

Boyce Thompson Institute for Plant Research

Intellectual Property Technology Report

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Office of Intellectual Property

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Baculovirus Cloning, Biopesticides, & Related Products

BTI-47A

In re Application of: Gary W. Blissard
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,858,205
Serial No.: 09/925,365
Filed: August 9, 2001
Priority date: August 11, 2000 (Ser. No. 60/224,612)
For: **A GP64NULL BACULOVIRUS PSEUDOTYPED WITH VSV G-PROTEIN**

Status

Issued.

Related Files or Patent Applications

Pending PCT Application (Ser. No. PCT/US01/25047), filed on August 10, 2001.

Summary of Technology

This application discloses a pseudotyped baculovirus comprising a deletion, inactivation or reduction from regulation of a baculovirus envelope protein gene, and is engineered to express an envelope protein from another virus or cell, or another protein or molecule that facilitates entry of said baculovirus into a non-host cell, or provided with a heterologous envelope protein or another protein or molecule that facilitates entry of said baculovirus into a non-host cell by other suitable means. Such baculoviruses can be used to efficiently deliver genes to mammalian cells or organisms, and such genes can be expressed either from the baculovirus genome, or integrated into the mammalian cell genome, and can be used for expression of proteins such that purification of secreted or other protein products does not require removal of contaminating baculovirus particles or baculovirus envelope proteins.

Claim Coverage

The claims generally are directed to a genetically engineered baculovirus, comprising a deletion, inactivation or reduction from regulation of an envelope protein gene of a progenitor baculovirus, from which said engineered baculovirus is derived, wherein said genetically engineered virus is supplied with a heterologous envelope protein or a protein or other molecule that facilitates entry of said engineered baculovirus into a cell that is not normally a host of said progenitor baculovirus, by expression of said heterologous envelope protein in a cell line and subsequent infection of said cell line with said engineered baculovirus, or by further engineering said baculovirus to express said heterologous envelope protein, or by other suitable means.

BTI-39

In re Application of: Robert Granados, Ping Wang
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,187,558
Serial No.: 09/103,429
Filed: June 24, 1998
Priority date: NA
For: **INVERTEBRATE INTESTINAL MUCIN cDNA AND RELATED PRODUCTS AND METHODS**

Status

Patent issued February 13, 2001.

Related Files or Patent Applications

PCT Application (Ser. No. PCT/US99/14220), filed on June 23, 1999, entered the National Phase in Canada on June 23, 1999; a continuation-in-part application was filed on April 19, 1999 (BTI-39CIP), incorporating new matter pertaining to additional mucin proteins. The CIP application is on Appeal at the USPTO; the Canadian application is pending.

Summary of Technology

This patent discloses a novel insect intestinal mucin comprising two nearly identical isoforms, IIM14 and IIM22 respectively. These isoforms of the IIM protein have been identified and cloned using *T. ni* larvae. The cDNA and amino acid sequences have been determined and are disclosed. Both IIM isoforms have an approximate molecular mass of 400 kDa. These sequences are useful for the production of transgenic or recombinant vectors including viral, microorganism cell, plant, or animals, wherein the virus, microorganism, cell, plant, or animal is the product of an insertion of a gene expression vector including a DNA that encodes an IIM protein sequence. Also useful is a purified and isolated recombinant DNA sequence comprising a DNA sequence that codes for an IIM protein. The recombinant DNA sequence used can be a cDNA sequence for either IIM isoform IIM14 or IIM22. The invention also provides for the use of the purified amino acid sequences of IIM isoforms IIM14 or IIM22. With this knowledge of the proteinaceous components of the PM, and particularly the mucin-like proteins it will be possible to enhance the effectiveness of bio-engineered pesticides, recombinant viral vectors, enhance the defenses of transgenic plants, or protect insect vectors susceptible to attack by organisms utilizing enhancin or enhancin-like enzymes.

Claim Coverage

The claims generally are directed to an isolated polynucleotide encoding an invertebrate intestinal mucin.

BTI-35

In re Application of: Robert R. Granados and Yoshifumi Hashimoto
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,475,090
Serial No.: 07/971,624
Filed: November 4, 1992
Priority date: February 21, 1989 (Ser. No. 07/313,226)
For: **GENE CODED FOR A POLYPEPTIDE WHICH ENHANCES VIRUS
INFECTION OF HOST INSECTS**

Status

Patent issued December 12, 1995.

Related Files or Patent Applications

PCT Application (Ser. No. PCT/US96/13645), filed on August 23, 1996, entered the National Phase in Canada; the Canadian application is pending.

Summary of Technology

This patent discloses baculovirus genes encoding polypeptides termed enhancins. The polypeptides are isolated from the occlusion body of certain baculoviruses, such as *Trichoplusia ni* granulosis virus and *Pseudaletia unipuncta* granulosis virus, Hawaiian strain. The polypeptides have the ability of enhancing the infectivity of baculoviruses and are useful ingredients of pest control compositions.

Claim Coverage

The claims generally are directed to an isolated and purified enhancin found in granulosis viruses obtained from within the vital occlusion body, the enhancin retaining the physical, chemical and biological properties of the enhancin of FIG. 3 or the PuGV DNA of FIG. 6, the enhancin purified by centrifugation and chromatography on a Sephacryl column and displays on a SDS-PAGE analysis no multiple bands and has a disruptive effect on the insect peritrophic membrane proteins and/or interacts with the midgut epithelium in such a manner as to effect the increased absorption, penetration, and uptake of virus by midgut cells with a concomitant increase in host mortality, the percent increase in mortality exceeding 50% when 10 ng of the enhancin per larvae is mixed with *Autographa californica* nuclear polyhedrosis (AcMNPV) inoculum for infection of *Trichoplusia ni* larvae.

BTI-34D1

In re Application of: Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,011,685
Serial No.: 07/580,083
Filed: September 10, 1990
Priority date: April 6, 1988 (Ser. No. 07/178,259)
For: **BACULOVIRUS PROTEINS AND VIRAL PESTICIDES CONTAINING
SAME**

Status

Patent issued April 30, 1991.

Related Files or Patent Applications

BTI-34 (issued); BTI-34CAN (issued).

Summary of Technology

This patent discloses Nuclear Polyhedrosis Viruses, for example, *Autographa californica* Nuclear Polyhedrosis Virus (AcMNPV), that are useful in the control of lepidopterous larvae, such as the larvae of the cabbage looper *Trichoplusia ni*, and have been found to have enhanced infectivity, when mixed with certain proteins obtained from the granulin fraction of *Trichoplusia ni* Granulosis Virus (TnGV) or *Heliothis armigera* Granulosis Virus (HaGV), and from the polyhedrin fraction of AcMNPV viruses. The proteins from the TnGV granulin fraction have molecular weights of about 101 and about 104 Kda. The enhanced infectivity is correlated to biochemical and structural changes in the *T. ni* peritrophic membrane.

Claim Coverage

The claims generally are directed to viral pesticide comprising a nuclear polyhedrosis virus and a viral factor that enhances infectivity, the factor comprising a baculovirus protein free of occlusion bodies, which protein breaks down the physical structure of the peritrophic membrane of lepidopterous larvae through the degradation of structural glycoproteins.

BTI-32

In re Application of: Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,717,069
Serial No.: 701846
Filed: August 23, 1996
Priority date: August 24, 1995 (Ser No. 60/002,743)
For: **DNA SEQUENCE CODING FOR ENHANCIN POLYPEPTIDE WHICH ENHANCES VIRUS INFECTION OF HOST INSECTS**

Status

Patent issued February 10, 1998.

Related Files or Patent Applications

BTI-32AUS (issued); pending National applications in Brazil (32BZL), Canada (32CAN), Europe (32EPO) and Japan (32JPN).

Summary of Technology

This patent discloses an isolated and cloned DNA from a granulosis virus which comprises an amino acid sequence of the vital gene encoding a polypeptide isolated from occlusion bodies of certain baculoviruses and which polypeptide possesses the biological activity of enhancing baculovirus infectivity. Such proteins termed as "enhancins" are found within the viral occlusion body, have a disruptive effect on the insect peritrophic membrane (PM) proteins, and/or interact with the midgut epithelium in such a manner as to permit the increased adsorption, penetration and uptake of virus particles by midgut cells with a concomitant increase in host mortality. Disclosed is a recombinant DNA sequence, which codes for the enhancin protein of the *Helicoverpa armigera* Granulosis Virus.

Claim Coverage

The claims generally are directed to an isolated DNA sequence selected from the group consisting of: a) a DNA sequence which codes for the amino acid sequence of SEQ ID NO. 2; b) a DNA sequence having the sequence of SEQ ID NO. 1; c) a DNA sequence which codes for the residue 1-550 amino acid sequence of SEQ ID NO. 2; and d) a DNA sequence which codes for the residue 551-901 of amino acid sequence of SEQ ID NO. 2.

BTI-31

In re Application of: Gary W. Blissard and Scott C. Monsma
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,750,383
Serial No.: 645,863
Filed: May 14, 1996
Priority date: NA
For: **BACULOVIRUS CLONING SYSTEM**

Status

Patent issued May 12, 1998.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses a novel baculovirus cloning system. The new cloning system is a marker-rescue system, using an essential gene, *e.g.*, *gp64*. In this system, a gene essential for viral replication, growth, or propagation in cell culture is removed from or inactivated in the viral genome. Once a null baculovirus is created, it is propagated in a host cell that expresses the essential protein or a functional homolog. For cloning into the baculovirus containing the null-mutation, the virus is used to infect wild type host cells and the same cells are transfected with a plasmid that contains the essential gene, or a functional homolog, linked to a foreign gene under the control of a selected promoter. The baculovirus is "rescued" by the rescue gene linked to the foreign gene and is able to propagate normally and express the foreign gene. The recombinant "rescued" baculovirus can be used for gene expression, biological control or presentation of a foreign protein on the surface of the virus for vaccines and antibody production. As an example of this new cloning system, disclosed are recombinant baculoviruses that contain an insertionally inactivated or deleted *gp64 efp* gene, a gene that encodes a protein essential for viral infectivity and propagation in cell culture and in animals. To generate the virus the GP64 EFP protein was supplied in *trans*, from a stably transfected cell line. Homologous recombination was then used to generate inactivated *gp64 efp* genes in the context of otherwise wild type AcMNPV baculoviruses.

Claim Coverage

The claims generally are directed to a method of cloning DNA into a nuclear polyhedrosis virus.

BTI-15 CIP

In re Application of: Raymond J. St.Leger, Donald W. Roberts, Richard C. Staples
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,962,765
Serial No.: 08/382,505
Filed: February 2, 1995
Priority date: August 2, 1991 (Ser. No. 07/739,645)
For: **MOLECULAR CLONING OF A COMPLIMENTARY DNA SEQUENCE
ENCODING A CUTICLE DEGRADING PROTEASE PRODUCED BY
ENTOMOPATHOGENIC FUNGI**

Status

Patent issued October 5, 1999.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses the structure and regulation of the extracellular chymoelastase protease (Pr1) of *Metarhizium anisopliae*, an enzyme involved in the penetration of insect cuticle by *Metarhizium* and other entomopathogenic fungi. The patent discloses the isolation and characterization of a Pr1 cDNA clone with a full-length insert. The genes coding for chymoelastase or slightly altered versions thereof, can be used to transform various organisms (*i.e.*, fungi, viruses, plants, bacteria, *etc.*) such that the transformed organisms are capable of producing chymoelastase in recoverable quantities. Fragments and derivatives of a DNA sequence coding for a chymoelastase could be used to code for a polypeptide having an activity which can: a) bind to insect cuticle; b) enhance signal processing of proteins; c) hydrolyze polypeptides; d) suppress protease expression; or e) be used as a probe to identify homologous genes in organisms. While chymoelastases and Pr1 have been previously isolated, new and novel uses for chymoelastase are disclosed, wherein the chymoelastase is used to selectively degrade protein in the presence of non-protein polymers. A new insecticide is disclosed which comprises a recombinant virus, microorganism, cell, plant or fungi infects, is eaten by or otherwise taken up by, an insect and expresses the enzyme Pr1 within the insect such that Pr1 activates a prophenoloxidase system within the insect.

Claim Coverage

The claims generally are directed to a recombinant virus, microorganism, cell, plant, or fungus, including a DNA sequence that encodes a chymoelastase enzyme, protein Pr1.

Insect Cell Lines, Protein Expression And Related Processes

BTI-44

In re Application of: Gary W. Blissard, Robert R. Granados, Guangyun Lin
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 09/518,763
Filed: March 3, 2000
Priority date: NA
For: **STABLE CELL LINE RESISTANT TO APOPTOSIS AND NUTRIENT STRESS AND METHOD OF MAKING SAME**

Status

Allowed (awaiting Notice of Allowance).

Related Files or Patent Applications

Pending PCT Application (Ser. No. PCT/US01/06846), filed July 15, 2000.

Summary of Technology

This application discloses cell lines commonly used for protein expression, which are engineered to express genes that encode suppressors of apoptosis (SA) (cell lines Sf9P35AcV5-1 and Sf9P35AcV5-3). Insect cell lines expressing these SA genes are resistant to apoptosis or programmed cell death, and express certain recombinant proteins at increased levels. These cell lines also have increased resistance to many types of stress. Because some of the SA proteins inhibit apoptosis in a wide spectrum of organisms, these genes may be inserted into other plant or animal cell lines for a variety of purposes involving resistance to apoptosis or resistance to stress.

Claim Coverage

The claims generally are directed to an Sf9 cell line engineered to express AcMNPV p35.

Interested Parties or Potential Licensees

Under MTA evaluation by two companies.

BTI-42

In re Application of: Alan Wood
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,261,805
Serial No.: 09/353,897
Filed: July 15, 1999
Priority date: NA
For: **SIALYLATION OF N-LINKED GLYCOPROTEINS IN THE
BACULOVIRUS EXPRESSION VECTOR SYSTEM (BEVS)**

Status

Patent issued July 17, 2001.

Related Files or Patent Applications

Pending PCT Application (Ser. No. PCT/US00/19109), filed July 15, 2000, and continuation-in-part application (Ser. No. 09/714,805), filed on November 17, 2000, both of which incorporate new matter teaching that terminal sialylation occurs in normal gravity with the addition of dexamethasone or N-acetylmannosamine to the culture media.

Summary of Technology

This patent discloses a novel approach to protein preparation in the baculovirus expression vector system (BEVS). Specifically, the invention analyzes the effects of microgravity/low shear on complex glycosylation of proteins prepared via BEVS, including the addition of terminal sialic acid residues to N-linked oligosaccharides.

Claim Coverage

The claims generally are directed to methods of expressing a recombinant gene in an insect cell line by using a baculovirus expression system, comprising the steps of: a) culturing cells for use in the baculovirus expression system; b) infecting the cells with a recombinant baculovirus that expresses the recombinant gene encoding a recombinant protein that would normally have N-linked glycosylation if expressed in the source organism of the recombinant gene; and c) culturing the infected cells in a microgravity environment, in a medium that includes serum.

BTI-33

In re Application of: Ping Wang and Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,686,305
Serial No.: 806,193
Filed: February 26, 1997
Priority date: NA
For: **ESTABLISHMENT OF NEW CELL LINES FROM PSEUDALETIA UNIPUNCTA WITH DIFFERENTIAL RESPONSES TO BACULOVIRUS**

Status

Patent issued April 5, 1994.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses the establishment of a new cell line from *Pseudaletia unipuncta* embryos. This cell line demonstrated the ability to produce high numbers of baculoviruses in cell culture. These virus particles are found internally in the cells in occlusion bodies. In the study of *Pseudaletia unipuncta*, two baculoviruses were found to infect this species: *P. unipuncta* nuclear polyhedrosis virus (PuNPV), and *P. unipuncta* granulosis virus (PuGV). In addition, the cell line was also selected and cultured for its ability to grow in suspension while maintaining high levels of OB production.

Claim Coverage

The claims generally are directed to an insect cell line established from embryonic egg cells from an insect from the order Lepidoptera which is designated BTI-Pu-527A7S and has been deposited under the accession number ATCC CRL 12285 and has the following characteristics: a) supports replication of virus, b) supports expression of protein after infection by a recombinant virus in a serum containing medium, c) can grow in suspension and/or shaker flask cell cultures; and d) grows in the serum containing medium and retains the ability to support replication of virus and to support expression of protein.

BTI-26

In re Application of: Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,300,435
Serial No.: 08/294,953
Filed: August 24, 1994
Priority date:
For: **TRICHOPLUSIA NI CELL LINES WHICH SUPPORT REPLICATION OF BACULOVIRUSES**

Status

Issued.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses insect cell lines derived from *Trichoplusia ni* (cabbage looper) (BTI-TN-4B and 4B3-1). The cell lines are susceptible to various baculoviruses, including TnSNPV and AcMNPV, and may be used to replicate such viruses for use as insecticides or otherwise.

Claim Coverage

The claims generally are directed to an isolated homogeneous cell line from *Trichoplusia ni*, having all the identifying characteristics of BTI-TN-4B or BTI-TN-4B3-1.

BTI-22

In re Application of: Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,300,435
Serial No.: 938,821
Filed: December 1, 1992
Priority date: September 16, 1991 (Ser. No. 07/760,697)
For: **TRICHOPLUSIA NI CELL LINE WHICH SUPPORTS REPLICATION OF BACULOVIRUSES**

Status

Patent issued April 5, 1994.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses an insect cell line derived from embryonic tissue (BTI-TN-5B1-4, ATCC CRL 10859) of *Trichoplusia ni* (cabbage looper). The cell line is susceptible to various baculoviruses, including TnSNPV and AcMNPV, and may be used to replicate such viruses for use as insecticides or otherwise.

Claim Coverage

The claims generally are directed to an isolated homogeneous cell line from the eggs of *Trichoplusia ni*, having all the identifying characteristics of BTI-TN-5-B1-4, ATCC CRL 10859.

Interested Parties or Potential Licensees

Widely non-exclusively licensed with one exclusive field of use for Human Papilloma Virus vaccine production.

BTI-20

In re Application of: Kevin A. McKenna and Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,348,877
Serial No.: 08/029,274
Filed: March 12, 1993
Priority date: NA
For: **METHOD OF ADAPTING ANCHORAGE-DEPENDENT CELL LINES TO
SUSPENSION CONDITIONS**

Status

Patent issued September 20, 1994.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses that normally anchorage-dependent insect cell lines are adapted to replicate under suspension conditions by addition of heparin to the culture medium and selection for resulting suspension-tolerant cells.

Claim Coverage

The claims generally are directed to a method of establishing a suspended cell line from an anchorage-dependent insect cell line comprising the steps of: a) providing a culture of normally anchorage-dependent cells in a culture medium, b) adding heparin to the culture medium of the anchorage dependent cell line, c) selecting the cells which are in suspension after the addition of heparin, d) subculturing the cells which were selected in step c) to a fresh culture medium containing heparin, e) repeating steps c) and d) until a suspended cell line is established.

Interested Parties or Potential Licensees

Non-exclusively licensed to Invitrogen, but still available for license with cell lines.

BTI-17

In re Application of: Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,298,418
Serial No.: 839,918
Filed: February 21, 1992
Priority date: September 16, 1991 (Ser. No. 07/760,697)
For: **CELL LINE ISOLATED FROM LARVAL MIDGUT TISSUE OF
TRICHOPLUSIA NI**

Status

Patent issued March 29, 1994.

Related Files or Patent Applications

BTI-17CAN (issued); European national registrations filed in 7 countries; BTI-17MEX (pending).

Summary of Technology

This patent discloses two new insect cell lines derived from midgut (BTI-TN-MG1, ATCC CRL 10860) and embryonic tissue (BTI-TN-5B1-4, ATCC CRL 10859) of *Trichoplusia ni* (cabbage looper). These cell lines are susceptible to various baculoviruses, including TnSNPV and AcMNPV, and may be used to replicate such viruses for use as insecticides or otherwise.

Claim Coverage

The claims generally are directed to an isolated cell line from the larval midgut tissue of *Trichoplusia ni*, having all the identifying characteristics of BTI-TN-MG1, ATCC CRL 10860.

Interested Parties or Potential Licensees

Non-exclusively licensed to a variety of companies. Exclusively to Medimmune Inc. for the production of a human HPV vaccine.

BTI-73PCT

In re Application of: Robert R. Granados
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: NA
Filed: November 15, 2003
Priority date: Filed November 15, 2002, 60/426,535
For: **IMPROVED CLONAL CELL LINES DERIVED FROM BTI-TN-5B1-4**

Status

Pending.

Related Files or Patent Applications

None at this time.

Summary of Technology

The invention pertains to the field of cell lines derived from insects. More particularly, the invention pertains to improved cell lines that are susceptible to baculovirus infection and are useful for replicating such viruses, and are useful for gene expression using a baculovirus expression system. Briefly stated, the invention provides new and useful cell lines from *Trichoplusia ni* (the cabbage looper), an insect species of the order Lepidoptera. The novel cell lines disclosed herein are derived from the well-known cell line BTI-TN-5B1-4 (ATC CRL 10859). An embodiment of the invention provides two new isolated homogeneous cell lines, designated H5CL-B and H5CL-F (both of which are derived from the parental cell line BTI-TN-5B1-4, ATCC CRL 10859), wherein said novel cell lines possess the properties of increased production of baculovirus particles, increased expression of foreign proteins using a baculovirus expression system, and increased resistance to cell culture stress

Claim Coverage

The claims generally are directed to an isolated cell line from the larval midgut tissue of *Trichoplusia ni*, having all the identifying characteristics of ATCC CRL 10859.

Interested Parties or Potential Licensees

Available for licensing.

High Density Insect Rearing System, Per Os Infection

BTI-21CIP

In re Application of: Patrick R. Hughes
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,351,643
Serial No.: 08/093,982
Filed: July 19, 1993
Priority date: December 11, 1992 (Ser. No. 07/989,103)
For: **HIGH DENSITY REARING SYSTEM FOR LARVAE**

Status

Patent issued October 4, 1994.

Related Files or Patent Applications

BTI-21CAN (issued); European national registrations filed in 9 countries.

Summary of Technology

This patent discloses methods and apparatus for rearing insects. Information concerning the physical and dietary needs of the insect as well as behavioral characteristics are utilized to maximize the number of larvae reared per unit surface area of diet and per unit of rearing area while minimizing the amount of labor and materials required. An enclosed rearing unit is provided which can be located within an appropriate environment for rearing the insects. There are three sections within the rearing unit: 1) a diet space, 2) a larval space, and 3) a frass space. The diet space includes an appropriate diet medium for the insects. The larval space is located below the diet space and includes a series of vertical partitions perpendicular to and in contact with or nearly in contact with the diet medium such that the insect larvae are able to disperse themselves over the partitions. The frass space is located below the larval space such that any frass collects within the frass space as it is produced and does not interfere with the larval space or the diet space. The rearing system can further include an emergence pan including an outlet for allowing emerging adults to enter an oviposition cage. The emergence pan replaces the frass collection pan when all of the larvae have pupated. The rearing unit is turned upside down such that the emergence pan is located above the larval space and the diet space.

Claim Coverage

The claims generally are directed to a method of rearing insect larvae.

Interested Parties or Potential Licensees

Exclusively licensed to Cheseapeake Perl Inc.

BTI-19 CI4

In re Application of: Alan Wood
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,090,379
Serial No.: 046293
Filed: March 23, 1998
Priority date: April 29, 1992
For: **STABLE PRE-OCCLUDED VIRUS PARTICLE FOR USE IN RECOMBINANT PROTEIN PRODUCTION AND PESTICIDES**

Status

Patent issued July 18, 2000.

Related Files or Patent Applications

BTI-19EPO (pending); BTI-19CAN (issued); BTI-19CI2 (issued).

Summary of Technology

This patent discloses a method of infecting insects is disclosed. The method utilizes a form of a baculovirus that is highly efficient at establishing infection and normally is destined to become occluded within the polyhedrin or granulin--Pre-occluded Virus (POV). Specifically, the POV as derived from a polyhedrin-minus or granulin-minus (lacking a functional polyhedrin or granulin gene) baculovirus is fed to insect larvae per os resulting in high infection rates. The stabilization and use of the POV form of polyhedrin-minus baculoviruses for recombinant protein production and as an insecticide is also disclosed.

Claim Coverage

The claims generally are directed to a method of producing recombinant protein, comprising: selecting stabilized, pre-occluded baculoviruses lacking a functional polyhedrin gene wherein the baculovirus maintains and expresses a foreign gene product but not a polyhedrin gene; using the stabilized, pre-occluded baculoviruses as an inoculum to infect insect larvae; and harvesting the infected insect larvae to collect the recombinant protein; and a method of infecting insect larvae per os with a form of a baculovirus which is highly efficient at establishing infection and is normally destined to become occluded within the polyhedrin, comprising the steps of: a. infecting an insect host larva with baculoviruses lacking a functional polyhedrin gene; b. waiting for the pre-occluded virus particles derived from the baculovirus to form in the insect host larva; c. harvesting the pre-occluded virus particles from the insect host larva prior to the liquefaction of the insect host larva; d. stabilizing the infectivity of the pre-occluded virus particles; and e. feeding the stabilized pre-occluded virus particles per os to insect larvae.

Interested Parties or Potential Licensees

Licensed exclusively

Genetically Engineered Plants, Gene Expression, Related Products

BTI-61PCT

In re Application of: Klessig and Kumar
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 956507PCT/US0226312
Filed: August 16, 2001
Priority date: NA
For: **SALICYLIC ACID-BINDING PROTEIN (SABP2) AND METHODS OF USE THEREOF**

Status

Pending. Filed PCT application August 16, 2002, selected US only on February 16, 2004.

Related Files or Patent Applications

None.

Summary of Technology

This application discloses novel nucleic acid molecules encoding SA-binding proteins involved in SA-mediated disease resistance responses are disclosed. Methods of use of the nucleic acid molecules and proteins of the invention are also provided.

Claim Coverage

The claims generally are directed to vectors, plants and seeds that are modified to include a DNA molecule that encodes an SA-binding protein, and related methods to enhance resistance of plant-to-plant pathogens or other disease causing agents.

BTI-60

Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,861,277
Serial No.: 08/723,624
Filed: October 2, 1996
Priority date: NA
For: **METHODS AND COMPOSITIONS FOR ENHANCING THE
EXPRESSION OF GENES IN PLANTS**

Status

Patent issued January 19, 1999.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses methods of increasing exogenous protein expression in a cell or a transgenic plant. Constructs, *i.e.*, vectors, DNA fusions and polynucleotides, for use in conjunction with the methods to cause increased exogenous protein expression are also disclosed. These constructs generally include intron 1 and/or intron 2 of the PAT1 gene. Additionally disclosed are cells, including recombinant cells, and plant lines transformed with the described constructs. In particular, a cultivated, transgenic food plant, the genome of which has been augmented through the genomic introduction of a preselected exogenous protein gene not found in the genome of non-transformed parentage of the plant is described. Also described are seed, progeny and cells of the described transgenic food plant.

Claim Coverage

The claims generally are directed to methods for increasing exogenous protein expression in a genetically engineered plant or cell, comprising the steps of constructing a DNA fusion comprising intron 1 or 2 of the PAT1 gene from potato operatively linked to a polynucleotide encoding a gene of interest, and introducing the fusion construct into a plant or cell, as well as vectors, cells, plants and seeds comprising the fusion construct.

BTI-55

In re Application of: Hugh S. Mason, Kenneth E. Palmer, Kathleen L. Hefferon, Tsafir S. Mor, Charles J. Arntzen
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,392,121
Serial No.: 09/414,276
Filed: October 7, 1999
Priority date: October 7, 1998 (Ser. No. 60/103,352)
For: **GEMINIVIRUS VECTORS FOR GENE EXPRESSION IN PLANTS**

Status

Issued.

Related Files or Patent Applications

Divisional abandoned

Summary of Technology

This application discloses a gene amplification system, based on plant virus genetic elements, which can dramatically increase foreign protein production in plants. A safer and more economical production system for expressing vaccines and antibodies in genetically engineered plants is described. The high-level expression system uses the replicative process of a plant mastrevirus, exemplified by bean yellow dwarf virus (BeYDV). The expression system is preferably inducible to avoid interference with plant growth and development. Developmental cues, such as fruit ripening, are employed to trigger expression of the foreign protein using a tissue-specific promoter. A single, stably integrated expression cassette for foreign protein is replicated extrachromosomally in ripening fruit, forming hundreds of transcriptionally competent copies. Preferred plant hosts include tomato as a model system and soybean for production of large quantities of protein at high total protein levels.

Claim Coverage

The claims generally are directed to vectors, plants and seeds that are modified to include one or more recombinant nucleic acid molecules that include at least a portion of a long intergenic region (LIR) of a geminivirus genome, and that lack a functional geminivirus coat protein coding sequence, and/or a recombinant nucleic acid molecule that includes a geminiviral replicase gene operably linked to a fruit ripening-dependent promoter, as well as methods of making transgenic plants and expressing foreign proteins in plants.

BTI-54PCT

In re Application of: Klessig, Krachoo and Shah
Assignee:
Patent No.: NA
Serial No.: PCT/US01/16134
Filed: May 18, 2001
Priority date: June 12, 2000 (Ser. No. 60/210,967)
For: **FATTY ACID DESATURASE GENE AND PROTEIN FOR
MODULATING ACTIVATION OF DEFENSE SIGNALING PATHWAYS
IN PLANTS**

Status

Pending.

Related Files or Patent Applications

None pending; expect to file National phase applications by December 12, 2002.

Summary of Technology

This application discloses a novel plant gene, SSI2, which encodes a stearyl-ACP desaturase in plants and plays a key role in modulating plant defense responses. Also disclosed is a FA-derived signaling molecule(s) that can be manipulated through the up- or down-regulation of the SSI2 FA desaturase, resulting in specific modifications of plant defense responses. This FA-derived signaling molecule(s) comprises at least an 18:1 FA or a derivative thereof. Mutant plants with substantially reduced SSI2 activity also are disclosed, along with transgenic plants that over- or under- express the SSI2 gene.

Claim Coverage

The claims generally are directed to plants that are modified to include a DNA molecule that encodes an SSI2, and related methods to enhance resistance of plant-to-plant pathogens or other disease causing agents.

BTI-45

In re Application of: Mor, Mason, Soreq, Arntzen
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,770,799
Serial No.: 09/810,861
Filed: March 16, 2001
Priority date: March 17, 2000 (Ser. No. 60/190,440)
For: **EXPRESSION OF RECOMBINANT HUMAN
ACETYLCHOLINESTERASE IN TRANSGENIC TOMATOES**

Status

Issued, divisional filed.

Related Files or Patent Applications

BTI-45DIV, Note: this patent is shared 50/50 with Yisum (Hebrew University). They pay _ of the related expenses.

Summary of Technology

This application discloses a method of making a transgenic plant that is capable of expressing a physiologically active human acetylcholinesterase, comprising the steps of introducing into at least one plant cell a polynucleotide that encodes a human acetylcholinesterase, and regenerating from the plant cell a transgenic plant that is capable of expressing a physiologically active human acetylcholinesterase in at least one tissue type of the transgenic plant. Another embodiment of the invention includes a method of making a physiologically active human acetylcholinesterase, comprising the steps of introducing into at least one plant cell a polynucleotide that encodes a human acetylcholinesterase, regenerating from the plant cell a transgenic plant that is capable of expressing a physiologically active human acetylcholinesterase in at least one tissue type of the transgenic plant, and isolating or purifying from the transgenic plant or a part thereof a physiologically active human acetylcholinesterase.

Claim Coverage

The claims generally are directed to vectors, cells, plants and seeds comprising a polynucleotide that encodes a human acetylcholinesterase. Currently in negotiation with ASU for a marketing agreement.

BTI-84

In re Application of: Jander and Joshi
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 60/519,313
Filed: PCT filed November 10, 2004
Priority date: November 10, 2003
For: **INCREASED SEED THREONINE CONTENT THROUGH ALTERATION
OF THREONINE ALDOLASE ACTIVITY**

Status

Pending.

Related Files or Patent Applications

This patent is also filed directly in Argentina, a non-PCT country.

Summary of Technology

The present invention discloses the identification of a mutation in a threonine aldolase (gij9802578) as the cause of high seed threonine levels in a mutant Arabidopsis line. Similar mutations or silencing of threonine aldolase gene expression could be used to increase the seed threonine levels of crop plants. Threonine is a limiting amino acid in certain grains (in particular soy) that are used as animal feed. Increased seed threonine content would eliminate the need for threonine supplementation of feed (relatively expensive) and would increase crop value.

Claim Coverage

The claims generally are directed to methods for controlling seed threonine content by alteration of threonine aldolase enzymatic activity.

Interested Parties or Potential Licensees

Exclusively option granted to Monsanto Company in exchange for payment of all related legal costs.

BTI-86

In re Application of: VanEck and Garvin
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 60/
Filed: December 17, 2004
Priority date: NA
For: **ENHANCMENT OF BETA CAROTENE IN PLANTS**

Status

Pendng.

Related Files or Patent Applications

None

Summary of Technology

The present invention relates to a nucleic acid construct configured for enhancement of beta-carotene content in plants. The inventors postulated that high zeaxanthin potato lines possess the potential to accumulate large amounts of beta-carotene in their tubers, but do not do so because of the activity of beta-carotene hydroxylase. In theory, reducing beta-carotene hydroxylase activity in such potato tubers should result in the accumulation of beta-carotene because it is the immediate precursor of zeaxanthin. RNA silencing is a means of providing specific and heritable genetic interference through the introduction into a genome of double-stranded RNA-expressing constructs (Chuang et al., "Specific and Heritable Genetic Interference by Double-Stranded RNA in *Arabidopsis thaliana*," *Proc. Nat'l. Acad. Sci. USA* 97:4985-4990 (2000); Waterhouse, et al., "Exploring Plant Genomes by RNA-Induced Gene Silencing," *Nat. Rev. Genet.* 4:29-38 (2003)). The enhancement of beta-carotene accumulation in the potato, by RNA silencing with the activity of beta-carotene hydroxylase, provides the potential of increasing vitamin A intake in developing countries, and of providing a source for increased beta-carotene intake in Western diets. The present invention is directed to overcoming these and other deficiencies in the art.

Claim Coverage

The claims generally are directed to methods for enhancing the beta carotene content in plants. Potato is an example.

Interested Parties or Potential Licensees

Fully available for license.

BTI-3

In re Application of: Leonard H. Weinstein and Arthur W. Galston
Assignee: Boyce Thompson Institute for Plant Research, Inc.; Yale University
Patent No.: 4,818,770
Serial No.: 921,543
Filed: October 22, 1986
Priority date: NA
For: **PREVENTION OF A PLANT DISEASE BY SPECIFIC INHIBITION OF FUNGAL POLYAMINE BIOSYNTHESIS**

Status

Patent issued April 4, 1989.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses that DL-alpha-Difluoromethylornithine (DFMO), an inhibitor of the polyamine biosynthetic enzyme ornithine decarboxylase (ODCase; EC 4.1.1.17), strongly retards the growth of several species of phytopathogenic fungi in vitro. Such inhibition can be completely reversed by putrescine or spermidine, confirming the essentiality of polyamines for growth of fungal hyphae. DFMO can protect a range of plants against a wide range of fungi. For example, DFMO can protect bean plants (*Phaseolus vulgaris* Linnaeus cv. Pinto) against infection by uredospores of the bean rust fungus, *Uromyces phaseoli* Linnaeus, race O. All concentrations of DFMO 0.50 mM or higher gave complete protection against the pathogen; at lower concentrations, postinoculation treatments with DFMO were generally more effective than preinoculation. The appearance of lesions on plants treated with lower concentration of DFMO was retarded 2-6 days. DFMO also conferred protection on unsprayed parts of treated plants, indicating the translocation of some protective effect from sprayed areas. DFMO has also been shown to be an effective synthetic fungicide for the following: protects tomato plants against *Verticillium* wilt fungus; protects wheat against stem rust fungus; protects wheat against powdery mildew fungus; protects Tendergreen bean plants against powdery mildew fungus; protects the McIntosh apple leaf against the powdery mildew fungus; protects Ogle oats against leaf rust fungus; and protects corn against the corn rust fungus.

Claim Coverage

The claims generally are directed to a method of protecting plants against infection by fungi by applying a fungicidally effective amount of DL-alpha-Difluoromethylornithine (DFMO) to the plants.

Banana Proteins And Regulatory Elements

BTI-58 and 58PCT (BTI-8001 and BTI-8002)

In re Application of: Gregory May and Stephanie Clendennen
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,284,946
Serial No.: 09/160,351
Filed: September 25, 1998
Priority date: September 25, 1997 (Ser. No. 60/060,062)
For: **BANANA PROTEINS, DNA, AND DNA REGULATORY ELEMENTS
ASSOCIATED WITH FRUIT DEVELOPMENT**

Status

Patent issued September 4, 2001.

Related Files or Patent Applications

PCT Application (Ser. No. PCT/US98/03343), filed on September 23, 1998; National Phase entered in Australia, Canada, Europe (regional) and Japan. A continuation-in-part application of U.S. Ser. No. 09/160,351 was filed on June 28, 2001, incorporating new matter pertaining to a promoter obtained from banana, which drives fruit-specific expression in tomato, and further pursuing divisional claims from Group II, drawn to an isolated and purified banana protein differentially expressed in developing fruit, and a composition including the protein.

Summary of Technology

This patent discloses isolated and purified genes, which are differentially expressed during banana fruit development, and the protein products of these genes. The disclosure further provides DNA regulatory elements which are differentially expressed during banana fruit development, chimeric genes comprising these DNA regulatory elements operably linked to heterologous DNA molecules, and plants transformed with the chimeric genes, providing for controlled expression of the heterologous DNA molecules during the development and ripening of the fruit of the plants, or in response to exogenous ethylene signals in the plants.

Claim Coverage

The claims generally are directed to polynucleotides and vectors (pBAN 3-6, and pBAN 3-23), cells, plants and fruits that are modified to include polynucleotides that encode a banana DNA molecule that is differentially expressed during fruit development, banana DNA regulatory elements that drive fruit-specific gene expression.

Interested Parties or Potential Licensees

Licensed but non-exclusive licenses still available in crops other than *Musa sp.*.

Plant-Defense Related Technology

BTI-70

In re Application of: Collmer, Alan; (*Ithaca, NY*); Alfano, James R.; (*Lincoln, NE*) ; Cartinhour, Samuel W.; (*Ithaca, NY*) ; Schneider, David J.; (*Trumansburg, NY*) ; Tang, Xiaoyan; (*Manhattan, KS*)

Assignee: Boyce Thompson Institute for Plant Research, Inc. and others.

Patent No.: NA

Serial No.: 365742

Filed: February 12, 2003

Priority date: February 12, 2002

For: **PSEUDOMONAS AVR AND HOP PROTEINS, THEIR ENCODING NUCLEIC ACIDS, AND USE THEREOF**

Status

Pendng.

Related Files or Patent Applications

Summary of Technology

One aspect of the present invention relates to isolated nucleic acid molecules encoding avirulence proteins or polypeptides of *Pseudomonas syringae* pv. *syringae* DC 3000, or nucleic acid molecules which are complementary thereto. Expression vectors, host cells, and transgenic plants that include the DNA molecules of the present invention are also disclosed. Another aspect relates to the isolated proteins or polypeptides and compositions containing the same. The various nucleic acid molecules and proteins of the present invention can be used to impart disease resistance to a plant, make a plant hypersusceptible to colonization by nonpathogenic bacteria, modify a metabolic pathway in a cell, cause eukaryotic cell death and treat a cancerous condition, as well as inhibit programmed cell death.

Claim Coverage

Claims are mainly based on the sequences that relate to the isolated NAs.

Interested Parties or Potential Licensees

Available for licensing. Currently being market by CRF.

BTI-71

In re Application of: Greg Martin, Rob Abramovich, Nai-Chun Lin, Young Jin Kim.
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 60/404,339
Filed: November 12, 2003
Priority date: November 12, 2002
For: **EFFECTOR PROTEINS WHICH SUPPRESS PLANT IMMUNITY BY
INHIBITION OF PROGRAMMED CELL DEATH**

Status

Pending.

Related Files or Patent Applications

The present invention claims benefit of U.S. Provisional Application Serial No. 60/404,339, filed August 16, 2002, and U.S. Provisional Application Serial No. 60/425,842, filed November 12, 2002, which are hereby incorporated by reference in their entirety.

Summary of Technology

The bacterial effector proteins of the present invention can be used to inhibit programmed cell death in eukaryotes. In particular, AvrPtoB will be a useful tool to dissect the molecular basis of plant R protein programmed cell death signaling, which presently is poorly understood. AvrPtoB anti-PCD activity may also have biotechnical applications. For example, AvrPtoB may allow efficient transgenic expression of proteins that otherwise elicit host PCD or may function to alter PCD-dependent plant developmental processes, such as senescence. Increased understanding of the complex basis of effector-mediated PCD inhibition and host mechanisms that guard against PCD inhibition, should lead to further novel insights into the molecular basis of plant immunity and disease.

Claim Coverage

The invention claims a range of uses of AvrPtoB including but not limited to its ability to inhibit programmed cell death in a broad range of organisms. This includes the use of AvrPtoB to modulate PCD in mouse and human cell types.

Interested Parties or Potential Licensees

Available for licensing.

BTI-77

In re Application of: Klessig; Daniel Frederick (Bridgewater, NJ); Chen; Zhixiang (Highland Park, NJ)
Assignee: Rutgers, The State University of New Jersey (New Brunswick, NJ)
Patent No.: 5,989,846
Serial No.: 470769
Filed: June 6, 1995
Priority date:
For: **ASSAYS TO IDENTIFY INDUCERS OF PLANT DEFENSE RESISTANCE**

Status

Issued.

Related Files or Patent Applications

This is a division, of U.S. Ser. No. 08/418,554, filed on Apr. 7, 1995, which is a Continuation-in-Part application of U.S. Ser. No. 08,259,535, filed on Jun. 14, 1994, which is a Continuation-in-Part application of U.S. Ser. No. 08/146,317, filed on Nov. 2, 1993, which in turn is a Continuation-in-Part application of U.S. Ser. No. 08/038,132, filed on Mar. 26, 1993, which is a Continuation-in-Part application Ser. No 07/923,229, filed on Jul. 31, 1992 all abandoned.

Summary of Technology

The invention relates to the fields of biochemistry and molecular biology and relates to proteins that are capable of binding salicylic acid and like compounds, methods of isolating same and their use. The present invention also relates to the cloning of genes for salicylic acid binding proteins. The present invention also relates to catalase, ascorbate peroxidase, H.sub.2 O.sub.2 and other active or reactive oxygen species derived from H.sub.2 O.sub.2 and their role in a plant's disease defense response

Interested Parties or Potential Licensees

Available for licensing.

BTI-78

In re Application of: Klessig; Daniel F. (Bridgewater, NJ); Yang; Yinong (Piscataway, NJ)
Assignee: Rutgers, The State University of New Jersey (New Brunswick, NJ)
Patent No.: 5,939,601
Serial No.: 722626
Filed: September 27, 1996
Priority date:
For: **GENES ASSOCIATES WITH ENHANCED DISEASE RESISTANCE IN PLANTS**

Status

Issued.

Related Files or Patent Applications

Summary of Technology

An isolated nucleic acid molecule is provided which encodes a tobacco myb homologue involved in the regulation of disease resistance in plants. The encoded protein comprises a basic N-terminal region with two imperfect tryptophan repeats of 53 and 51 amino acids, a potential ATP/GTP binding site or P-loop, a redox sensitive cysteine and a nuclear localization sequence. The acidic C terminus of Myb1 forms amphipathic alpha.helices, which are characteristic of transcriptional activation domains. The invention also provides novel Myb1 protein and antibodies thereto. Additionally, the invention provides novel transgenic plants with enhanced disease resistance to certain pathogens.

Interested Parties or Potential Licensees

Available for licensing. Note: This patent is part of a group of patents that BTI has acquired a 50% stake as part of a sharing arrangement made when Dr. Klessig came to the BTI.

BTI-79

In re Application of: Klessig; Daniel F. (Bridgewater, NJ); Du; He (Piscataway, NJ)
Assignee: Rutgers, The State University of New Jersey (New Brunswick, NJ)
Patent No.: 6,136,552
Serial No.: 956507
Filed: October 23, 1997
Priority date:
For: **HIGH-AFFINITY SALICYLIC ACID-BINDING PROTEIN AND METHODS OF USE**

Status

Issued.

Related Files or Patent Applications

This application claims priority from U.S. Provisional Application Ser. No. 60/029,806, filed Oct. 25, 1996 now abandoned.

Summary of Technology

A high-affinity salicylic acid-binding protein (SABP2) derivable from tobacco and Arabidopsis is disclosed. The tobacco protein has a molecular weight of approximately 25 kDa and reversibly binds SA with an apparent $K_{sub.d}$ of approximately 90 nM and a $B_{sub.max}$ of 10 fmol/mg protein. The SABP2 of the invention may be used to identify analogues of SA. Analogues so identified may be used in plants to augment disease-resistance response pathways or other SA-sensitive processes in which SA plays a role. Possible examples include flowering and alternative respiration. The SABP2 of the invention may also be used to identify and clone a gene or cDNA that encodes it, which then may be used to generate transgenic plants having altered SABP2 levels.

Interested Parties or Potential Licensees

Available for licensing. Note: This patent is part of a group of patents that BTI has acquired a 50% stake as part of a sharing arrangement made when Dr. Klessig came to the BTI.

BTI-80

In re Application of: Klessig; Daniel F. (Bridgewater, NJ); Du; He (Piscataway, NJ)
Assignee: Rutgers, The State University of New Jersey (New Brunswick, NJ)
Patent No.: 5,977,442
Serial No.: 837593
Filed: April 21, 1997
Priority date:
For: **SALICYLIC ACID INDUCED MAP KINASE AND ITS USE FOR
ENHANCED DISEASE RESISTANCE IN PLANTS**

Status**Issued.****Related Files or Patent Applications**

This application claims priority to U.S. Provisional Application Ser. No. 60/029,805, filed Oct. 25, 1996, which is incorporated by reference herein.

Summary of Technology

A salicylic acid-induced protein (SIP) kinase is disclosed. The kinase has a molecular weight of about 48 kDa and is activated in response to salicylic acid, H.sub.2 O.sub.2 and infection with tobacco mosaic virus. The activation and enzymatic properties of the purified protein have been characterized. The partial amino acid sequence and complete nucleotide sequence of a cDNA encoding the SIP kinase demonstrate that it is a unique member of the mitogen-activated protein (MAP) kinase family. The novel SIP kinase may play a critical role in signal transduction for activation of plant defenses against microbial pathogens.

Interested Parties or Potential Licensees

Available for licensing. Note: This patent is part of a group of patents that BTI has acquired a 50% stake as part of a sharing arrangement made when Dr. Klessig came to the BTI.

BTI-63

Inventors: Kipp, Peter B.; (*Houston, TX*) ; May, Gregory D.; (*Ardmore, OK*) ; Mahajan, Pramod B.; (*Urbandale, IA*) ; Baszczyński, Christopher L.; (*Urbandale, IA*) ; Zhu, Tong; (*San Diego, CA*)
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,906,243
Serial No.: 10/029,065
Filed: December 20, 2001
Priority date: NA
For: **PLANT MSH2 GENES AND METHODS OF USE THEREOF**

Status

Issued.

Summary of Technology

The invention relates to isolated nucleic acid molecules encoding MutS homologues (MSHs). Such MSH proteins are involved in DNA mismatch-repair processes in organisms. The invention provides isolated nucleic acid molecules comprising MSH2 nucleotide sequences, which encode MSH2 proteins, and MSH2 nucleotide sequences, which encode dominant-negative MSH2 variants. Such MSH2 nucleotide sequences find use in altering mismatch repair, mutation rates and recombination frequencies in both eukaryotic and prokaryotic organisms. The invention also provides isolated nucleic acid molecules comprising MSH2 promoter nucleotide sequences. Such MSH2 promoter nucleotide sequences find use in regulating the expression of genes of interest in plants. Additionally provided are isolated proteins, transformed host cells, and transformed plants, tissues, cells and seeds thereof.

Interested Parties or Potential Licensees

Licensed exclusively Pioneer Hi-bred

Plant-Expressed Vaccines And Related Products

BTI-59

In re Application of: Dwayne Kirk, Hugh S. Mason, Amanda Walmsley and Charles J. Arntzen
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 60/283,884
Filed: April 13, 2001
Priority date: NA
For: **METHODS AND COMPOSITIONS FOR STABLE TRANSGENIC PLANT PHARMACEUTICALS AND THEIR USE AS CONTRACEPTIVES**

Status

Pending.

Related Files or Patent Applications

None.

Summary of Technology

The present invention provides for processing methods that preserve pharmaceutical proteins expressed in plants. Herein raw plant tissue is reduced to a stable homogenate without significant loss of protein or pharmaceutical potency. The homogenate can be used directly for pharmaceutical purposes without the need to further extract, purify, or precipitate the pharmaceutical protein. The present invention further provides a method of effective immunocontraception for animal and human application. Methods are disclosed for producing transgenic plants or plant cells which express contraceptive proteins, and which can be delivered whole, in part, or after processing, to an animal to cause a contraceptive effect in the target species.

Claim Coverage

The claims generally are directed to methods for contraception, comprising the step of administering to an animal transgenic plant material comprising a contraceptive polypeptide, wherein the method reduces the number of offspring by at least 50%, as well as vectors, cells, plants and plant derived food products that are modified to include polynucleotides that encode the polypeptides.

Interested Parties or Potential Licensees

Exclusively licensed to Dow AgroSciences for use in Animal vaccines (non-human). DAS pays all patent costs US and foreign. Issued in some countries at this stage.

BTI-57A

In re Application of: Mason, Arntzen, Thanavala, Richter
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 6,551,820
Serial No.: 09/471,573
Filed: December 23, 1999
Priority date: December 23, 1998 (Ser. No. 60/113,827)
For: **EXPRESSION OF IMMUNOGENIC HEPATITIS B SURFACE
ANTIGENS IN TRANSGENIC PLANTS**

Status

Issued.

Related Files or Patent Applications

PCT Application (Ser. No. PCT/US99/31020), filed on December 23, 1999; National Phase entered in Australia, Brazil, Canada, China, Europe (regional), Japan, Mexico and Singapore; **BTI-52A** series co-owned with Health Research, Inc. (Roswell Park), prosecuted by Dunn & Associates.

Summary of Technology

Plant expression vectors comprising at least two expression cassettes are provided which function to reduce transcriptional silencing of polynucleotide expression. Further, novel plant expression vectors for expression of immunogenic polypeptides, including HBsAg, are provided. The plant expression vectors can be used to produce immunogenic polypeptides, including HBsAg, in edible plant tissues. The edible plant tissues can be used to elicit an immune response in humans and animals when the plant tissues are consumed.

Claim Coverage

The claims generally are directed to plants that express a HepB surface antigen.

BTI-56

In re Application of: Hugh S. Mason and Charles J. Arntzen
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 09/470,124
Filed: December 22, 1999
Priority date: December 22, 1998 (Ser. No. 60/113,507)
For: **ORALLY IMMUNOGENIC BACTERIAL ENTEROTOXINS EXPRESSED
IN TRANSGENIC PLANTS**

Status

Pending.

Related Files or Patent Applications

PCT Application (Ser. No. PCT/US99/30747), filed December 22, 1999; National Phase entered in Brazil, Canada, China, Europe (regional), Japan and Mexico.

Summary of Technology

This application discloses mutant *Escherichia coli* heat labile (LT) and *Vibrio cholerae* toxin (CT) polypeptides and the polynucleotides that encode them. The mutant LT and CT polypeptides can be readily produced in plants and can be used to treat or prevent diseases caused by *E. coli* and *V. cholerae*. The polypeptides are also useful as adjuvants.

Claim Coverage

The claims generally are directed to vectors, cells, plants and seeds that are modified to include polynucleotides that encode *Escherichia coli* heat labile (LT) and *Vibrio cholerae* toxin (CT) polypeptides; methods of eliciting an immune response by administration of a transgenic plant, or a part thereof, comprising the toxins, or a polypeptide purified from the plant, or part thereof; and a polypeptide adjuvant derived from the plant. The invention provides mutant *Escherichia coli* heat labile (LT) and *Vibrio cholerae* toxin (CT) polypeptides and the polynucleotides that encode them. The mutant LT and CT polypeptides can be readily produced in plants and can be used to treat or prevent diseases caused by *E. coli* and *V. cholerae*. The polypeptides are also useful as adjuvants.

Interested Parties or Potential Licensees

Exclusively licensed to Dow AgroSciences for use in Animal vaccines (non-human). DAS pays all patent costs US and foreign. Issued in some countries at this stage.

BTI-53

In re Application of: Yasmin Thanavala et al
Assignee: Boyce Thompson Institute for Plant Research, Inc.; Health Research, Inc.
Patent No.: NA
Serial No.: 09/414,416
Filed: December 16, 1999
Priority date: NA
For: **ORAL IMMUNOLOGY USING PLANT PRODUCT CONTAINING A
NON-ENTERIC PATHOGEN ANTIGEN**

Status

Pending.

Related Files or Patent Applications

National Phase entered in 13 countries.

Summary of Technology

This application discloses a method for obtaining an immune response to a non-enteric pathogen antigen, such as hepatitis B surface antigen.

Claim Coverage

The claims generally are directed to a method for providing an immune response to a non-enteric pathogen antigen in an animal, by feeding an immunoreceptive animal with a plant material comprising the antigen.

BTI-76

In re Application of: William Hamilton, Timothy Jones, Dwayne Kirk, Hugh S. Mason, Xhang, Xiuren, and Charles J. Arntzen
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 60/489,005
Filed: July 21, 2004
Priority date: July 21, 2003
For: **VECTORS AND METHODS FOR IMMUNIZATION AGAINST NORWALK VIRUS USING TRANSGENIC PLANTS**

Status

Pending PCT and regular US application.

Related Files or Patent Applications

None.

Summary of Technology

This patent is related to a specific tomato produced Norwalk vaccine that has a pending Phase I clinical application in progress. Target date for the clinical trial pending selection of a corporate partner is fall or winter of 2005. We have numerous toxicity trials that need to be completed prior to the approval of the IND. We are actively seeking a partner to cover these costs as well as the legal costs related to the filings.

Claim Coverage

The claims generally are directed to methods and components for the immunization against Norovirus with a plant made oral vaccine.

Interested Parties or Potential Licensees

License negotiations ongoing

BTI-85

In re Application of: Dwayne Kirk, Hugh S. Mason, Amanda Walmsley and Charles J. Arntzen, Guy Cardineau, Joyce VanEck
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: NA
Serial No.: 838834
Filed: May 4, 2004
Priority date: May 4, 2003 from provisional filing.
For: **VECTORS AND CELLS FOR PREPARING IMMUNOPROTECTIVE COMPOSITIONS DERIVED FROM TRANSGENIC PLANTS**

Status

Pending.

Related Files or Patent Applications

Files in several foreign countries.

Summary of Technology

The invention is drawn towards vectors and methods useful for preparing genetically transformed plant cells that express immunogens from pathogenic organisms which are used to produce immunoprotective particles useful in vaccine preparations. The invention includes plant optimized genes that encode the HN protein of Newcastle Disease Virus. The invention also relates to methods of producing an antigen in a transgenic plant.

Claim Coverage

The claims generally are directed to vectors and methods specific to the production and use of plant made vaccines.

Interested Parties or Potential Licensees

Exclusively licensed to Dow AgroSciences for use in Animal vaccines (non-human). DAS pays all patent costs US and foreign.

Method Of Protecting Biological Materials In The Dry State

BTI-16

In re Application of: Scott H. Wettlaufer and Aldo C. Leopold
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,290,765
Serial No.: 07/833,735
Filed: February 11, 1992
Priority date: September 14, 1990 (Ser. No. 07/583,858)
For: **METHOD OF PROTECTING BIOLOGICAL MATERIALS FROM
DESTRUCTIVE REACTIONS IN THE DRY STATE**

Status

Patent issued March 1, 1994.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses a method for protection of biological materials from the stresses of air-drying and also from destructive reactions, such as oxidation and free-radical attack, which degrade the materials during long-term storage. The method involves drying the materials, which may contain potentially destructive agents such as free-radical generators or reducing sugars, in the presence of a vitrifying substance, and under conditions that allow the protective substance to become vitrified.

Claim Coverage

The claims generally are directed to a method of protecting biological materials selected from the group consisting of tissues, cells, organelles, and biologically active compounds from drying and from destructive reactions which take place during storage, comprising the steps of: (a) selecting a mixture including cells such as living rhizobia cells; (b) combining the mixture with sufficient quantity of one or more vitrifying solutes to protect the mixture during drying and to inhibit the destructive reactions, (c) drying the combination, by exposing the combination to a desiccant, at a temperature above that at which the combination will freeze and below that at which the vitrifying solutes achieve the vitrified state, at approximately normal atmospheric pressure, until the combination is substantially dry, and (d) storing the combination in a dry state.

Interested Parties or Potential Licensees

Licensed exclusively to Initiatech (non-exclusive for biopesticides) for purposes of sublicensing.

BTI-13 CIP

In re Application of: Scott H. Wettlaufer and Aldo C. Leopold
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 5,200,399
Serial No.: 07/678,065
Filed: April 1, 1991
Priority date: September 14, 1990 (Ser. No. 07/583,858)
For: **METHOD OF PROTECTING BIOLOGICAL MATERIALS FROM
DESTRUCTIVE REACTIONS IN THE DRY STATE**

Status

Patent issued April 6, 1993.

Related Files or Patent Applications

BTI-13CAN (issued).

Summary of Technology

This patent discloses a method for protection of biological materials from the stresses of air-drying and also from destructive reactions, such as oxidation and free-radical attack, which degrade the materials during long-term storage. The method involves drying the materials, which may contain potentially destructive agents such as free-radical generators or reducing sugars, in the presence of a vitrifying substance, and under conditions that allow the protective substance to become vitrified.

Claim Coverage

The claims generally are directed to a method of protecting biological materials selected from the group consisting of tissues, cells, organelles, and biologically active compounds from drying and from destructive reactions which take place during storage, comprising the steps of: (a) selecting a mixture comprising materials from the group consisting of tissues, cells, organelles, and biologically active compounds; (b) combining the mixture with sufficient quantity of one or more vitrifying solutes to protect the mixture during drying and to inhibit the destructive reactions, (c) drying the combination, by exposing the combination to a desiccant, at a temperature above that at which the combination will freeze and below that at which the vitrifying solutes achieve the vitrified state, at approximately normal atmospheric pressure, until the combination is substantially dry, and (d) storing the combination in a dry state.

Interested Parties or Potential Licensees

Licensed exclusively to Initiatech (non-exclusive for biopesticides) for sublicensing

Canine Parvovirus

BTI-11

In re Application of: Harry A. Wood and Colin R. Parrish
Assignee: Boyce Thompson Institute for Plant Research; Cornell Research Foundation, Inc.
Patent No.: 4,971,793
Serial No.: 07/191,684
Filed: May 9, 1988
Priority date: NA
For: **SUBUNIT CANINE PARVOVIRUS VACCINE**

Status

Patent issued November 20, 1990.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses a recombinant subunit vaccine for protecting dogs against infection caused by canine parvovirus comprising VP-2 protein produced during replication of a recombinant baculovirus in insect tissue culture cells or insects that are a permissive host for the replication of selected baculoviruses.

Claim Coverage

The claims generally are directed to a prophylactic subunit vaccine for protecting dogs against infection caused by canine parvovirus produced by a recombinant process comprising the steps of: a. selecting a *Autographa californica* nuclear polyhedrosis virus; b. using a transfer plasmid known as pAc 6C2B23 for introducing the canine parvovirus VP-2 gene into the *Autographa californica* nuclear polyhedrosis virus by a process known as recombination thereby forming a recombinant virus known as CPV 6C2B23; c. inoculating the recombinant virus CPV 6C2B23 into insect tissue culture cells or insects that are permissive hosts for *Autographa californica* nuclear polyhedrosis virus replication and production of VP-2 protein and culturing CPV 6C2B23 in insect tissue culture cells for a time and under conditions sufficient for the production of VP-2 protein; and d. recovering the CPV 6C2B23 produced VP-2 protein for inoculation of a canine as a vaccine free of other CPV proteins.

Interested Parties or Potential Licensees

Co-owned and licensed through Cornell Research Foundation

Genetic Engineering in Cyanobacteria

BTI-

In re Application of: Aladar A. Szalay and John G. K. Williams
Assignee: Boyce Thompson Institute for Plant Research, Inc.
Patent No.: 4,778,759
Serial No.: 06/689,514
Filed: January 9, 1985
Priority date: July 9, 1982 (Ser. No. 06/396,595)
For: **GENETIC ENGINEERING IN CYANOBACTERIA**

Status

Patent issued October 18, 1988.

Related Files or Patent Applications

None pending.

Summary of Technology

This patent discloses a procaryotic microorganism and a method for its production is provided wherein the microorganism contains at least one stable foreign DNA portion in the chromosome. The disclosed microorganisms and their progeny are substantially free of genetic rearrangement involving the foreign DNA. In a preferred embodiment, cyanobacteria are employed. The microorganisms are produced by introducing into the cell an insertion vehicle that contains foreign DNA ligated between two portions of DNA homologous to adjacent portions of the recipient's chromosome.

Claim Coverage

The claims generally are directed to a cyanobacterium containing at least one stable foreign DNA portion covalently bonded directly to two originally adjoining segments of its chromosomal DNA oriented in relation to each other in the same manner as the segments are in the cyanobacterium, wherein the cyanobacterium and its progeny are substantially free of genetic rearrangement involving the foreign DNA and wherein the foreign DNA portion is derived from a source other than the genus of the cyanobacterium and is other than a transposable element.