce a range of velocities to optimally transform many different cell types.

### System Components and Accessories

The PDS-1000/He system includes the bombardment chamber (main unit), connective tubing for attachment to vacuum source, and all components (helium regulator, solenoid valve, and connective tubing) necessary for attachment and delivery of high-pressure helium to the main unit. Rupture disks, macrocarriers, microcarriers, and stopping screens must be purchased separately. An optimization kit containing samples of the different sizes of microcarriers and rupture disks is also available. This kit allows you to try several experimental conditions to determine exactly the conditions that are optimal for your cells.



**Schematic representation of the PDS-1000/He system upon activation.** The arrows indicate the direction of helium flow.



**The PDS-1000/He system, shown here with magnified view of the Hepta adaptor.**

## Helios Gene Gun Specifications

Functional	
Maximum current	10 mA peak
Voltage input	9 V alkaline battery, replaceable
Battery life	1,000 discharges in continuous use
Gas pressure	600 psi maximum helium
Safety relief pressure	700 ± 35 psi at regulator assembly
Regulator adjustment	800 psi limit maximum
Discharges	12 per cylinder, mechanical indexing
Environmental	
Operating conditions	10–32°C (50–90°F); 30–80% humidity
Storage conditions	0–60°C (32–110°F); 10–90% humidity
Physical	
Construction	Super epoxy or polycarbonate
Cylinder	Acetal
Barrel liner	Ryton
O-rings	Viton
Dimensions	20 x 25 cm (8 x 10"; approximate)
Weight	1.42 kg (3.15 lb)

## PDS-1000/He Specifications

Mechanical	
Fuse	1.0 A, 250 V, 5 x 20 mm
Vacuum	<0.4" Hg/min leakage
Overpressure	0.5 psi relief valve, self-resetting
Environmental	
Operating conditions	0–35°C (32–95°F); 0–95% noncondensing humidity
Storage conditions	0–70°C (32–158°F); 0–95% noncondensing humidity
Physical	
Construction	Aluminum, ABS plastic, and acrylic chassis
Input power	100–120 VAC, 50–60 Hz
Maximum current	<5 A
Dimensions (W x D x H)	29 x 25.5 x 47.5 cm
Weight	15 kg

## Ordering Information

Catalog #	Description
<b>Helios Gene Gun System and Accessories</b>	
165-2431	<b>Helios Gene Gun System</b> , 100/120 V, includes Helios gene gun kit, helium hose assembly, helium regulator, tubing prep station, syringe kit, tubing cutter, Helios gene gun optimization kit, instructions
165-2432	<b>Helios Gene Gun System</b> , 220/240 V
165-2411	<b>Helios Gene Gun Kit</b> , includes gene gun unit, 5 O-rings, 5 barrel liners, 5 white cartridge holders, cartridge extractor tool, 9 V battery
165-2412	<b>Helium Hose Assembly</b> , with Swagelok quick-connect fittings
165-2413	<b>Helium Regulator</b> , CGA 580 female fitting (US standard), with pressure relief valve; maximum pressure 2,600 psi
165-2418	<b>Tubing Prep Station</b> , 100/120 V, includes tubing support cylinder, power cord, O-rings, tubing prep unit, 12' Nalgene nitrogen regulator hose, two 3/16" barb-to-male Luer-Lok fittings, nitrogen flowmeter fitting, two 1/8" barb-to-male Luer-Lok fittings, 5/64" Allen wrench, 10 ml syringe holder
165-2421	<b>Syringe Kit</b> , includes syringe adaptor tubing, silicone, 5', 0.104" ID x 0.192" OD, five 10 ml syringes, syringe adaptor fitting, five 1/8" barb-to-female Luer-Lok fittings
165-2422	<b>Tubing Cutter</b> , includes tubing cutter unit and 10 razor blades
165-2424	<b>Helios Gene Gun Optimization Kit</b> , includes 0.25 g 0.6 µm gold microcarriers, 0.25 g 1.0 µm gold microcarriers, 0.25 g 1.6 µm gold microcarriers, cartridge kit
<b>PDS-1000/He and Hepta Systems and Accessories</b>	
165-2257*	<b>PDS-1000/He System</b> , includes helium pressure regulator, solenoid, spacer rods, microcarrier launch assembly, target shelf, 5 macrocarrier holders, tubing, instructions
165-2258*	<b>PDS-1000/He Hepta System</b> , includes PDS-1000/He system, Hepta adaptor
165-2225	<b>Hepta Adaptor for PDS-1000/He System</b> , includes 5 stopping screens
165-2259	<b>Voltage Converter</b> , for 220 V or 240 V line voltage
165-2278	<b>500 Optimization Kit</b> , includes 0.25 g each of 0.6 µm, 1.0 µm, and 1.6 µm gold microcarriers, 100 each of 9 rupture disks, 500 macrocarriers, 500 stopping screens
165-2335	<b>Macrocarriers</b> , 500
165-2336	<b>Stopping Screens</b> , 500
165-2262	<b>0.6 µm Gold Microcarriers</b> , 0.25 g
165-2326	<b>450 psi Rupture Disks</b> , 100

\* Required items for operation (in addition to PDS-1000/He system): helium tank, grade 4.5 (99.995% pure) or better, pressurized to 2,600 psi, vacuum source.

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