



Biolistic[®] Particle Delivery System

Bibliography

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Introduction

The Biolistic system is an instrument for the delivery of genetic substances directly into intact cells and tissues.

The Biolistic process has been used to successfully transform both agricultural and non-agricultural plants, animal cells, insect and fish embryos, algae, fungi, pollen, bacteria, and intracellular organelles.

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Reference Tables

Table 1. Stable Transformation of Plants by the Biolistic Process

Plant Species	Tissue Bombarded	Plants Recovered?	Reference
<i>Arabidopsis</i>	roots	yes, progeny	81
Bean	meristems	yes, progeny	69
Cotton	meristem	yes, progeny	53
Cranberry	stems	yes	82
<i>Liriodendron</i>	embryogenic culture	yes	103
Maize	suspension culture	non-regenerable*	43
	embryogenic culture	yes	28, 29
	embryos	yes, field test	47
Oat	embryogenic callus	yes, progeny	85
Orchid	protocorm	yes	48
Papaya	somatic embryos	yes	24
<i>Picea</i>	embryogenic callus	yes	22
	somatic embryos	no	68
<i>Populus</i>	cultured nodules	yes	56
Rice	embryos	yes	12
	embryogenic callus	yes, progeny	50
Sorghum	suspension culture	no	30
Soybean	embryos	not attempted	14
	apical meristem	yes	15, 59
Sugarcane	embryogenic callus	yes	6
Sweet Potato	leaves	no	65
Tobacco	suspension culture	non-regenerable*	42, 70, 71
	leaves	yes	42, 95
	leaves, chloroplasts	yes, progeny	88, 89
Wheat	embryogenic callus	yes, progeny	98

* Plants can not be regenerated from these lines of suspension culture cells even prior to bombardment.

Table 2. Transient expression of DNA delivered into various plant tissues by the Biolistic process*

Tissue Type and Species	Reporter Gene (Promoter/coding region)	Reference
Tissue Culture Cells		
Tobacco	35S/GUS	41, 42, 59
	35S/LUC	59
	35S/CAT	18
	chloroplast promoter/CAT ^{††}	18
Soybean, Wheat, Rice	Adh/GUS or 35S/CAT	57, 61, 100
Corn	Adh/GUS	41, 100
	35S/CAT	39
	PAT/GUS	7
Barley	35S/CAT	36
	GUS, NPTII	58
<i>Larix</i>	GUS	21
<i>Picea</i>	35S/GUS	9
	EM/GUS	9
Leaves		
Tobacco	35S/GUS	42, 96
Corn	35S/R [†]	51
Wheat	Adh/GUS	61
Seedlings (various tissues)		
Corn	35S/R	51
Eggplant	35S/luciferase	59
Rice, Barley, Oats, Cucumber, Tobacco, <i>Arabidopsis</i>	35S/CAT, maize ubiquitin/LUC, or rice phytochrome/CAT	7
Seed Tissues		
Corn aleurone or embryo	Adh/GUS	41, 61
	35S/GUS or R	51
	Adh/LUC or CAT	45
	<i>Bz1</i> or <i>A1</i> [§] /LUC	28, 45
	<i>A1</i> or <i>Bz1</i> genomic clones**	45
Barley embryos	35S/CAT	36
Corn, Rice embryos	Adh/GUS	8
Wheat, apical	Adh/GUS	61
Epidermal Tissues		
Onion	35S/CAT	46
Corn	35S/R	51

Table 2 continued

Tissue Type and Species	Reporter Gene (Promoter/coding region)	Reference
Floral Tissues		
Tobacco anthers or petals	35S/GUS	96
Wheat meristem		49
Pollen and Microspores		
Tobacco	Pollen promoter or 35S/GUS	96
Barley	Viral mediated, wheat dwarf virus	61, 99
Organelles		
Tobacco chloroplast	Chloroplast Promotor or 35S/GUS	18

Footnotes to Table 2:

- * Abbreviations: 35S, 35S promoter from cauliflower mosaic virus; Adh, promoter from the Alcohol dehydrogenase 1 gene of maize; GUS, β -glucuronidase; CAT, chloramphenicol acetyltransferase; LUC, luciferase; NPTII, neomycin phosphotransferase II.
- † The R gene from maize is one of the regulatory genes of the anthocyanin biosynthetic pathway. Production of the product of the R gene in cells of mutants lacking a functional R gene results in expression of the pathway and therefore pigment production in the affected cell.
- § A1 and Bz1 are structural genes of the maize anthocyanin biosynthetic pathway.
- ** Introduction of the A1 or Bz1 genomic clones into tissue from the appropriate mutant plant results in pigment production in bombarded cells.
- †† Construct specifically expressed in the chloroplast.

Table 3. Transformation of organisms other than higher plants by the Biolistic process

Cell Type and Intracellular Location	Marker	Reference
Animal Cells		
NIH 3T3	neomycin	33, 109
CHO, lymphocytes	ADH, β -gal, neomycin	25
mouse ear	HGH	90
mouse ear, liver, skin	actin/luciferase	35
Insect Embryos		
<i>Drosophila melanogaster</i>	β -gal	2
Algae		
<i>Chlamydomonas reinhardtii</i>	arginosuccinate lyase	19
<i>Chlamydomonas reinhardtii</i>	nitrate reductase	38
<i>Chlamydomonas reinhardtii</i>	oxygen evolving enhancer	18
<i>Chlamydomonas reinhardtii</i>	neomycin, kanamycin	52
<i>Chlamydomonas reinhardtii</i>	<i>dum1</i>	66
<i>Chlamydomonas reinhardtii</i> , chloroplasts	<i>atpB</i>	3, 4, 5
<i>Chlamydomonas reinhardtii</i> , chloroplasts	<i>petD/GUS</i>	73
<i>Chlamydomonas reinhardtii</i> , chloroplasts	<i>atpB</i>	86
Fungi:		
<i>Saccharomyces cerevisiae</i>	<i>ura3</i>	1, 34
<i>Saccharomyces pombe</i>	<i>leu1</i> or <i>ura4</i>	1
<i>Neurospora crassa</i>	<i>qa2</i>	1
<i>S. cerevisiae</i> , mitochondria	<i>oxi1</i>	26
<i>S. cerevisiae</i> , mitochondria		34
<i>Podospora anserina</i> , mitochondria	Premature senescence	17
<i>Cryptococcus neoformans</i>	<i>ade2</i>	94
Bacteria		
<i>Bacillus megaterium</i>		83
<i>Agrobacterium tumefaciens</i>	antibiotics	84
<i>Erwinia</i>	antibiotics	84
<i>Escherichia coli</i>	antibiotics	84
<i>Pseudomonas</i>	antibiotics	84

Bibliography

This bibliography is a listing of references in scientific literature citing microprojectile bombardment.

Reviews	33 , 37, 40, 44, 60, 62, 63, 64, 74, 75, 76, 77, 78, 79, 93, 102, 110
Algae	3, 4, 5, 19, 38, 52, 66, 73, 86
Bacteria	83, 84
Fish Embryos	107
Fungi	1, 17, 26, 34, 92, 94
Insect Embryos	2
Mammalian Cells	25, 33, 35, 76, 90, 93, 104, 108, 109
Onion	46
Orchid	48
Organelles	
Chloroplasts	3, 4, 18, 31, 106
Mitochondria	26, 34
Plants	
<i>Arabidopsis</i>	7, 80, 81
<i>Brassica</i>	77
Barley	7, 16, 36, 58
Bean	69
Cotton	53
Cucumber	7
Eggplant	59
Maize	8, 27, 28, 29, 39, 41, 43, 45, 47, 51, 61, 67, 101
Millet	91
Oat	7, 85
Pollen/Microspores	16, 55, 96
Rice	7, 8, 12, 50, 57, 61, 99, 100, 105
Sorghum	30
Soybean	11, 13, 14, 15, 54, 55, 99, 100
Sugarcane	6
Sweet Potato	65
Tobacco	18, 32, 42, 59, 70, 71, 72, 88, 89, 95
Wheat	10, 49, 61, 96, 97, 98, 99
Woody Species	
Cranberry	82
<i>Larix</i>	21
<i>Liriodendron</i>	103
Papaya	24
<i>Picea</i>	9, 22, 23, 68
<i>Pinus</i>	87
<i>Populus</i>	56

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