



June 2018

Agricultural Research Partnerships (ARP) Network NOTES

Welcome to ARP Network Quarterly Notes! Our goal is to keep you informed about ARP Network and Agricultural Research Service's current information. We hope that the notes build networking opportunities for businesses to connect with ARP Network Members.

Please help us spread the word by sharing ARP Network Notes with your company contacts, colleagues, other organizations, etc. Thank you!

ARP Network

The ARP Network enlists the help of partners to spark economic development, entrepreneurship and community development. USDA ARS founded the ARP Network to expand the impact of ARS research and provide resources to help companies grow. By combining ARS research expertise with complementary capabilities and talents of partnering organizations, the ARP Network helps stimulate economic growth through technological advancements. The ARP Network matches business needs with ARS innovations and research capabilities and provides business assistant services to help companies and startups solve agricultural problems, develop products and create new jobs. Learn more by visiting us on LinkedIn: <https://www.linkedin.com/in/agricultural-research-partnerships-arp-network-3863a8147>

USDA SBIR & ARS Webinar Recording

Become a USDA SBIR Success Story!

The recording of the webinar, which took place in April, includes an overview of the USDA-SBIR program; how to craft a competitive SBIR proposal; an overview of ARS research programs and why and how to build a partnership with ARS to enhance your USDA-SBIR proposal; and talks from two successful SBIR phase I and II awarded companies (PathSensors and *US BIOLOGIC*) highlighting their experiences with the USDA-SBIR program and collaborating with ARS scientists. Click [here](#) for a recording of the webinar.

Small companies and entrepreneurs can reap many benefits from technology partnerships with ARS laboratories. Through the National Institute for Food and Agriculture (NIFA), the USDA SBIR program provides competitive grants to small businesses to conduct research of innovative concepts in agriculture.

For more information contact Cathy Cohn: cathleen.cohn@ars.usda.gov

Accomplishments of the Southern Regional Research Center (New Orleans, LA)

1941 – 2016

This is a booklet that contains a general summary and a sampling of remarkable accomplishments of Southern Regional Research Center with significant economic impact that have benefited U.S. Agriculture and individuals globally. The accomplishments are summarized from patents, peer-reviewed articles as well as popular articles, and are presented by decade, spanning the 1940s to 2016. Click [here](#) to read.

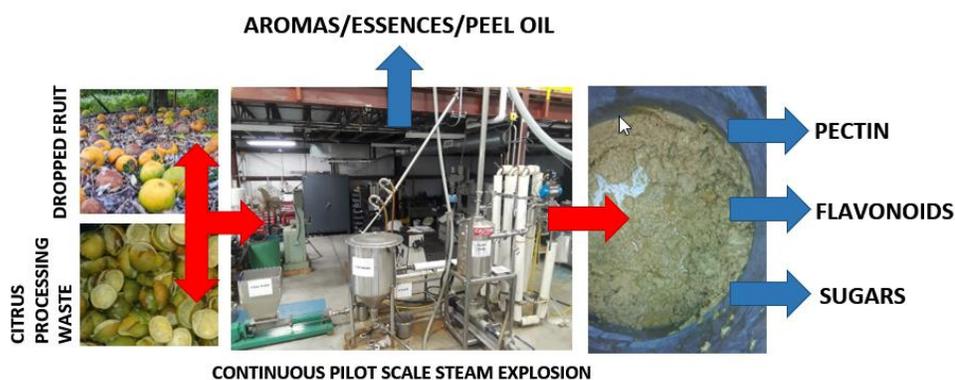


ARS Partnership and/or Licensing Opportunities

ARS is looking for commercial partners interested in commercializing these technologies and/or evaluating the technologies for potential commercial applications through a Cooperative Research and Development Agreement (CRADA). Many of these technologies are also available for licensing.

Isolation & Extraction of Valuable Components in Agricultural and Processing Residues

When agricultural or processing residues are exposed to steam at elevated temperature and pressure for an extended period of time, the steam penetrates the cells of the biomass. Reintroduction of this material to atmospheric conditions results in an explosion that causes the cells and the material to burst allowing for easy access to valuable components within the material. ARS has developed a continuous pilot scale steam explosion system that can process whole citrus fruit and citrus processing waste resulting in the separation of volatiles such as aromas, essences and peel oil from the steam exploded mash. The steam exploded mash contains pectin, flavonoids and sugars that can be extracted using water, and can be used in products for the food, beverage, pharmaceutical and cosmetic industries.



Benefits

- Environmentally friendly process
- Volatile removal, size reduction and microbial reduction in one process
- Increases value of agricultural and processing waste streams

Applications

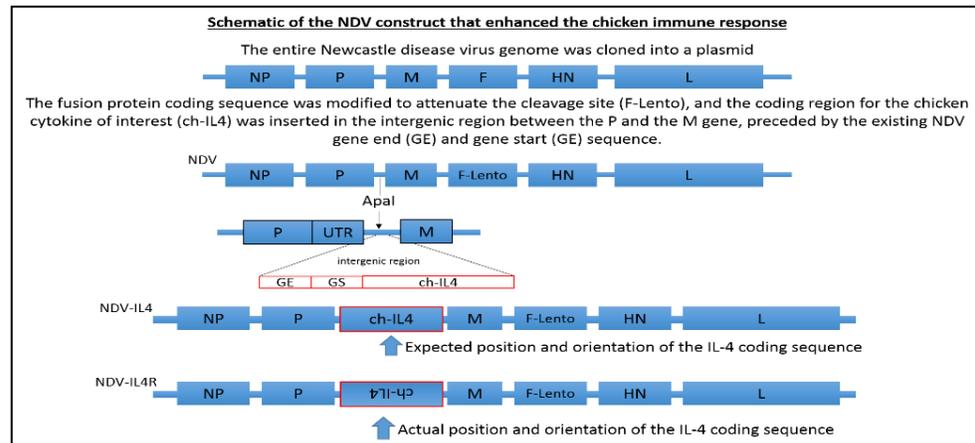
- Can be used in any agricultural or processing setting where income generated from waste streams is desired

Further details are in US Patent No. 7,879,379.

ARS Docket no. 120.06. Please Contact Joe Lipovsky: joseph.lipovsky@ars.usda.gov

Altered Avian Virus for *In-Ovo* Inoculation and Methods of Use

Attenuated recombinant Newcastle disease virus (NDV) vaccines, containing an antisense coding region of the chicken interleukin 4 (IL4R) inserted into the NDV viral genome, were evaluated as candidates for *in-ovo* vaccination. ARS results indicate that these altered NDV-IL4R vaccines are a reliable *in-ovo* immunogenic composition that modulates the host animal's immune response and induces good protection in the host upon challenge.



Benefits

- The Vaccine can be administered safely *in-ovo* so that animals are protected at an early stage of life
- Antisense IL4 is used as an adjuvant to enhance the safety and protection induced by the vaccines and to create stronger immune responses

Applications

- Since Newcastle disease (ND) continues to be a threat to the poultry industry world-wide, this vaccine has the potential to be used as a novel, more effective *in-ovo* vaccine that elicits a strong immune response in hatchling chicks to decrease virulent virus replication and horizontal transmission

ARS Docket no. 46.16. Please Contact Joe Lipovsky: joseph.lipovsky@ars.usda.gov

Adhesive Compositions and Methods of Adhering Articles Together

There is ongoing interest in using agro-based materials (like proteins) in wood adhesives. The issues are cost, adhesive strength, and water resistance. New adhesive compositions involving cottonseed protein are shown here to be attractive adhesive ingredients. These include the use of specific modifiers that enhance cottonseed protein performance and several biopolymers (e.g. soy protein or polysaccharides) that can decrease the cost of use. With these compositions, the performance/cost ratio for cottonseed protein-based adhesives



can be enhanced.

Benefits

- Use of agro-based materials will minimize toxicity and environmental impact
- Cottonseed protein with modifier provides effective adhesive strength and water resistance
- Blends with modifier provides effective adhesive strength and water resistance
- Potential new products for wood adhesives

Applications

- These can be used as cost-effective, eco-friendly products for wood adhesives

ARS Docket no. 115.16. Please Contact Joe Lipovsky: joseph.lipovsky@ars.usda.gov

Bio-based Resins/Adhesives for Wood Composites

There has been significant interest in using non-petroleum based adhesives and resins to fabricate wood composites, particularly for interior uses. Unfortunately, currently available bio-based adhesives derived from soybean meals are more expensive than their petroleum counterparts. ARS has developed methodologies to employ inexpensive by-products from corn, ethanol processing (distiller's dried grains and solubles (DDGS)) for production of a more cost-effective bio-based adhesive/resin for this purpose.

Benefits

- Inexpensive to produce
- Excellent adhesive and mechanical properties

Applications

- Building, furniture and manufacturing industries

ARS docket no. 166.16. Please contact Renee Wagner: renee.wagner@ars.usda.gov

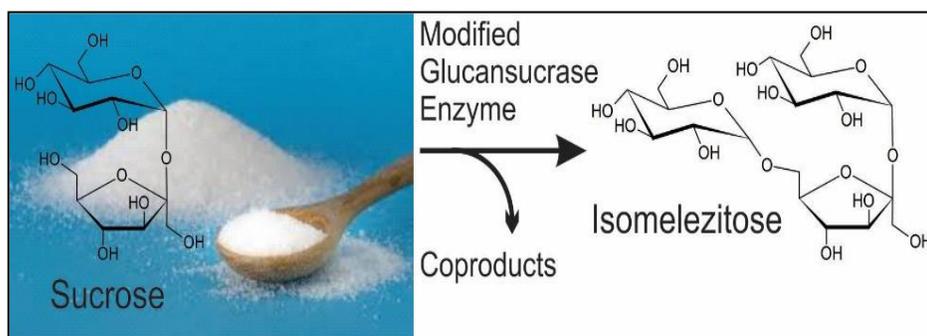
Enzymatic Synthesis of a Novel Bioprotectant

ARS has engineered an enzyme to produce high yields of a rare sugar, called isomelezitose. Similar types of sugars, such as trehalose, are known to have bioprotective properties that minimize damage to proteins from heat, freezing, or drying; and are therefore extremely important to the pharmaceutical, agricultural, and food industries.

Isomelezitose was originally found in trace amounts in honey, but efforts to produce this compound were hampered by inefficient synthesis methods. This technology allows the valuable isomelezitose sugar to be produced in commercial quantities.

Benefits

- High product yield from a simple enzymatic conversion of inexpensive sugars
- Demonstrated ability to maintain bacterial viability when added to cultures during drying



Applications

- Low-calorie sweetener that does not promote tooth decay
- Improved long-term stability of foods, drugs, vaccines, cells and bacterial cultures
- Potential prebiotic food ingredient for improved intestinal health

ARS Docket no. 19.16. Please contact Renee Wagner: renee.wagner@ars.usda.gov

Plant-mediated Silencing of a Fatty Acid and Retinol-binding Protein in *Pratylenchus Penetrans*

Fatty acid and retinol-binding (FAR) proteins are a family of proteins unique to *Pratylenchus Penetrans*, a species of nematodes. This invention consists of a region of the FAR-1 gene from the root lesion nematode that has been made into a dsDNA construct (ds-FAR-1) that is designed to silence the FAR-1 gene of root lesion nematodes. The reproduction of root lesion nematodes feeding on soybean roots engineered to contain this construct was significantly reduced.



Benefits

- ds-FAR-1 can be used to engineer plants, or apply directly to plants, for resistance to root lesion nematodes
- Plants with resistance to root lesion nematodes decreases the use of fumigants and pesticides for nematode control
- Because the FAR-1 protein is found in nematodes, application of this technology should not affect non-target organisms such as humans, plants, insects (e.g. bees), etc.

Applications

- The ds-FAR-1 construct may be a useful technology for genetic improvement of plants that are susceptible to root lesion nematodes such as potatoes, soybeans, corn, fruits (apples, raspberries, and cherries), and lilies

ARS Docket No. 199.16. Please contact Jim Poulos: jim.poulos@ars.usda.gov

Chorismate Mutase Gene from Potato Cyst Nematode *Globodera Rostochiensis*

ARS scientists have isolated, sequenced, and cloned a chorismate mutase gene from *G. Rostochiensis* that can be useful for control of that pest. *G. Rostochiensis* is a very destructive nematode pest that reduces yields of potato crops worldwide. This pest is also very hard to control once it has infected the soil as it may take thirty years or longer to eradicate the eggs from the soil. The use of pesticides, substandard resistant potatoes, and quarantining fields have shown limited success controlling the pest. The polynucleotide discovered and claimed by ARS scientists can effectively control the pest by utilization of double stranded (ds) RNA complimentary to the chorismate mutase gene. This dsRNA will inhibit biological function of the nematode by RNA interference. Further details are in US Patent No. 8,575,427.

ARS Docket No. 120.08. Please contact Jeff Walenta: jeffrey.walenta@ars.usda.gov.

Sorgoleone as a Natural Product-based Herbicide in Crop Plants

Sorgoleone accounts for up to 90% (w/w) of the content of sorghum root exudates. Whole-plant assays demonstrate effective inhibition of many important weed species at 10 μ M concentrations.

Sorgoleone biosynthesis occurs exclusively in root hair cells and is then secreted into the soil/rhizosphere, therefore genetic engineering of this compound requires obtaining root-hair-specific promoters to drive gene expression in these cells. A genomics-based strategy was employed to identify root hair-specific sorghum promoters for driving the expression of sorgoleone biosynthetic genes in transgenic plants. The root hair-specific activity of these promoters was confirmed by histochemical localization studies in both transgenic rice and *Arabidopsis* plants.



R₀ transgenic rice transformed with multi-gene vector (USDA Greenhouse, Oxford, MS 11/12/2017)

The lab is nearing completion of a project using all the biosynthetic genes to produce sorgoleone in root hairs of transgenic rice plants. If successful this will represent a breakthrough in the plant-produced biopesticide field. The technology is available for a partnership and/or patent licensing.

Intellectual Property:

The following US Patents have been granted for the genes isolated by ARS scientists involved in sorgoleone biosynthesis: DES2, 3 genes: patent no. US8,383,890; ARS2, 3 genes: patent no. US9,248,145; OMT3 gene: patent no. US7,732,666; CYP71AM1 gene: patent no. US9,284,537.

A US patent was also recently granted for the root hair-specific gene promoters: Patent application no. US2016034,068, patent issue fee paid 5/15/2018.

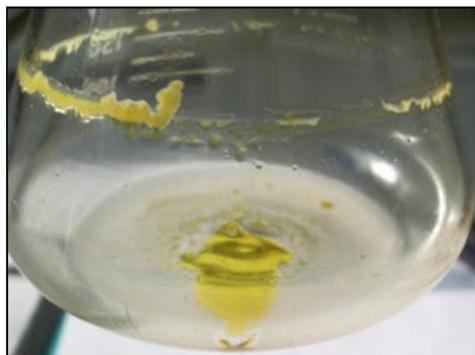
Please Contact Joe Lipovsky: joseph.lipovsky@ars.usda.gov

Novel Oil Having Antibacterial Activity

Liamocins produced by certain strains of the fungus *Aureobasidium pullulan* have anti-bacterial activity with specificity for *Streptococcus* spp., *Enterococcus* spp., and *Bacillus* spp. The invention includes methods of using the liamocins and compositions containing modified liamocins to kill bacteria. Also included are methods to produce modified liamocins with specific head groups.

Benefits

- Liamocins are chemically different than conventional



antibiotics, and cross-resistance should be minimal. They may be effective for *Streptococcus* infections that do not respond to conventional antibiotic therapy

- The liamocins are produced from low-cost agricultural biomass substrates, particularly pretreated wheat straw

Applications

- The liamocins produced could be used as a dairy cattle dip for prevention of mastitis or as a tropical antibacterial treatment
- In more refined forms, the pharmacologically active component(s) of the liamocins have potential to be incorporated into injectable or oral medicines

ARS docket no. 107.13 + 51.18. Please contact Renee Wagner: renee.wagner@ars.usda.gov

Animal Behavior Monitor

A system for monitoring ruminant animal foraging that utilizes a piezoelectric film sensor in communication with a computer processor to record and characterize jaw movement data for the foraging ruminant animal. The processor applies pattern algorithms to categorize the jaw movement data so that the jaw movements are categorized as at least chewing, biting, ruminating, and/or idling. Knowledge about livestock behavior and resource use can inform management decisions that influence outcomes in agricultural production, the environment and rural prosperity.



Benefits

- The system quantifies grazing behavior including grazing time, ruminating time, resting time, bites/min and bites/day
- It has GPS tracking at a fix frequency of 5 minutes. It can track time spent in sensitive areas (e.g. riparian) and time spent in forage patches (diet selection)
- Other metrics can be added, including tail switch to track nutrient deposition, activity monitor for # of steps and bites/feeding station
- Remote data access and troubleshooting

Applications

- This product would be of interest to grazing-based animal researchers
- It could be adapted for use for rangeland livestock, confinement livestock and for wildlife to monitor movement and grazing behavior

ARS Docket No. 125.17. Please contact Jim Poulos: jim.poulos@ars.usda.gov

Automatically Attaching Collar Pendant System

ARS scientists have developed an automatically attaching collar pendant system that is useful for delivering insecticides to animals, such as white-tailed deer or other similar animals, feeding at a feeding station. In addition to ease of use through automated attachment, the system utilizes Radio Frequency Identification

(RFID) chips in a pendant in the collar. The RFID tag prevents tagging the animal twice and is part of a separately patented detachment system integrated into this collar system. These collars are especially useful for administering compounds without the need to handle an animal. The automatic collaring device technology electronically identifies individual animals and thus makes them subject to passive individualized injection with antibiotics, vaccines, immuno-contraceptives, endectocides, vermicides, anesthesia and other substances. This would permit local, state, and federal regulatory, and health agencies as well as farmers and ranchers to identify and therapeutically does individual animals according to selected criteria such as sex, age, etc. Further details are in US Patent No. 9,832,973.

ARS Docket No. 231.13. Please contact Jeff Walenta: jeffrey.walenta@ars.usda.gov.

Automatically Detachable Collar Pendant System

ARS scientists have developed an automatically detaching collar pendant system. This pendant system can be used in conjunction with the proprietary ARS automatically attaching collar pendant system, ARS Docket No. 231.13, and is useful in situations where it is difficult to handle the animal to remove the collar. This system works by activating a mechanism within the collar by a magnetic field to allow the collar to fall off by gravity. Further details are in US Patent No. 9,795,114.

ARS Docket No. 230.13. Please contact Jeff Walenta: jeffrey.walenta@ars.usda.gov

System for Cleaning Fresh-Cut Produce

A system and method for cleaning and sanitizing fresh-cut produce. The approach is to use an upwardly-directed spray, with one or more water jets of sanitizer solution to remove organic exudate foreign materials and microorganisms from fresh-cut produce. This is done immediately after the produce exits the cutter blades. The system is designed so that as the produce falls, it is impacted, reoriented, cleaned and/or sanitized by the produce-washing liquid.

Benefits

- Minimizes the use of chlorine (or other sanitizers) and reduces the volume of water used

Applications

- A system and method to quickly and efficiently remove organic exudate, field debris and soil particulates from freshly-cut produce

ARS Docket No. 161.15. Please contact Jim Poulos: jim.poulos@ars.usda.gov

Soil Water and Conductivity Sensing System

ARS scientists have developed an apparatus and method for measuring soil water content and bulk electrical conductivity (BEC) by time domain reflectometry (TDR). This apparatus integrates the TDR instrument and temperature sensor with the waveguide to create a combined soil water content, temperature and BEC sensor that is fully functional and capable of delivering raw TDR waveform, reflection coefficients, waveform effective frequency and soil temperature data that can be transformed remotely or directly on site by system. This apparatus also allows users to determine water content and BEC, including temperature at multiple depths in the soil such that the entire soil profile is monitored from the surface to a user-selected depth. The apparatus comprises a cylindrical hollow tube with external electrodes attached

to a separate integrated pulse generator and waveform acquisition unit for each depth. This system is easy to calibrate and is more efficient than similar systems. Further details are in US Patent No. 8,947,102.

ARS Docket No. 44.11. Please contact Jeff Walenta: jeffrey.walenta@ars.usda.gov.

Starch-based Fire Retardant

Spraying a home or business with a temporary fire-retardant coating may prevent it from being destroyed by a forest or brushland wildfire. The composition is made of sodium bentonite clay, corn starch and water. Tests suggest that a quarter-inch layer of the gel may protect wood-based home siding for up to 30 minutes.



Benefits

- Inexpensive to make the gel and the components are widely available

Applications

- Fire retardant gel for protecting structures or objects

ARS docket no. 57.11. Please contact David Nicholson: david.nicholson@ars.usda.gov

Use of Vitamin D in Dairy Mastitis Treatment

Mastitis is a costly disease that affects the mammary gland or udder of dairy cattle, resulting in decrease milk production and quality. ARS scientist have discovered that hydroxylated derivatives of vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol) are effective for preventing or treating mastitis in animals. The hydroxylated derivatives of vitamins D3 or D2 are administered to the mammary gland of a female animal in an amount effective to inhibit or significantly reduce the growth of bacteria in the animal's mammary gland. Animals treated with vitamin D have a significant reduction in bacterial counts and fewer clinical signs of severe infection than untreated cows



Benefits

- Vitamin D might help reduce antibiotic use in treating mastitis
- It has the potential to decrease other bacterial and viral diseases such as respiratory tract infections

Applications

- Vitamin D can delay and reduce the severity of mastitis infection in dairy cattle

Further details are in US Patent No. 88,785,421.

ARS docket No. 51.11. Please contact Renee Wagner: renee.wagner@ars.usda.gov

Available Technologies for Licensing

Each year, approximately 60 new patents are issued by the U.S. Patent Office for USDA inventions. The Office of Technology Transfer (OTT) transfers these inventions through licenses to the private sector for commercialization. Here is a link to *recently filed* U.S. patent applications that are available for licensing. This list is updated monthly so check back often! <http://www.ars.usda.gov/Business/Business.htm>

ARS Technology Transfer at a Glance

A brief information sheet that highlights some ARS Technology Transfer metrics and commercial products resulting from ARS Research. Click [here](#) to read.

Resources for Businesses

Some resources for small businesses at USDA and other Federal agencies. Click [here](#) to read.

ARS Latest News

Agricultural Research Service started posting high-resolution images depicting science in action—from mites magnified thousands of times their size, to fluffy, wide-eyed chicks. [More](#)

The photo, like others every other week, includes a brief captions and links to feature articles and other information about the nationwide efforts of ARS' 2,000 scientists to find solutions to agricultural problems affecting Americans every day.



Eastern Tiger Swallowtail Butterfly, *Papilio glaucus*, feeding on a pink *Zinnia elegans* flower at the Bee Research Lab pollinator garden in Beltsville, Maryland. Learn [more](#) about ARS research and education on pollinators.

USDA Blog

Check out USDA Blog site for updates on Agricultural issues. Click [here](#) to read. One can sign up for email updates on the website by checking boxes of categories of interest including the blog, news categories and social media.

ARS

The Agricultural Research Service (ARS) is USDA's primary internal research agency. ARS conducts research to develop and transfer solutions to agricultural problems that are both national and international in scope. ARS has nearly 2,000 scientists nationwide and a few in overseas locations. ARS scientists carry out 690 research projects on a variety of subjects. ARS has a Congressional mandate to disseminate the research findings of these projects to the American public and other interested parties. Learn more by visiting: <http://www.ars.usda.gov>

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