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ARS Collections

Providing the Foundation of Science
Status Report



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Foreword

I am pleased to present the 2008 Agricultural Research Service's (ARS) collections status report, entitled ARS Collections: Providing the Foundation of Science (Status Report). As the title indicates, this plan provides an overview of the variety, scope, and purpose of the Agency's hundreds of collections. This status report will be joined with a Strategic Plan for management of collections.

This ARS collections report has been developed in response to the Administration's Guidance on Research and Development Priorities for Federal agencies in fiscal years 2007 and 2008, which identified the stewardship of Federal scientific collections as a top research and development priority. This report represents the Agency's coordinated efforts to document the holdings and needs of its collections within a vast range of research areas. Using the plan, ARS will carry out the Government's call to identify, maintain, and use Federal collections to promote agricultural production, public health and safety, homeland security, trade and economic development, and environmental monitoring.

The ARS collections report provides an important historical record of the Agency's 53-year history of maintaining collections, including collections that existed before the founding of ARS and that later came into Agency possession. The ARS collections report thus represents an important benchmark for our collections in the future.

I would like to thank the many ARS researchers and curators who maintain our valuable collections, and the able works of authors who have created this report. Without their dedication and conscientious efforts, this important step toward preserving and improving ARS collections would not have been possible.

List of Acronyms

APHIS – Animal and Plant Health Inspection Service

ARS – Agricultural Research Service

BARC – Beltsville Agricultural Research Center

BIRL – Beneficial Insects Research Laboratory

BSL – Biological Safety Level

CDC – Center for Disease Control and Prevention

CRIS – Current Research Information System

GRIN – Germplasm Resources Information Network

IRB – Informational Review Board

MTA – Materials Transfer Agreement

NCAUR – National Center for Agricultural Utilization Research

NPGS – National Plant Germplasm System

NRRL – Northern Regional Research Laboratory; laboratory has been renamed, but acronym remains

OSTP – Office of Science and Technology Policy (White House)

USDANC – Department of Agriculture Nematode Collection

USNPC – U.S. National Parasite Collection

EXECUTIVE SUMMARY

ARS possesses hundreds of diverse collections at research locations throughout the Nation. These divide generally into 18 categories, including bacteria, fungi, nematodes, parasites and vertebrate protozoa, invertebrate protists, invertebrate viruses and cell cultures, plant viruses and viroids, vertebrate viruses, invertebrate germplasm, invertebrate systematics, vertebrate germplasm, plant germplasm and systematics, plant cell cultures, human tissues, natural resources, chemicals, molecular reagents, and overseas laboratory collections. For the majority of these groups, ARS maintains several collections across the Nation, each with their own research purposes, strengths, and difficulties.

An ARS collections taskforce studied the collections of 18 object groups, most defined by taxa, but including groups on chemicals, molecular reagents, and others. The focus was on scientific-based objects that are primarily acquired, maintained, and used for scientific research, such as natural and physical science specimens, living animals and plants, archaeological and ethnographic objects, or technology objects of current or contemporary design. These collections do not include library material, data (digital or analog), or collections of objects that can be purchased commercially.

INTRODUCTION

The importance of collections units to the quality and impact of ARS research is often underestimated. Every day, ARS scientists at locations across the Nation, working in nearly every National Program, make use of collections to support their research. The value of this activity is evident. In the Agency's 53-year history, collections have contributed to a number of groundbreaking discoveries and have had a significant economic impact on the agricultural community.

Importance of ARS Collections

The ARS Culture Collection (NRRL) in Peoria, Illinois, exemplifies this success. Using cultures from this collection, USDA scientists conducted research that led to the commercial development of penicillin, which contributed to the Allied success in World War II and heralded a revolution in disease treatment. Showing the breadth of this collection's impact on science and society, the unit also commercialized riboflavin (Vitamin B2), dextran gum, and xanthan gum, and developed several databases of gene sequences that allow rapid identification of fungal and bacterial species. The databases are used worldwide to greatly enhance plant food safety and medical research. These remarkable accomplishments were made possible in part because the fungal and bacterial collections were so well maintained.

ARS collections have also played a significant role in enhancing economic opportunities for agricultural producers. The USDA Nematode Collection (USDANC) in Beltsville, Maryland, has contributed to this component of the ARS mission on several occasions. In 1970, nematode pests threatened the billion-dollar potato economy of the Pacific Northwest; after comparisons of pest specimens with archived specimens at USDANC, scientists determined that the source of the problem was a new nematode species and were able to make recommendations about crop rotations to save the industry. Similarly, in 2000, ARS scientists persuaded Brazilian officials to lift a ban on wheat imports by showing that U.S. wheat exports were free of a quarantined nematode. This demonstration, which saved the wheat industry millions of dollars, was made possible with the use of ARS' thorough and well-preserved collection of nematodes.

Moreover, the scope of ARS collections extends beyond the Agency. A number of current collections predate the formation of ARS, and many are used by scientists around the globe. The National Plant Germplasm System (NPGS), for example, is one of the largest distributors of germplasm in the world. NPGS conserves more than 472,000 accessions and annually distributes approximately 120,000 of these to external researchers. NPGS furnishes the raw material for crop improvement worldwide, thereby helping to underpin global food security. NPGS' germplasm collection contributes tremendously to scientific research efforts and provides a valuable service to the scientific community.

The ARS collections taskforce conducted a survey focused on object-based scientific collections, acquired, maintained, and used primarily for scientific research. These collections do not include library material, data (digital or analog), or collections of objects that can be purchased commercially.

In examining this issue, the taskforce studied the collections of 18 object groups, most defined by taxa, but including groups on chemicals, molecular reagents, and other materials.

Extent of Collections

In support of ARS research, the Agency possesses hundreds of collections at research locations throughout the Nation. These include various culture (or living organism) collections, specimen-based (non-living organism) collections, and non-organismal object collections.

ARS collections divide generally into 18 categories:

- Bacteria
- Fungi
- Nematodes
- Parasites and Vertebrate Protozoa
- Protists, Invertebrate
- Viruses and Cell Cultures, Invertebrate
- Viruses and Viroids, Plant
- Viruses, Vertebrate
- Germplasm, Invertebrate
- Systematics, Invertebrate
- Germplasm, Vertebrate
- Germplasm and Systematics, Plant
- Cell Cultures, Plant
- Human Tissues
- Natural Resources
- Chemicals
- Molecular Reagents
- Overseas Laboratory Collections

Use and Access

ARS collections play a variety of roles and serve scientific research and development communities in a multitude of ways. In general, the size, scope, and fiscal support for the collections are strongly associated with the collections' assigned roles and objectives. Despite its idiosyncracies, each individual ARS collection may be assigned to one or more broadly-defined categories listed below. Throughout the report, the following symbols are used to denote the primary category, role or roles of each collection:

R (ARS Research Collection): These collections, which may encompass living or non-living samples, have been assembled by ARS research units to enable an “in-house” ARS project or unit to address its assigned research objectives. These collections may be small, but are often critical to attaining those objectives. The collections often do not have the support necessary for their long-term maintenance, or a publicly-accessible database for distributing collection samples to the general scientific community on request. However, materials may be exchanged with research cooperators as part of a joint project or, if surplus materials are available, may be distributed *ad hoc* to requestors.

C (National Core Systematic and Reference Collections): These collections, which may include living or non-living samples, have frequently been assembled, managed, preserved, and funded over many decades, with the objective of serving as international resources for microbial, plant, insect, parasite, and animal research. They often serve as critical reference vouchers for systematic and taxonomic research, and are critical to the continuity of specific scientific disciplines. Information about samples is publicly available in databases on the Internet. Funding is allocated specifically for distributing samples, without charge or restriction, to researchers and breeders on request. Living samples in the inventory may be propagated under controlled conditions to enable repeated distribution. Collection personnel may conduct research aimed at enhancing curatorial efficiency and effectiveness, and/or facilitating the use of particular samples.

G (National Genetic Resource Collections—“Genebanks”): These collections have been assembled, managed, preserved, and funded, often over many decades, with the objective of serving as international resources for crop, beneficial insect, microbial, and livestock research and breeding, or for microbial research. Their purpose is to maintain in perpetuity the essential genetic materials (species, varieties, lines, etc.) that underpin microbial, crop, or livestock scientific research and genetic improvement worldwide. Their inventories consist of living organisms—plant seeds or propagules, animal herds, eggs, or semen, and/or microbial cultures. Samples in the inventory are propagated under controlled conditions to enable repeated distribution. Information about samples is publicly available in databases on the Internet. Funding is allocated specifically for distributing samples, without charge or restriction, to researchers and breeders on request. Genebank personnel may conduct research aimed at enhancing curatorial efficiency and effectiveness, and/or facilitating the use of particular samples. These collections include, for example, the component genebanks of the U.S. National Plant Germplasm System, the U.S. National Animal Genetic Resources Program, the ARS Culture Collection, or the National Rhizobium Collection. .

Collections Care

Generally speaking, caring for a collection involves conserving, maintaining, processing, organizing, and storing accessions, identifying collected items clearly and accurately, and maintaining an inventory of existing items, or databasing. Although each of these activities is essential to ensuring optimal function of a collection, deferring the care for collections, and particularly curation of critical specimens, is common when resources become limited. More visible activities such as research have often taken precedence over properly maintaining a collection. Nevertheless, caring for specimens routinely remains essential for ensuring the continuity and the long-term utility of the collection, including its essential role in supporting research.

PART I: COLLECTIONS SUMMARIES

For the majority of the 18 collection groups enumerated on page 11, ARS maintains several collections across the Nation, each with its own research purposes, strengths, and difficulties. Following is a description of the major collections in each group and a summary of its most pressing challenges and needs.

BACTERIAL COLLECTIONS

ARS scientists maintain approximately 240,000 living bacterial cultures in facilities at 36 locations nationwide. The size of the collections range from a few hundred isolates to 10,000 or more strains. ARS collections are particularly strong with respect to types of bacteria. Even though all bacterial collections are used to support ARS research, some are also available for distribution to non-ARS scientists. Within ARS, the bacterial collections are most often used for biocontrol research, food safety research, and research on plant and animal diseases. The purpose and impact of some collections have changed over time to reflect major changes in need supporting, for example, efforts of the Departments of Defense, Health and Human Services to combat bioterrorism.

Units

ARS has 11 collections of bacterial germplasm that contain 5,000 or more strains, and 25 much smaller collections. The ARS Culture Collection in Peoria, Illinois, is by far the largest publicly-accessible bacterial culture collection in the world and plays the most important role in germplasm preservation, while another major bacterial collection is the National Rhizobium Culture Collection. These are described below; see Appendix 2 for a more detailed description of the 11 most significant bacterial collections.

ARS Culture Collection: “NRRL” (Peoria, Illinois)

This core collection, used by researchers worldwide, has approximately 19,000 strains of bacteria, in addition to 65,000 strains of fungi and other taxonomic groups. The collection both supports ARS research at the National Center for Agricultural Utilization Research (NCAUR), and serves as an international reference collection. The collection is officially registered with the World Data Center for Microorganisms and is internationally recognized for its abundance of resources. The bacterial germplasm holdings are in the collection database system, and the catalog of its holdings has been online since 1995. Users from around the world visit the website to request that strains be distributed to them for research. The collection was the first in the world to accept patent culture deposits, and is now a major depository for patent cultures under the Budapest Treaty.

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National Rhizobium Culture Collection (Beltsville, Maryland)

The Beltsville Agricultural Research Center (BARC) maintains a collection of approximately 5,000 specimens of rhizobia and an additional 2,000 uncurated specimens. The collection was begun in 1913 and is used for research, legume inoculation, bioremediation, and land reclamation. Specimens are available for distribution to researchers around the world. This collection recently provided valuable support to Iraqi scientists; when the Iraqi *Rhizobium* collection was destroyed during the war in Iraq, the

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Beltsville collection was used to provide these nitrogen-fixing bacteria to help Iraqi scientists reestablish this important agricultural resource.

Antimicrobial Resistance Collection (Athens, Georgia)

The Bacterial Epidemiology and Antimicrobial Resistance Research Unit maintains a unique collection of over 93,000 antimicrobial resistant strains of food safety pathogens and commensals. Begun in 1996, the collection contains approximately 50,000 isolates of *Salmonella*, 15,000 of *E. coli*, 12,000 of *Campylobacter*, 15,000 of *Enterococcus*, and 1,000 of *Listeria*. ARS food safety researchers use resources from this collection to develop strategies for reducing and controlling bacterial pathogens in food products. The collection is also an integral component of the animal section of the National Antimicrobial Resistance Monitoring System, a multi-agency national program for surveillance of antimicrobial resistance in bacteria in the United States.

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Other Collections

The Agency's other bacterial research collections are used primarily for in-house research, rather than being available for distribution. The collections have proved useful for research on biocontrol, food safety, plant and animal diseases, and in various biotechnological and industrial-scale settings. ARS had also developed an extensive spiroplasma collection, but, because of resource limitations, this is now housed at universities.

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FUNGAL COLLECTIONS

ARS scientists working in at least 36 facilities nationwide maintain approximately 90,000 living cultures of fungi and one million non-living specimens. These fungal collections support a wide range of basic and applied research, playing a critical role in supporting both ARS research and outside research programs worldwide. ARS scientists use these fungal collections for a variety of purposes: as experimental stocks for the study and control of crop diseases, as biocontrol agents for invertebrate pests and weeds, and to produce commercial products such as vitamins and ethanol.

Units

The three largest ARS collections of living fungal cultures include the ARS Culture Collection in Peoria, Illinois; the ARS Collection of Entomopathogenic Fungal Cultures in Ithaca, New York; and the Systematic Botany and Mycology Laboratory in Beltsville, Maryland. These locations maintain nearly 80,000 isolates. In addition, there are approximately 33 smaller research collections in ARS laboratories, each maintaining between 100 and 1,000 accessions to support the research activities at the given location. See Appendix 2 for a more detailed description of the resources of each major collection.

ARS Culture Collection: "NRRL" (Peoria, Illinois)

This ARS Culture Collection, a core collection used by researchers worldwide, is part of the Microbial Genomics and Bioprocessing Research Unit at the NCAUR. The collection is the largest publicly-available culture collection in the world, housing over 6,000 patent cultures, and approximately 60,000 fungal and 19,000 bacterial cultures. These cultures are used for ongoing ARS research in microbial genomics and bioprocessing, as well as for

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distribution to numerous U.S. and foreign scientists. Cultures from this collection have played an important role in a number of important scientific developments. These include the commercial development of penicillin in the 1940's, the commercial production of riboflavin, pioneering research in biomass conversion, and the development of extensive gene sequence databases for rapid identification of species having agricultural, food safety, and medical importance.

ARS Collection of Entomopathogenic Fungal Cultures (Ithaca, New York)

ARS also houses the Collection of Entomopathogenic Fungal Cultures, founded in 1977 at the U.S. Plant, Soil, and Nutrition Laboratory. This collection is the world's largest and most taxonomically diverse germplasm repository for fungal pathogens that affect insects, mites, spiders, and other invertebrates of agricultural, veterinary, and medical significance. The collection includes over 8,000 isolates of 550 fungal taxa from 1,100 different hosts at 1,700 locations throughout the world. The collection is unique in covering the entire range of entomopathogenic fungi. Cultures are used for internal research on insect biocontrol and gene sequencing projects, and are also available for distribution to institutions and scientists worldwide.

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BARC Living Fungal Collection (Beltsville, Maryland)

ARS maintains a collection of living and non-living fungal accessions at the Beltsville Agricultural Research Center's Systematic Botany and Mycology Laboratory. The laboratory houses approximately 11,000 living fungal cultures and makes up ARS' largest closed culture collections, serving the research programs of the staff mycologists. These cultures include plant pathogens of ascomycetous fungi and their asexual states as well as biocontrol agents. The latter are particularly used for control of cacao diseases.

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U.S. National Fungal Collection (Beltsville, Maryland)

The U.S. National Fungal Collection is the "Smithsonian for fungi" and includes about one million reference specimens used by scientists throughout the world. This is the world's largest collection of non-living fungi, documenting fungi through time and space for the past 200 years. These reference specimens have proved to be an important resource for determining the origin and spread of major diseases, including potato late blight and citrus bacterial canker. All the specimen data are computerized and thus serve as an information resource for plant quarantine policy makers.

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Smaller Research-Oriented Collections (Various Locations)

Various ARS laboratories maintain about 33 project- or crop-specific collections. These collections are solely for internal use by ARS researchers, and serve as important resources, particularly for research on fungal diseases of plants and the use of fungi in various biotechnological and industrial-scale settings.

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NEMATODE COLLECTIONS

ARS scientists maintain nematode collections at three research locations across the Nation. The collections include plant-parasitic nematodes, insect pathogens, and microbivorous (free-living) species. Scientists use these collections to assist with research to reduce nematode-associated

crop losses, to reduce the negative impact of these pests on global trade through accurate identification of nematodes intercepted in commerce, and to study the usefulness of certain nematodes as biocontrol agents.

Units

The primary collection is the USDA Nematode Collection (USDANC) housed in the Nematology Laboratory at the Beltsville Agricultural Research Center (BARC) in Beltsville, Maryland. This laboratory contains the Nation's premier repository of fixed specimens of plant and insect nematodes, as well as a small living collection of microbivorous nematodes. Other collections of living nematodes include a collection of frozen entomopathogenic nematodes at the Southeastern Fruit and Tree Nut Research Laboratory at Byron, Georgia, and a collection of root-knot nematodes (the Florida *Meloidogyne* collection) maintained at the U.S. Horticultural Research Laboratory in Fort Pierce, Florida.

USDA Nematode Collection (Beltsville, Maryland)

The USDA Nematology Laboratory houses two collections, most notably the USDANC, a core collection used by researchers worldwide. USDANC was established in 1960 and contains 40,000 nematode specimens. Recognized as one of the world's largest and most valuable international resources for nematode research, the collection is used by ARS researchers, regulatory personnel, and outside scientists for identification purposes and systematics research. The collection plays a particularly important role in ensuring the competitiveness of American agriculture. In 2000, using USDANC material, scientists from the Nematology Laboratory showed Brazilian officials that U.S. wheat was safe from the wheat seed gall nematode, thus ending the ban on U.S. wheat and raising the value of wheat exports to Brazil by \$70 million per year. Similarly, in 2003 and 2004 Beltsville scientists used USDANC nematode specimens to train and work with Mexican officials and lift a ban on potato exports to Mexico; this work earned an estimated \$30 million for the U.S. potato industry.

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Beltsville Collection of Microbivorous Nematodes (Beltsville, Maryland)

The BARC Nematology Laboratory also houses the Beltsville Collection of Microbivorous Nematodes, a collection of 50 nematode species managed by one scientist and one support scientist. This relatively small collection is used for research on microbivorous nematodes, which play an important role in agricultural ecosystems.

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Entomopathogenic Nematode Collection (Byron, Georgia)

ARS scientists maintain a nematode collection at the Southeastern Fruit and Tree Nut Research Laboratory. This collection contains approximately 50 living strains of insect-pathogenic nematodes, which are used as biocontrol agents of insect pests. The collection is used primarily for in-house research, but is also available to outside scientists.

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Florida Meloidogyne Collection (Fort Pierce, Florida)

ARS has a collection of living root-knot nematodes at the U.S. Horticultural Research Laboratory. This recently-organized collection of plant-parasitic nematodes is used to study chemical and biological methods of controlling these pests. The collection is used primarily by ARS scientists and occasionally by outside researchers.

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PARASITE AND VERTEBRATE PROTOZOA COLLECTIONS

ARS stores parasites for research purposes, the vast majority of which are kept at the U.S. National Parasite Collection (USNPC) housed at the Beltsville, Maryland. Parasite and vertebrate protozoa holdings include primarily macroparasites, representing the major phyla of endoparasitic worms (tapeworms, nematodes, flukes, and spiny-headed worms) and some ectoparasitic arthropods (fleas, ticks, and lice.) In addition, ARS maintains microparasite accessions, including a limited number of parasitic protozoans. This collection was established in 1892 and is the largest parasite research collection in the world.

Unit: *U.S. National Parasite Collection (Beltsville, Maryland)*

USNPC is a core collection serving as a national and international resource for systematics, taxonomy, identification, and ecological and epidemiological research in parasitology. The current holdings include over 20 million catalogued specimens with a database available online, and a similar number of uncatalogued specimens. Specimens at USNPC are available upon request to outside researchers.

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Scientists at the unit are also working to develop a collection of frozen tissues and parasites with direct linkage by vouchers and informatics to the specimen-based collection, which would greatly expand the collection's research potential locally and globally. The collection serves both as an archive for critical information related to parasites and pathogens, and also supports ARS' parasite research. USNPC contributes significantly to research on understanding the diversity and economic and ecological significance of parasites and pathogens, which for livestock alone, contribute to over \$2 billion in losses in the United States annually. During a 2003 outbreak of the monkeypox virus from imported Gambian pouched rats, the animals were also found to be infected with taeniid tapeworms, parasites that lead to severe illness and even death in their animal and human hosts. This diagnosis was made possible in part because of the foundation for research provided by ARS' parasite collection.

INVERTEBRATE PROTIST COLLECTIONS

ARS researchers maintain invertebrate protist collections at three research locations. Protists include protozoa and microsporidia (formerly classified as protozoa), and the primary purpose of these collections is to provide resources to ARS researchers rather than to serve as core collections. ARS researchers use accessions from the collections to study the protists' potential as insect biocontrol agents, as well as their role in causing detrimental diseases of beneficial insects.

Units

ARS' three primary collections of arthropod protists are located at the Northern Plains Agricultural Research Laboratory in Sidney, Montana; the Center for Medical, Agricultural, and Veterinary Entomology (CMAVE) in Gainesville, Florida; and the Grain Marketing and Production Research Center in Manhattan, Kansas.

Orthopteran Microsporidia Collection (Sidney, Montana)

The Pest Management Unit maintains a collection of approximately 350 Orthopteran (grasshopper) microsporidia to assist in research to manage grasshoppers as

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agricultural pests. In the past, ARS scientists used this collection to develop the first microbial control agent registered for use in the United States. This collection is probably the largest collection of microsporidia in the world. Although the unit does not actively seek deposits or distribute collected items freely, items can be provided upon special arrangement.

Microsporidia in Mosquitoes and Fire Ants Collection (Gainesville, Florida)

ARS researchers at CMAVE maintain a collection of five species of microsporidia, focusing on their use as biocontrol agents for mosquitoes, fire ants, and other pests. Researchers at this location also study their role in causing detrimental diseases to beneficial insects.

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Microsporidia and Gregarines in Stored Products Pests Collection (Manhattan, Kansas)

The Grain Marketing and Production Research Center's Biological Research Unit maintains a collection of two species of beetle-associated microsporidia and four species of gregarines (protojoa); scientists at this location study the use of these microbes as biocontrol agents.

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INVERTEBRATE VIRUS AND CELL CULTURE COLLECTIONS

ARS maintains several invertebrate virus and invertebrate cell collections at research locations across the Nation. These invertebrate collections presently contain insect-associated material only. They are used to support ARS research. Both types of collections have increased gradually over the past 40 years along with ARS' efforts in pathogen identification. Accessions support ARS research on potential biocontrol agents for managing pest insects as well as many medical and veterinary applications, such as vaccine development.

Insect Virus Collections

Insect virus collections are maintained at ARS research locations in Beltsville, Maryland; Columbia, Missouri; and Sidney, Montana. Several very small collections are maintained in Gainesville and Fort Pierce, Florida; Fresno, California; and Wapato, Washington.

BARC Collection of Insect-Pathogenic Viruses (Beltsville, Maryland)

The Beltsville Agricultural Research Center (BARC) hosts the most extensive collection of insect-pathogenic viruses in the world. The collection contains over 2,600 samples of insect viruses, representing 142 different insect hosts or virus species. This collection is used to support ARS research on potential biocontrol agents for managing pest insects, and has contributed to the discovery of several important species that have helped control the pests.

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Biological Control of Insects Unit Virus Collection (Columbia, Missouri)

ARS researchers at the Biological Control of Insects Unit maintain a collection of 20 different virus species. The majority of these viruses are used to infect and control lepidopteran (butterflies and moths) pests of agricultural importance.

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Pest Management Unit Grasshopper Virus Collection (Sidney, Montana)

The Pest Management Unit maintains a collection of grasshopper viruses to assist in research to manage grasshoppers' agricultural pests.

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Other Insect Virus Collections (various locations)

ARS also maintains small insect virus collections at Fresno, California; Gainesville and Fort Pierce, Florida; and Wapato, Washington. Each collection contains only a few virus species and is used exclusively to support pest management research at that location.

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Insect Cell Culture Collections

BARC and the Biological Control of Insects Unit in Columbia, Missouri, are the primary collection sites for insect cell lines, while other collections exist in Laramie, Wyoming; Fargo, North Dakota; Gainesville, Florida; Fort Pierce, Florida; Fresno, California; and Sidney, Montana.

BARC Insect Cell Culture Collection (Beltsville, Maryland)

The Insect Pathology Laboratory (now the Insect Biocontrol Laboratory) was one of the first institutions to have developed continuous insect cell lines for research on insect viruses. This collection was started in the 1960's, and now includes approximately 90 cell lines from 30 different species, with a focus on moths and beetles. Aside from the collection's key role in developing insect viruses for biocontrol, scientists were also able to use the collection to develop expression vectors for producing proteins with the potential for vaccine development.

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Biological Control of Insects Unit Cell Culture Collection (Columbia, Missouri)

ARS researchers at the Biological Control of Insects Unit maintain a collection of 54 insect cell lines from 27 different species, with a focus on moths. This collection is used for Agency research on insect virus control.

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ABADRL Biting Midge and Mosquito Collection (Laramie, Wyoming)

Scientists at the Arthropod-Borne Animal Diseases Research Laboratory maintain an insect cell collection of 10 strains of biting midges and mosquitoes for use in their studies on controlling insect-caused human and animal diseases. Research projects currently focus on bluetongue virus, epizootic hemorrhagic virus, West Nile virus, and vesicular stomatitis, and provide general information that may be applied to other arthropod-borne animal pathogen-caused diseases such as African horse sickness, anaplasmosis, heartwater fever, rift valley fever and akabane. Epidemics caused by such diseases could seriously affect the food supply in the United States and have significant economic impact on the agricultural industry and American consumers.

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Biosciences Research Collection of Lepidoptera and Coleoptera (Fargo, North Dakota)

ARS researchers at the Insect Genetics and Biochemistry Research Unit maintain a collection of 20 strains of moth and beetle cell lines for use in studying insect viruses. Research focuses on the use of these cell lines to develop insect viruses as biocontrol agents as well as for use as expression vectors for producing proteins and, potentially, vaccines.

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Other Insect Cell Collections (various locations)

ARS also maintains small insect cell collections at Fresno, California; Gainesville, Florida; Sidney, Montana; and Fort Pierce, Florida. Each collection contains only a few cell lines and is used primarily to support the insect virus and developmental biology research at that location.

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PLANT VIRUS AND VIROID COLLECTIONS

ARS' plant virus and viroid collections contain several hundred agents used to support research projects at various research locations and are used for virus diagnosis and research around the world. These collections play a critical role in responding to threats posed by new and recurring diseases; for example, the whitefly-transmitted virus collection at Salinas, California, has helped with the diagnosis and characterization of viruses and provided critical support during a recent emergence of whitefly-transmitted criniviruses that have threatened a number of crops. On other occasions, plant virus collections have been used to demonstrate that plants in question were virus-free and safe for release to industry. Plant virus and viroid collections are primarily "working collections" used to support a particular research project, although some are also available for distribution upon request.

Units

ARS maintains 33 plant virus or viroid collections at management units across the country. Of these, approximately eight units maintain core collections with a significant number of specimens. The core collections are maintained in Corvallis, Oregon; Salinas and Parlier, California; Fargo, North Dakota, Beltsville, Maryland, Aberdeen, Idaho, and Ithaca, New York.

Quarantine Virus/Viroid Collection (Beltsville, Maryland)

The National Germplasm Resources Laboratory's Plant Disease Research Unit maintains a quarantine collection of viruses/viroids for crop production research. The collection currently includes more than 60 isolates of foreign and domestic sources, which are used primarily for ARS research to detect, characterize, and eliminate quarantine pathogens. Resources from the collection support ARS scientists in their work to improve pathogen detection and elimination protocols, promoting the safe exchange and preservation of plant genetic resources. The collection is not routinely available for distribution.

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Potato Virus Y Isolates Collection (Ithaca, New York, and Aberdeen, Idaho)

In collaboration with the Canadian government and the potato industry, ARS scientists are developing a collection of potato virus Y isolates to support a new research program to control damage caused by necrotic strains of this virus. The collection contains 3,000 isolates of the virus, which has emerged in recent years as a serious pathogen affecting potato production in the United States and Canada.

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Exotic Pathogens of Citrus Collection (Beltsville, Maryland)

The Beltsville Fruit Laboratory maintains a collection of viruses and viroids used to develop and validate diagnostic tests for the pathogens. This collection, including 90

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different species, contains the only comprehensive collection of citrus tristeza virus isolates, which have been characterized both biologically and at the nucleotide sequence level. Using this collection, ARS was able to develop a rapid, sensitive, and specific test for Huanglongbing, or Greening Disease, an incurable disease of citrus trees; this rapid test will aid greatly in efforts to eradicate the disease.

Ornamentals-associated Plant Virus Collection (Beltsville, Maryland)

The Floral and Nursery Plants Research Unit maintains a collection of viruses that infect ornamental plants and related viruses. The collection consists of over 60 distinct species, several represented by multiple isolates from different hosts and geographic origins. These serve as reference standards for serological and nucleic acid based tests, assisting both internal and external institutions with the development of monoclonal antibodies and PCR primers for detection and identification. The collections include associated monoclonal antibodies and hybridoma cell lines, as well as polyclonal antisera against some accessions. Using antigens and isolates from this collection, scientists have conducted research leading to the patenting of a cross-reactive antibody and cell line, which were subsequently licensed to a diagnostics company and commercialized. Resources from this collection have also contributed to the development of detection methods for Angelonia flower break virus, a virus that had initially halted breeding programs.

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Vegetable and Sugarbeet Virus Collection (Salinas, California)

The Crop Improvement and Protection Research Unit maintains a Vegetable and Sugarbeet Virus Collection, consisting of two smaller collections. One is a collection of whitefly-transmitted viruses, possibly the most diverse collection of criniviruses in the world, and the other is a collection of soil-borne viruses of vegetable and sugarbeet, which includes all major soil-borne viruses affecting these crops. The collections are used for diagnosis and research within ARS and around the world, and their resources are available for distribution to virus detection companies and outside research institutions. Recently, the collection has been used for several economically important discoveries; for example, scientists used the virus collection to identify the greenhouse whitefly as the vector of the virus causing severe stunting and yield loss in strawberries, allowing the strawberry industry to control the whitefly and significantly reduce crop damage.

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Citrus Tristeza Virus Collection (Parlier, California)

The ARS San Joaquin Valley Agricultural Sciences Center maintains approximately 125 isolates of citrus tristeza virus, the most significant viral disease affecting citrus in the United States. The collection includes isolates representing all important strains that currently exist in California. The collection is used for genomic research on the virus, and isolates are distributed to universities for collaborative research.

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Cereal Virus Collection (Fargo, North Dakota)

The Cereal Crops Research Unit maintains a collection of over one million specimens of cereal viruses, including barley stripe mosaic virus strains and antisera, to support genomic and other research at that location. In addition, isolates from the collection are

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available for distribution to research labs around the Nation. In the past, strains from the collection have been used to identify the genomic sequences of the virus that cause the greatest damage to oat and barley.

Small Fruit Crops-Plant Virus Collection (Corvallis, Oregon)

The Horticulture Crops Research Laboratory maintains a collection of plant viruses to support research on viruses that infect small fruit plants. The collection represents a broad range of virus species and includes over 250 species, strains, and isolates of plant viruses. The collection's primary use is for research to develop and test reagents for virus detection and differentiation, although some resources from the collection are also available to outside institutes and companies. In 2004, ARS scientists used isolates from the collection to show that blueberry and blackberry plants were not infected with blueberry leaf mottle and tomato ring viruses, and were therefore safe for export to Argentina.

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Specialty Crop-Associated Plant Pathogen Collections (Corvallis, Oregon)

The National Clonal Germplasm Repository maintains a collection of plant genetic resources, including 97 different pathogens, many of which are plant viruses. The collection is used for pathogen detection, evaluation, and distribution to international quarantine agencies, university researchers, and private companies, where it is used for research and for the establishment of pathogen testing programs.

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VERTEBRATE VIRUS COLLECTIONS

ARS maintains a number of small vertebrate virus collections to support Agency research efforts to combat diseases. These collections are dynamic rather than static, changing frequently as new disease outbreaks are detected and new ways of differentiating viruses are discovered. As it often takes years for pathogens to be isolated and characterized and for collections to be built, the collections themselves are highly valuable.

Units

ARS' vertebrate virus collections are used primarily for research purposes, although some are available for distribution. These collections are extremely diverse, ranging from frozen fresh tissues to actual viral stock, and are held at research locations across the Nation. Vertebrate virus collections are maintained at Laramie, Wyoming; Athens, Georgia; East Lansing, Michigan; and Ames, Iowa.

Arthropod-borne Viruses (Laramie, Wyoming)

The Arthropod-Borne Animal Diseases Research Laboratory (ABADRL) maintains a collection of numerous low to high pathogenicity arthropod-borne viruses from North, Central, and South America; Europe; Australia; Africa; and Asia. The collection includes a large number of bluetongue and epizootic hemorrhagic disease virus isolates and strains of low pathogenicity, which have been used to develop and validate diagnostic tests, to conduct molecular epidemiological investigations, and to investigate mechanisms of viral replication and transmission. ABADRL scientists maintain a substantial collection of low to medium pathogenicity vesicular stomatitis viruses for similar purposes. The laboratory also has a U.S. equine isolate of medium pathogenicity West Nile virus that has been used to produce

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new recombinant vaccines. In addition, an archive collection of low to high pathogenicity arboviruses (Sindbis, Getah, Mayaro, Middleburg, Ndumu, Omatilla, Ora Bear, Ross River, Whataroa, Una, Buttonwillow, VEE, EEE, WEE), originally used for diagnostic development and epidemiological studies, is maintained at the ABADRL. Finally, there is an archive collection of a number of medium pathogenicity non-arthropod-borne viruses (vaccinia virus, adenoviruses, herpesviruses and pseudorabies virus). This virus collection, used to support ARS research, plays an important role in the Nation's homeland security efforts.

Avian Viruses (Athens, Georgia)

The Southeast Poultry Research Laboratory maintains a collection of over 2,000 virus strains, including low pathogenicity avian influenza viruses, paramyxovirus type 1-9 viruses, and enteric viruses from poultry and other avian species collected from North and South America, Europe, Australia, Africa, and Asia. These viruses have been used to develop and validate diagnostic tests, to develop new vaccines and to conduct molecular epidemiological investigations as to the origin of new field viruses. Using this collection, ARS was able to develop rapid, sensitive, and specific real-time RT-PCR tests for avian influenza and Newcastle disease, which are now the official USDA tests for these diseases. In addition, the collection has been used for molecular epidemiological purposes to trace the viral progenitors of these California 2002 Newcastle disease outbreak and the Chilean H7N3 avian influenza outbreak, and to keep track of H7N2 virus evolution in live poultry markets of the Northeast United States. Currently, 1,000 avian influenza virus strains are undergoing full-length sequencing.

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Avian Viruses (East Lansing, Michigan)

The Avian Disease and Oncology Laboratory maintains approximately 60 strains of Marek's disease and avian retroviruses from poultry and other avian species collected primarily from the United States. These viruses have been used to develop and validate diagnostics including PCR and RT PCR, to develop new vaccines (only for Marek's disease), and to conduct basic studies on molecular characteristics and gene function of avian tumor viruses. Using this collection, ARS developed overlapping cosmid clone and BAC technologies that allowed studies on gene function of Marek's disease virus through gene deletion. Also, ARS developed monoclonal antibodies against Marek's disease, avian leukosis and reticuloendotheliosis viruses; this ARS collection of monoclonal antibodies is considered a unique source of these important reagents and has been widely used by scientists in industry, government and academia for specific diagnosis of avian tumor viruses. In addition, ARS developed a more sensitive and specific test (cell culture-ELISA) for detection of avian leukosis virus, which is now the official test used by the USDA, APHIS Center for Veterinary Biologics for screening live-virus poultry vaccines for avian leukosis virus contamination.

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NADC Virus Collection (Ames, Iowa)

The National Animal Disease Center (NADC) maintains collections of several types of viruses, held as working research and archival collections that affect various animals. Accessions include 1,100 strains of the BVDV virus isolated between 1964 and 2006. In addition, NADC maintains influenza virus strains representing the major subtypes circulating in U.S. swine as well as novel emergent subtypes. Accessions include strains isolated from 1930 to the present and are maintained for research and archival purposes. The collection

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also includes a number of adenovirus accessions, including prototypes affecting cows, sheep, goats, and deer, as well as type-specific polyclonal antibodies to these viruses, and PCR primers for the hexon gene that will detect all adenoviruses in the collection. These viruses have been used for the characterization of field isolates, pathogenesis studies, and serologic surveys; in addition, the bovine respiratory syncytial virus strain was used by the biologics industry for vaccine development and as a challenge virus for vaccine evaluation.

INVERTEBRATE GERMPLASM COLLECTIONS

ARS scientists maintain an estimated 46 collections of insects and arachnids at locations throughout the Nation. Collections vary considerably in size and scope. Unlike other ARS collections, scientists have little or no storage options for accessions in this category, and maintain them by continuous rearing for research purposes. However, these collections have been highly valuable to ARS research, and promise to provide valuable support to ARS' cutting-edge efforts at screwworm eradication, cryopreservation technology, and other critical research efforts.

Units

Most of ARS' insect and arachnid collections are small collections used to support the research at a given location. Several larger insect collections are maintained at the Biological Control Research Unit in Manhattan, Kansas; the Wheat, Peanut, and Other Field Crops Research Unit in Stillwater, Oklahoma; the National Animal Germplasm Program (NAGP) at the National Center for Genetic Resources Preservation in Fort Collins, Colorado; and the Red River Valley Agricultural Research Center in Fargo, North Dakota.

Biological Control Research Insect Collection (Manhattan, Kansas)

ARS scientists at the Biological Control Research Unit maintain a collection of 39 species of insects, including over 550 strains of the red flour beetle. Used to support ARS research, this collection is noteworthy for the comprehensiveness of its accessions, particularly for those of the beetle.

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Aphid Biotype and Natural Enemy Collection (Stillwater, Oklahoma)

The Wheat, Peanut, and Other Field Crops Research Unit maintains a collection of over 100,000 specimens of aphid biotypes and natural enemies of aphids. This collection also includes a frozen collection of over 10,000 biotypes of aphids and over 100 species of natural enemies of aphids. This collection is available to external researchers as a reference library for aphid and natural enemy research.

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Screwworm Collection (Fort Collins, Colorado)

Scientists in the NAGP National Center for Genetic Resources Preservation (NCGRP) maintain a collection of many important and unique strains of screwworms. Presently, the collection includes approximately 25,000 screwworm embryos, including 10 of the most important strains. This collection represents an important resource for screwworm eradication, and is available as needed by the ARS sterile male screwworm release program.

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Mexican Fruit Fly Collection (Fargo, North Dakota)

The Red River Valley Agricultural Research Center stores over 7,000 embryos of the Tapachula mass-rearing strain of the Mexican fruit fly. In recent years, ARS developed this collection from collaborative research with APHIS scientists to develop a cryopreservation protocol for the fly. The collection is being stored for future use, and is available to support developments in cryopreservation technology.

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INVERTEBRATE SYSTEMATICS COLLECTIONS

ARS scientists maintain 26 collections of dead insects, acquired as part of one of two types of mandated research programs. Type 1 collections are maintained by ARS research programs studying fire ants, sugarcane insects, and a variety of other insects. Type 2 collections belong to the Smithsonian Institution, falling under an ARS-Smithsonian agreement to conduct systematic research to identify insects of economic importance. Accessions are used for research and as voucher specimens for the identification and permanent scientific verification of research organisms.

Units

The Agency has four major collections, each holding more than 500,000 accessions. These include the U.S. National Insect Collection, the National Pollinating Insect Collection, the Cereal Insects Genetic Resource Library, and the Beneficial Insects Research Laboratory (BIRL) Reference Voucher Specimen Collection. In total, ARS has 11 insect collections with 5,000 or more accessions, each of which is described in further detail in Appendix 2.

U.S. National Insect Collection (Beltsville, Maryland, and Washington, D.C.)

The Beltsville Agricultural Research Center (BARC) Systematic Entomology Laboratory maintains a collection of over one million insect specimens, representing all insect orders. This collection, which has been in development for over 100 years, is considered a major historic collection. Accessions are used to support insect research at BARC and worldwide, providing identification and verification resources for the greater scientific community. Resources from this collection have recently been used to protect American citrus crops. Using the U.S. National Fly Collection, an insect systematist identified flies intercepted on Clementine oranges from Spain as the Mediterranean fruit fly, one of the world's most destructive pests. This identification led to the immediate suspension of all importations of Clementine oranges from Spain.

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R***National Pollinating Insect Collection (Logan, Utah)***

The Pollinating Insect Biology, Management, and Systematics Research Unit maintains a collection of around one million insect accessions. This collection serves ARS and the greater scientific community by supporting in-house research and existing as an archive of pollinating insects. This collection has played an important role in helping producers address recent pollination crises for several crops. Using the collection's database, producers were able to identify bee species that could serve as pollinators for sunflowers and cane berries and could be maintained with less labor and at reduced cost than traditional honey bees. In addition, the collection has helped mitigate the current pollination crisis experienced by California almond producers. The collection was used to determine where and how blue orchard

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bees can be collected naturally in California to pollinate almond crops as well as what plants can be used to increase the bee populations, thus allowing people to farm the bees and make them more available, at a reduced cost, to almond growers.

Cereal Insects Genetic Resource Library (Stillwater, Oklahoma)

The Wheat, Peanut, and Other Field Crop Research Unit maintains an important collection of insect genetic material for research regarding economically important pests of wheat and other small grains. The collection is used as an internal resource for scientists to develop pest management strategies through genetic research, and its resources are also provided to every plant breeding program in the Nation for germplasm selection. This collection is unique in maintaining live colonies of all known biotypes of the two most important cereal aphids, the greenbug (*Schizaphis graminum*) and the Russian wheat aphid (*Diuraphis noxia*); the latter costs the wheat industry \$100 million in annual losses. By comparing Russian wheat biotypes to resources in the collection, scientists recently determined that these specimens were new, rather than old introductions, and were able to pinpoint U.S. locations where these harmful pests were reproducing. This discovery allowed scientists to develop control strategies to reduce the further spread of the pest and ultimately prevented the wheat industry from experiencing substantial losses of time and financial resources.

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BIRL Reference Voucher Specimen Collection (Newark, Delaware)

The Beneficial Insects Introduction Research Laboratory maintains a collection of an estimated 620,000 insect accessions of 909 species, compiled over the past 65 years. This collection plays a critical role in the biocontrol of invertebrate pests and weeds. It is available to support identification and verification needs, and it also provides valuable support to ARS scientists conducting genetic and genomics research, pest management research, crop protection research, crop production research, and research in other areas. Using specimens from this collection, ARS scientists have conducted research leading to the identification, evaluation, and release of several biocontrol agents, including parasites of the cereal leaf beetle, the alfalfa blotch leafminer, and the alfalfa weevil; collectively, these agents save agricultural producers over \$160 million in annual insecticide costs.

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VERTEBRATE GERMPLASM COLLECTIONS

ARS researchers maintain several collections of vertebrates, including cryopreserved germplasm (semen, embryos, and primordial germ cells), dead tissue or organisms, and live animal populations. Several purposes of the collections include biosecurity, research on environmental quality, genome function, and maintenance of genetic diversity.

Units

Eleven ARS locations are engaged in vertebrate collection development and utilization. The largest collection is maintained as part of the National Animal Germplasm Program (NAGP) at the National Center for Genetic Resources Preservation in Fort Collins, Colorado. The NAGP has an elaborate structure in place to identify vertebrate populations that should be maintained as part of a collection. Through this system, animal collections of value are deposited, through the NAGP, into a collection at another research unit involved in livestock, poultry, and aquatic species research.

NAGP Vertebrate Germplasm and Tissue Collection (Fort Collins, Colorado)

The NAGP collects, maintains, and distributes germplasm and tissue (live semen, embryos, blood, and primordial germ cells) for all vertebrate species (mammalian, avian, and fish) of interest. The collection is the largest vertebrate germplasm collection in the world, consisting of 23 species, 120 breeds across species, and 300,000 samples. The collection is used for maintenance of genetic diversity, reconstitution of whole livestock breeds, and gene exploration, and is also available for distribution to U.S. researchers and livestock industries.

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Cooperative Dairy DNA Repository (Beltsville, Maryland)

The Bovine Functional Genomics Laboratory maintains the Cooperative Dairy DNA Repository (CDDR), a collection that consists of one species, approximately 7 dairy cattle breeds, and 250,000 dead semen samples. Samples are used to support gene exploration research and DNA research studies.

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Subtropical Cattle Repository (Brooksville, Florida)

ARS' Subtropical Agriculture Research Station maintains semen and embryo samples from cattle genotypes produced in the Gulf Coast region of the United States, and imported embryos from Costa Rica and Venezuela. This collection currently contains 2 species, 12 breeds, and 25,750 samples.

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Disease Resistant and Susceptible Live Chicken Lines (East Lansing, Michigan)

Researchers at the Avian Disease and Oncology Laboratory have developed 60 chicken lines selected for resistance and susceptibility to Marek's disease, avian leucosis, and reticuloendotheliosis. Of these, 15 congenic lines are unique throughout the world and are used to study disease. Eggs from these lines have been distributed to researchers internationally.

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Live Cattle Germplasm Collection (Miles City, Montana)

The Livestock and Range Research Laboratory maintains a collection of approximately 230 cattle and cattle semen, embryos, and blood as part of a cattle inbreeding experiment started in 1946. The cattle have been used to support a wide range of research, including the sequencing of the bovine genome and research conducted by the Hereford cattle breeding industry.

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Multispecies Aquatic Species Collection (Oxford, Mississippi)

ARS researchers at the National Sedimentation Laboratory Water Quality and Ecology Research Unit have developed a multispecies collection of fish, amphibians, reptiles, and mammals. This collection, containing 10,600 specimens of 124 vertebrate species, provides baseline information on life form changes in rivers, streams, and wetlands.

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PLANT GERMPLASM AND SYSTEMATICS COLLECTIONS

ARS maintains plant germplasm and systematics collections as part of the National Plant Germplasm System (NPGS), one of the largest distributors of germplasm in the world. NPGS conserves over 474,000 accessions of more than 11,800 species of plant germplasm. In the 1970's, as part of a combined Federal and State effort, NPGS arose as a national network of people and institutions responsible for managing germplasm important to U.S. and world agriculture. The collection comprises more than 20 different genebanks located throughout the Nation. Accessions include a very comprehensive collection of grains, vegetables, fruits, nuts, beans, and other major crops such as cotton. Other accessions include ornamental and medicinal plants, some forest trees, and potential industrial crops.

Unlike the majority of ARS collections, which are small and exist to support in-house research, most of NPGS' distributions go to external crop breeders, researchers, and educators, with an average of 120,000 accessions distributed annually and 30,000 accessions exported to non-U.S. requestors. Accessions are distributed widely, free-of-charge, and without restriction. Many samples are sent to requestors seeking crop varieties that are resistant or tolerant to various pathogens and environmental stresses that, collectively, threaten to lead to significant food shortages in parts of the world, as well as billions of dollars in crop losses annually. NPGS is recognized worldwide as pivotal to current and future global food security.

NPGS is unique in being a highly-integrated and well-functioning system for managing plant germplasm. Maintenance is a high priority within these collections, and for the most part, storage facilities are adequate and in good condition. Unlike many other collections, NPGS has an extensive online system to organize its collections and evaluation data. All new germplasm is documented with collector numbers, locality data, associated vegetation, and a variety of other relevant data. This data is then incorporated into the Germplasm Resources Information Network (GRIN) System, a database available online for public access. The taxonomy for the system is world class, with one full-time scientist devoted to keeping taxonomies up-to-date. NPGS is also distinctive in having a centralized operations manual for the entire system, and each NPGS site is required to develop a manual for its individual site with policies for acquisition, disposal, documentation, preservation, access and use, handling, and security.

Units

ARS maintains numerous collections of plant germplasm and systematics through NPGS. Seventeen of the most significant collections appear below.

National Center for Genetic Resources Preservation Collection (Ft. Collins, Colorado)

The National Center for Genetic Resources Preservation (NCGRP) conserves genetic resources of crops and animals important to U.S. agriculture and landscapes. Genetic resources from this collection are used for the conservation of biological diversity and utilization of genetic resources for economic and environmental sustainability. In addition to being a seed bank, NCGRP is a repository for animal genetic resources in the form of semen, and plant genetic resources in the form of graftable buds or *in vitro* plantlets. Genetic resources are often preserved using cryopreservation technologies.

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National Small Grains Collection (Aberdeen, Iowa)

The National Small Grains Collection (NSGC) is an active germplasm collection that maintains collections representing global diversity of the small grains, including 54,927 accessions of wheat, 27,704 accessions of barley, 21,194 accessions of oat, 18,442 accessions of rice, 2,123 accessions of rye, 2,007 accessions of triticale, and various accessions of wild relatives. The beginnings of the small grains germplasm collections date to about 1897 with the organization of the Seed and Plant Introduction Office, and the NSGC was officially organized in 1948.

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Southern Regional Plant Introduction Station Collection (Griffin, Georgia)

The Southern Regional Plant Introduction Station (Griffin, Georgia) maintains collections of bambara groundnut, bamboo, castor, eggplant, grass (warm season), guar, hibiscus, okra, peanuts, peppers, pigeon-pea, pearl millet, gourds, legume, luffa, sesame, sorghum, sweet potato, vigna, watermelon, and wingbean. Located on the Griffin Campus of the University of Georgia, College of Agricultural and Environmental Sciences, the PGRCU is one of four regional plant introduction stations and is also known as Multistate Research Project S-009. The PGRCU is charged with the responsibility to acquire, characterize, maintain, evaluate, document, and distribute genetic resources of agronomic and horticultural crops. Objectives include conserving genetic resources and associated information for a broad spectrum of crops and related species; developing and applying new or improved evaluation procedures and marker-based approaches to assess diversity of genetic resources in the collections and evaluate materials for useful traits; and transferring technology to researchers and plant breeders in the Southern Region and worldwide in the form of plant genetic resources and associated information.

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Western Regional Plant Introduction Station Collection (Pullman, Washington)

The Western Regional Plant Introduction Station (WRPIS) has the responsibility of maintaining seed and clonal germplasm of over 2,600 plant species from 376 genera. The station was established in 1952 with the initial mission to acquire new plant germplasm and establish a maintenance program. Subsequently, germplasm conservation and research programs developed in the disciplines of horticulture, agronomy, genetics, plant pathology, and entomology. Primary facilities are located on the campus of Washington State University, and sister programs include the National Temperate Forage Legume Genetic Resources Unit in Prosser, Washington, and the National Arid Land Plant Genetic Resources Unit in Parlier, California. Recently, WRPIS has been involved in preserving collections of special genetic stocks and developing core subsets of the larger collections.

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Northcentral Regional Plant Introduction Station Collection (Ames, Iowa)

The North Central Regional Plant Introduction Station (NCRPIS) maintains collections of amaranths, *Brassica*, cucumbers, melons, *Cuphea*, carrot, flax, grasses, sunflowers, ornamentals, umbels, and corn. The station was founded in 1948, and is a joint venture among ARS' Plant Introduction Research Unit, the Agricultural Experiment Stations of the 12 North Central States, and Iowa State University. The NCRPIS mission is to conserve genetically diverse crop germplasm and associated information, conduct germplasm-related

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research, and encourage the use of germplasm and associated information for research, crop improvement and product development.

Northeast Regional Plant Introduction Station Collection (Geneva, New York)

The Northeast Regional Plant Introduction Station maintains collections of cherry, apple, and grape. The ARS location at Geneva, New York, consists of two research units: Plant Genetic Resources Unit and Grape Genetics Research. The facility is located on the Geneva campus of Cornell University. ARS and Cornell have had a mutually beneficial working relationship for many years. The ARS Plant Genetic Resources Unit is located on the Geneva, New York Campus of Cornell University, The Plant Genetic Resources Unit was formed in 1986 by merging the Northeast Regional Plant Introduction Station (NERPIS) and the National Clonal Germplasm Repository for Apple, Tart Cherry and Grape (NGR). The two missions of the PGRU are the preservation of germplasm of selected crop plants and the breeding and improvement of grapes and apples. Specific activities include acquisition, documentation, maintenance, characterization, breeding, enhancement, and distribution of the assigned crops. PGRU maintains approximately 20,000 different accessions, representing over 300 species.

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National Clonal Repository for Temperate Fruit, Nut, and Specialty Crops Collection (Corvallis, Oregon)

The National Clonal Repository in Corvallis, Oregon, conserves global genetic resources for hazelnuts, strawberries, hops, mint, currants, gooseberries, blackberries, raspberries, hybrid berries, blueberries, cranberries, lingonberries, kiwifruit, pawpaws, juneberries, mountain ash, quince, elderberries, and graft- or cross-compatible relatives and other edible fruits. The collection includes frozen accessions and cryogenically-preserved accessions, as well as accessions stored in field genebanks and tissue cultures.

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USDA Soybean Germplasm Collection (Urbana, Illinois)

The USDA Soybean Germplasm Collection maintains 20,752 accessions of the genus *Glycine*, with 19 species. The majority of these, (18,667 accessions), are the cultivated soybean, *Glycine max*, and the remainder are several thousand accessions of soybean's wild relatives used for research on gene transference for crop improvement.

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National Cotton Germplasm Collection (College Station, Texas)

The National Cotton Germplasm Collection maintains collections of cultivated cottons and several thousand accessions of their wild relatives.

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U.S. Potato Genebank (Sturgeon Bay, Wisconsin)

ARS scientists at the Potato Introduction Station maintain a collection of true seeds, *in-vitro* stocks, and tubers of wild and cultivated potato (*Solanum*, section *Petota*). The collection includes 4,308 germplasm accessions of 146 species of the potato and 14,270 herbarium sheets. The collection has about 75 percent of the wild species and is actively incorporating more. Resources are used by a variety of scientific disciplines from physiology to entomology to taxonomy, but its primary use is by potato breeders to incorporate resistances to diseases and pests that affect the cultivated potato crop, and for agronomic improvements in appearance, flavor, and yield. The genebank takes a five-fold

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approach of introduction, classification, preservation, evaluation, and distribution of potato germplasm. In addition, duplicate herbarium specimens can be loaned to recognized institutions and scientists upon request.

National Clonal Germplasm Repository (Hilo, Hawaii)

The Hilo National Clonal Germplasm Repository maintains and evaluates accessions of breadfruit, carambola, guava, litchi, longan, papaya, peach-palm, pili-nut, pineapple, and rambutan, important clonal crops designated as tropical fruits, nuts, beverages, and ornamentals. In 1986, the National Clonal Germplasm Repository for Tropical Fruit and Nut Crops was initiated as a joint cooperative project between ARS, NPGS, and the University of Hawaii at Manoa, and became part of NPGS in 1989. The current collection includes approximately 1,000 accessions maintained as living plants in 33 acres of field plantings at three locations. Selected germplasm are grown in tissue culture and in greenhouses.

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National Clonal Germplasm Repository (Davis, California)

The National Clonal Repository in Davis maintains figs, grapes, kiwis, mulberries, olives, persimmons, pistachios, pomegranates, various *Prunus* crops (peaches, cherries, almonds, apricots, plums), and walnuts. Most of the plants in the collections are maintained through vegetative propagation (by rooting cuttings or budding onto rootstocks) to preserve their unique traits. The plants in the collections are grown in greenhouses, screen houses, and as field plantings.

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National Clonal Germplasm Repository (Mayaguez, Puerto Rico)

The Tropical Agriculture Research Station at Mayaguez, Puerto Rico, maintains one of the finest and best-documented tropical plant collections in the Western Hemisphere. It has been built up over more than half a century by collections from all over the tropical world and consists of more than 2,000 permanently-established species. Accessions include samples of camphor, teak, mahogany, cinnamon, nutmeg, rubber, coffee, bamboo, various palms and tropical fruits, vanilla, bay oil, manila hemp, black pepper, cacao, citronnella, lemon-grass, insecticidal plants, cortisone yams, coconuts, numerous exotic flowers, and others.

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National Clonal Germplasm Repository (Miami, Florida)

The National Germplasm Repository shares responsibility with the Mayaguez, Puerto Rico, site for maintaining the U.S. clonal collections of mango, avocado, banana and plantain, tropical citrus, annonas, sugarcane and related grasses, palms, *Tripsacum*, and a few other relatively minor tropical crops. The collection maintains approximately 6,000 accessions, with the majority (3,500) being of fruit and grass, and the remaining 2,500 consisting of ornamental, chemurgic, and spice introductions from tropical and subtropical areas of the world. These plants are part of a unique collection, and requests for material come from many scientific disciplines. This repository meets the needs of U.S. agriculture by the collection, evaluation, and development of improved commercial plants; the development of methods for the management of exotic insect pests; and the development of technologies to promote a sustainable agro-hydrology system.

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U.S. National Arboretum Herbarium (Washington, D.C.)

ARS scientists maintain a wide variety of plants from all over the world as part of the U. S. National Arboretum Herbarium, a facility for research on the systematics, nomenclature, and history of cultivated plants. The herbarium contains about 600,000 specimens of 2,400 types of ornamentals, crop plants, weeds, and forest trees. The collection is worldwide in scope, and is noted for its extensive reference collection of the native flora of the United States and Canada. Formally organized in 1934, the herbarium serves as a national repository for voucher materials of wild and cultivated progenitors of various plants used for food, forage, industrial, and medicinal purposes. The collection has served to document germplasm materials as a permanent legacy of the history and development of American agriculture. Materials from the collection support ARS research on the nomenclature and taxonomy of cultivated plants, particularly those of economic importance. ARS also uses the collection to carry out 5,000 identifications annually as requested by government agencies, educational institutions, farmers, and other individuals and organizations.

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U. S. National Seed Herbarium (Beltsville, Maryland)

The U.S. National Seed Herbarium is the world's largest taxonomic seed collection, providing research material and rapid identifications of isolated seeds and fruits of economically important plants. The collection contains 120,000 seed and fruit samples of 390 families, 13,000 genera, and 27,000 species. Materials from the collection are used for almost 5,000 identifications of specimens each year as well as to support ARS research and documentation efforts. Information about the collection, including passport, taxonomy, description, and other data, is available on the Internet through the GRIN database.

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Grass and Legume Collection (Logan, Utah)

ARS scientists at the Forage and Range Research Laboratory maintain a collection of 3,500 accessions of grass and legume germplasm. This collection supports ARS research in plant genetics, molecular biology, plant ecology, and physiology; scientists use resources from the collection for the genetic improvement of grasses, legumes, and forbs to develop and release plant species with improved characteristics, including the ability to grow in semiarid and irrigated environments. Breeding lines and clonal material from the collection are also available for distribution.

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PLANT CELL CULTURE COLLECTIONS

Many ARS laboratories maintain collections of plant cell cultures and genetic stock plants. Researchers maintain collections of stock plants for the establishment of plant cell cultures, which typically, due to epigenetic and genetic changes, are not maintained indefinitely, but are routinely reestablished from stock plants. Thus, most cell cultures are maintained as *in vitro* cultured whole plants. In addition to the collections of stock plants maintained for cell culture establishments, most plant breeding programs also maintain genetic stock plants and populations specific to their research projects. ARS' genetic stock plant collections contain several thousand plants at many research locations. These collections play a critical role in developing improvement germplasm that is used by both the private and public sector and in maintaining standard genotypes for research studies. Both types of collections are primarily "working

collections” used to support a particular research project, although some are also available for distribution upon request.

Units

Although ARS has no “core” collections of plant cell cultures and genetic stock plants, the Agency has several hundreds of small collections used for genetic research. These include, but are not limited to, collections of potatoes, tomatoes, peppers, eggplant, petunias, wheat, barley, corn, alfalfa, soybeans, strawberry, carrots, cucumbers, onions, lettuce, brassica, blueberry, and cherry. For example, ARS scientists maintain a collection of *Petunia* at Beltsville, Maryland; *Citrus* at Fort Pierce, Florida; *Capsicum* at Beltsville, Maryland; *Prunus* at Washington, D.C., and *Pyrus* at Kearneysville, West Virginia.

Petunia Collection (Beltsville, Maryland)

The Floral and Nursery Plants Research Unit maintains a collection of plant cell cultures, as well as whole plants of unique taxa/genotypes. The collection consists of over 50 distinct taxa/genotypes. The collection serves as a research tool for classical breeding, molecular breeding, physiological studies, and genetic mapping. Germplasm from this collection has been used to create commercially successful cultivars, and also serves as a source of “standard” petunia genotypes for scientific genetic/physiological studies throughout the world.

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Citrus Collection (Fort Pierce, Florida)

ARS scientists at the Horticulture and Breeding Research Unit maintain a collection of over 750 distinct taxa/genotypes of plant cell cultures and whole plants. The collection serves as a research tool for classical breeding, molecular breeding, physiological studies, and genetic mapping. Over 80 percent of the citrus trees planted in the United States contain a variety developed by this Unit using this collection.

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Capsicum Collection (Beltsville, Maryland)

The BARC Vegetable Laboratory maintains a seed and plant collection of genetic mutants and unique wild and cultivated germplasm, incorporating over 100 distinct taxa/genotypes. Several of the plants represent unique gene combinations. The collection serves as a research tool for classical breeding, physiological studies, and genetic mapping. In the past, scientists have used germplasm from this collection to create commercially successful cultivars.

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Prunus Collection (Washington, D.C.)

The Floral and Nursery Plants Research Unit maintains a collection of plant cell cultures, as well as genetic mutants and unique wild and cultivated germplasm. The collection consists of over 30 distinct taxa/genotypes. The collection serves as a research tool for classical breeding, molecular breeding, physiological studies, and genetic mapping. Germplasm from this collection has been used to create commercially successful cultivars.

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Pyrus and Prunus Collections (Kearneysville, West Virginia)

The Appalachian Fruit Research Station maintains a number of field planted clones and populations of peach, nectarine, and pear for research on fruit quality traits, growth habits, and

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resistance to major diseases and insect pests. These collections include foundation parental and grandparental genotypes essential for pedigree-based mapping. Resources from the collection include unique tree fruit clones and populations segregating for traits of economic importance, which are an invaluable asset for the development of molecular markers for breeding and for functional genomic studies.

HUMAN TISSUE COLLECTIONS

ARS Human Nutrition Centers maintain human biological samples to support research on the effects of foods and food components on human health. During research, samples are collected, processed, and stored. Samples are kept at appropriate temperatures with the bulk going into biological freezers. Blood plasma/serum is the major human biological fluid stored; other materials include whole blood, blood cells, urine, feces, and less commonly, samples of body fat, milk, and cells from sites other than plasma (e.g., buccal [cheek] cells). Samples are preserved until analyses are completed, and then discarded. Thus, these samples are not considered part of a core collection, but rather maintained temporarily to support particular research projects.

Units

ARS has six Human Nutrition Research Centers throughout the United States, and all centers conduct human studies. The number of subjects in a study and the number of samples collected from any given subject vary depending on the goal of the study. For example, six subjects may be sufficient for one outcome measure whereas 60 may be required for another. Samples are generally collected from subjects who are in good health, but subjects are not necessarily representative of the U.S. population with regard to income, race, geographical representation, and other characteristics.

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NATURAL RESOURCES COLLECTIONS

ARS maintains only one natural resource collection, a soils collection at the Salinity Laboratory in Riverside, California.

Soil Collection (Riverside, California)

ARS scientists maintain a collection of soils compiled over the last 20 to 50 years, including soils with a variety of properties and chemistries. The collection is used primarily for research by the ARS Salinity Laboratory, but it also serves as a “benchmark” of soils associated with different regions. Using the collection, scientists can determine the impact of agriculture, industry, and urbanization on soil quality. For example, scientists used soils from the collection to determine the dramatic effects of urbanization on the city of Los Angeles.

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CHEMICAL COLLECTIONS

ARS scientists maintain non-commercially available, classical collections of organic/natural product chemicals to support internal and external research. These collections include hormones, semiochemicals, flavanoids, caseins, dextran phosphomannans, and materials used for synthesis of these compounds, ranging in size from as few as 25 to as many as several thousand

accessions. The collections are often unique in type, size, and scope, and provide critical support to the research of the units involved.

Semiochemical Collection (Gainesville, Florida)

The CMAVE Chemistry Research Unit houses one of the world's largest collections of semiochemicals that modify insect behavior. This collection contains 350 synthetic samples of insect pheromones and 300 samples of kairomones and plant-produced attractants for insects; it includes many unique compounds. Samples from the collection are available to scientists from around the world.

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Insect Ecdysteroid Hormone and Reagent Collection (Beltsville, Maryland)

The BARC Chemicals Affecting Insect Behavior Research Unit maintains a collection of 150 sterols related to insect ecdysteroid hormones. This collection is unique in size and structure and has been used extensively for research purposes. The unit also maintains a very substantial collection of reagents used to synthesize compounds affecting insect behavior and physiology; this collection is available for distribution to external scientists.

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Casein Genetic Variants (Wyndmoor, Pennsylvania)

The Dairy Processing and Products Research Unit maintains a small but unique collection of 25 naturally produced caseins from different genetic sources, which is used to support ARS research.

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NRRL Dextran Phosphomannan Collection (Peoria, Illinois)

ARS scientists at the Bioproducts and Biocatalysis Research Unit have compiled the NRRL Dextran Phosphomannan Collection (200-300 samples) over the last 20-50 years. This unique collection, including 200-300 samples of dextran phosphomannan, is available to scientists worldwide.

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MOLECULAR REAGENTS COLLECTIONS

To support in-house and external research, ARS scientists maintain collections of chemicals associated with molecular genetic/germplasm research. These include DNA sequences, ESTs, gene sequences, and BAC libraries ranging in size from as few as 25 to 70,000 accessions. The collections are often unique in type, size, and scope, and provide critical support to the research of the units involved.

Although this report has some information on molecular reagents, the informatics submitted was quite incomplete in representing a small portion of a vast, growing collection of ESTs, etc. Molecular reagents will be addressed more comprehensively, later, by a separate strategic plan.

Units

ARS molecular reagent collections include the following: a soybean DNA collection, an EST collection of blueberries, an EST collection of Euphorbiaceae, an EST collection for the red imported fire ant, a body fluid and blood collection for bulls, and collections of flavonoids and viral gene clones.

Soybean Tilling Library (West Lafayette, Indiana)

The Soybean Tilling Library at the Crop Protection and Pest Control Research Unit maintains a 9,000 specimen DNA collection, one of the largest collections of its type. The collection supports research by ARS, university scientists, and other external researchers.

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Blueberry EST Library (Beltsville Maryland)

The Beltsville Fruit Laboratory maintains a 5,000 specimen collection of blueberry ESTs that includes samples from throughout the world. This collection is unique in scope and is available to scientists worldwide.

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Euphorbiaceae EST Database Collection (St. Paul, Minnesota)

The Plant Science Research Unit maintains a 70,000 EST database collection of Euphorbiaceae, the largest collection of its type. The collection is used to support ARS research and is also available for distribution to researchers around the world.

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Solonopsis invicta EST Library (Gainesville, Florida)

The Imported Fire Ant and Household Insect Research Unit maintains a 2,500 EST library for the red imported fire ant. The collection is used to support ARS fire ant research.

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Bovine Body Fluid and Blood Collection (Beltsville, Maryland)

The BARC Bovine Functional Genomics Laboratory maintains a collection of body fluid and blood from bulls. The collection is one of the largest of its type, including 250,000 samples from 25,000 bulls.

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Viral Gene Clone Collection (Beltsville, Maryland)

A collection of flavonoid standards collected over the past 50 years and is used to support ARS research. The Beltsville Agricultural Research Center Floral and Nursery Plants Research Unit maintains the first unique collection of viral gene clones of significance to diseases of ornamental and nursery crops and is accessed by scientists globally.

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OVERSEAS BIOCONTROL LABORATORY COLLECTIONS

ARS operates four overseas laboratories in six countries that conduct research in support of U.S. biocontrol research programs. The overall mission of these laboratories is to search for, identify, evaluate, and prioritize potential biological control agents for use against invasive species, with emphasis on species that are invasive to the United States. The overseas laboratories and their locations are the Australian Biological Control Laboratory (ABCL), Brisbane, Australia; the European Biological Control Laboratory (EBCL), Montpellier, France; the South American Biological Control Laboratory (SABCL), Buenos Aires, Argentina; and the Sino-American Biological Control Laboratory (Sino-ABCL), Beijing, China. Various biological collections in support of biocontrol research have been assembled and are maintained at these laboratories. Each of the laboratories has had a positive impact on U.S. agriculture through the collection, identification, and release and establishment of one or more biocontrol agents. Some of these

agents have provided millions of dollars of benefit through increased yields, lower production costs, and reduced environmental contamination.

Units

The collections at the four laboratories consist of biocontrol agents (arthropods and plant pathogens) and botanical specimens. These collections, though small in comparison to U.S. collections, are unique and are invaluable to biocontrol researchers. It would be impossible to reassemble these collections if they were lost. A large portion of the biological resources at these laboratories are “working” collections associated with specific projects. The more substantial collections are detailed below.

European Biological Control Laboratory (EBCL) (Montpellier, France)

EBCL, the largest and longest-operating overseas laboratory, maintains a number of working collections, consisting of arthropod natural enemies for weed and insect biocontrol targets. These collections are maintained by individual researchers as a part of specific projects. EBCL also has a pathogen collection consisting of approximately 2,000 living specimens collected over the past 20 years. These pathogens were collected from a variety of countries for use as potential biocontrol agents for target insects and weeds. The collection is nearly completely identified, catalogued, and accessible through an electronic database.

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Australian Biological Control Laboratory (ABCL) (Brisbane, Australia)

ABCL is located on the Brisbane campus of Australia’s Commonwealth Scientific and Industrial Research Organization. Despite being one of the smallest overseas biological control laboratories, ABCL has the largest arthropod collection with up to 10,000 specimens. These insects were collected over the past 25 years as part of foreign exploration research for biocontrol of weeds. The collection is generally sorted and identified to some level, and the overall condition is fair. There is no electronic database associated with the collection.

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South American Biological Control Laboratory (SABCL) (Buenos Aires, Argentina)

SABCL is the second largest and second oldest overseas laboratory. A large arthropod collection (approximately 8,000 specimens) has been developed over the past 44 years as a result of foreign exploration research for weed biological control. The SABCL collection is generally sorted and identified, with less than 25 percent catalogued; it is not accessible through an electronic database.

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Sino-American Biological Control Laboratory (Sino-ABCL) (Beijing, China)

Sino-ABCL is the smallest and most recently established overseas laboratory. Collections at this laboratory are primarily “working collections” used to support biocontrol research on-site.

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APPENDIX 1: GLOSSARY

ACCESSIBILITY – the ability of ARS researchers, external researchers, and the general public to obtain information about collection items, either onsite or electronically

ACCESSIONS – items or groups of items in a unit's collection

ACQUISITION – 1) the act of gaining legal title to a collection item or group of items; 2) an item that a collecting unit has obtained and added to its collection

CATALOGUE – a set of records that identifies, names, classifies, numbers, and describes each item in a unit's collection.

COLLECTION – a group of items with a common base of association

COLLECTIONS CARE – activities intended to protect the long-term integrity of collection holdings and their associated documentation. Typical activities include identifying, recording, and locating collection items; storing them in safe environments; conserving or restoring them when necessary; ensuring safe and responsible use; and routinely assessing their condition.

CULTURE COLLECTIONS – collections of colonies or growths of microorganisms, tissue cells, or other living matter in a specially prepared nutrient medium

CURATOR – individual in charge of caring for a collection, often a category 3 or category 4 scientist

DATABASING – maintaining an inventory of existing items in a collection

DIGITIZATION – the process of capturing both text and/or image information on collections in electronic form

DISPOSAL – the process of physically removing de-acquisitioned or other non-acquisition collection items from a collecting unit, often accompanied by transfer of title to another entity

INVENTORY – 1) an itemized listing of a unit's collection items, groups, or lots, and their current physical location; 2) the process of developing and maintaining such an itemized listing

MAINTENANCE – the routine actions that support collection preservation and access, such as monitoring storage and exhibition conditions, organizing a collection in storage, and performing general housekeeping

POLICY – a principle or set of principles that establishes directions, guides decisions, and provides a framework for plans and related actions

PRESERVATION – protection and stabilization of collections and associated information through a coordinated set of activities aimed at minimizing chemical, physical, and biological deterioration, and at preventing loss of intellectual, aesthetic, and monetary value

SPECIMEN-BASED COLLECTIONS – a collection of non-living organisms, parts of organisms, or naturally occurring materials (in this document, used to distinguish between living culture collections and non-living collections, although a specimen can be used to denote a living object)

APPENDIX 2: TABLES BY TAXONOMIC GROUP

***Note: Invertebrate Germplasm, Vertebrate Viruses, and Overseas Labs Tables Incomplete or Unavailable**

Table 1: Bacteria

Collection	ARS Culture Collection (NRRL)	National Rhizobium Culture Collection	Bacterial Collection	Bacillus Environmental
Management Unit	Microbial Genomics and Bioprocessing Research Unit, NCAUR; Peoria, IL	Soybean Genomics and Improvement Laboratory; Beltsville, MD	Bacterial Epidemiology and Antimicrobial Resistance Research Unit; Athens, GA	Insect Biocontrol Laboratory; Beltsville, MD
National Program	NP 301, “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant, Microbial & Insect Genetic Resources, Genomics, & Genetic Improvement”	NP 108 “Food Safety”	NP 304 “Crop Protection and Quarantine”
Type	Broad collection of bacteria and fungi important to agriculture and biotechnology; international reference center; international patent culture collection	<i>Rhizobia</i>	Frozen and lyophilized bacterial cultures	Environmental <i>Bacillus</i>
Use/Importance	ARS/Worldwide source of microbial germplasm for agriculture, biotechnology, and medicine	<i>Rhizobia</i> are symbionts that have to be maintained with host plants. Used by scientists, industry, the general public for legume inoculation, bioremediation, land reclamation	Used for research primarily on antimicrobial resistance in bacteria from animal and environmental sources	Source of insect biocontrol agents as well as background <i>Bacillus</i> for Defense and Homeland Security research
Size	Bacteria, 19,000; Fungi, 60,000; Patent Cultures, 6,000. Square footage of collection space: 800 sq. ft.	5,000 specimens; 2,150 sq. ft., another 2,000 specimens uncurated	93,000 isolates; 250 sq. ft.	41,000 isolates; 20 sq. ft.; another 30,00 isolates uncurated
History	November 1940	1913	October 1996	1983

Staffing	1.8 FTE Cat. 1 SY; 0.4 FTE Cat. 3 support sci.; 2.6 FTE Cat. 7 Technicians	.25 FTE Cat. 1 SY; .5 FTE Cat. 3 support sci.; 1.0 FTE Technician	0.2 FTE support sci.; 0.6 FTE Technician 0.6 PTE Biol. Aid	.1 FTE Cat. 1 SY; .2 FTE GS-8 Technician
Duplications	≤ 11 percent	Unique	Unique	1 percent backup, otherwise unique
Specimens Identified	75 percent from phenotype, ca. 15- 20 percent from genotype	100 percent; however, acquisitions from 2 other collections would increase specimen number by one-third	100 percent	99 percent partially characterized
Accessibility	All strains in the open collection have digitized records; publicly accessible database is available http://nrri.ncaur.usda.gov	76-99 percent Web accessible	Digital records; none Web accessible	Digital records; none Web accessible

Table 2: Fungi

Collection	ARS Culture Collection (NRRL)	ARS Collection of Entomopathogenic Fungi (ARSEF)	BARC Living Fungal Collection	U.S. National Fungus Collections (BPI)
Management Unit	Microbial Genomics and Bioprocessing Research Unit; NCAUR, Peoria, IL	U.S. Plant, Soil, and Nutrition Laboratory; Ithaca, NY	Systematic Botany & Mycology Laboratory; Beltsville, MD	Systematic Botany & Mycology Laboratory; Beltsville, MD
National Program	NP 301 “Genetic	NP 304 “Crop Protection and	NP 303 “Plant Diseases”	NP 301 “Genetic Resources”

	Resources”	Quarantine” also NP 301 “Genetic Resources” and NP 306 “Quality and Utilization of Agricultural Products”		
Type	Living fungi, primarily yeasts and filamentous fungi, worldwide	Living fungi that attack insects, worldwide	Living fungi, primarily plant pathogens and biocontrol fungi, worldwide	All kinds of fungi, reference specimens, worldwide
Use/Importance	Used for systematics, food processing, plant pathogens	Used for development of fungi for biocontrol of insects	Used for systematics and identification of plant pathogens and development of biocontrol fungi	Serves as repository for voucher specimens, historical; documents fungi through time and space
Size	60,000 fungal cultures, ca. 1,000 sq. ft.	8,500 fungal cultures; 500 non-living specimens, 1,700 sq. ft.	11,000 fungal cultures, 100 sq. ft.	1,100,000 non-living specimens, 3,200 sq. ft.
History	Compiled over 50-100 years	Initiated 1977	1970’s, associated with systematic research programs	Originated over 100 years ago, 1890’s, includes free-living fungal specimens from Smithsonian Institution
Staffing	1.9 FTE SY 2.0 FTE Full-time support; 3.9 FTE part-time support	1.0 FTE Cat. 4 SY 3.0 FTE support staff	No staff dedicated to collection	0.5 FTE Cat. 1 SY 1.0 FTE support staff
Duplications	15 percent plus back-up	15 percent plus back-up	<10 percent, no back-up	<20 percent
Specimens Identified	Variable, depends on group	Excellent	>70 percent	>95 percent
Accessibility	>50 percent data accessible on internet	>95 percent data accessible on internet	100 percent computerized, not available on internet	>95 percent data accessible on internet

Table 3: Nematodes

Collection	USDA Nematode Collection	Entomopathogenic Nematode Collection	Florida <i>Meloidogyne</i> Collection
Management Unit	Nematology Laboratory, Beltsville Agricultural Research Center; Beltsville, MD	Southeastern Fruit Tree and Nut Research Laboratory; Byron, GA	U.S. Horticultural Research Laboratory; Fort Pierce, FL
National Program	NP 303 “Plant Diseases”	NP 304 “Crop Protection and Quarantine”	NP 308 “Methyl Bromide Alternatives”
Type	Fixed plant and insect nematodes	Insect-pathogenic nematodes in liquid nitrogen	Living root-knot nematodes
Use/Importance	Used for systematics and identification of plant-parasitic nematodes; used in CRIS and by outside scientists	Used in research to control pest insects with insect-parasitic nematodes	Used for research to control plant-parasitic nematodes with chemicals and biological control agents
Size	41,000 slides and vials; 371 sq. ft.	50 strains; 12 sq. ft.	200 sq. ft.
History	June 1960	November 1999	November 1997
Staffing	0.2 FTE Cat. 4 SY 0.5 FTE Support Sci. 0.5 FTE Biol. Aid	0.75 FTE GS 5-7 Technician 0.05 FTE Cat. 1 SY	0.5 FTE GS-5 Technician
Duplications	<25 percent	<67 percent	100 percent
Specimens Identified	>75 percent identified	>75 percent catalogued	100 percent
Accessibility	Vast majority of records digitized, all Web accessible	No digital records	Digital records; none Web accessible

Table 4: Parasites and Vertebrate Protozoa

Collection	National Parasite Collection
Management Unit	US National Parasite Collection; Beltsville, MD
National Program	NP 103 “Animal Health”
Type	fixed, preserved, and frozen physical specimens of macroparasites (helminths) and DNA products linked to physical vouchers; phototypes for protozoans; frozen tissue for protozoan parasites
Use/Importance	core collection, foundation for parasitological research nationally and globally
Size	110,000 lots (about 20-30 million individual specimens catalogued in online database); estimated 100,000 lots of uncatalogued specimens

History	Founded 1892
Staffing	GS-15/ SY/ .20 FTE GS-11/ SS/ .80 FTE GS-11/SS/ .20 FTE GS-7/ Tech/ .25 FTE
Duplications	< 20 percent
Specimens Identified	> 75 percent
Accessibility	50 percent of records are accessible on line

Table 5: Invertebrate Protists

Collection	Orthopteran Microsporidia Collection	Microsporidia in Mosquitoes and Fire Ants Collection	Microsporidia and Gregarines in Stored Products Pests Collection
Management Unit	Northern Plains Agricultural Research Laboratory; Sidney, MN	Mosquito and Fly Research Unit and Imported Fire Ant and Household Insects Research Unit; Gainesville, FL	Grain Marketing and Production Research Center Biological Research; Manhattan, KS
National Program	NP 304 "Crop Protection and Quarantine"	NP 104 "Veterinary, Medical and Urban Entomology"	NP 304 "Crop Protection and Quarantine"
Type	Grasshopper microsporidia	Mosquito and fire ant microsporidia	Stored products pests microsporidia and gregarines
Use/Importance	Research; largest collection of Orthopteran microsporidia	Research; biocontrol	Research; biocontrol
Size	6 species, 350 isolates	5 species	2 microsporidia , 4 gregarine species
History	25-50 years	30 + years	5 years
Staffing	2	0.2 FTE Bio. Aid (2)	0.5 FTE Bio. Aid
Duplications	None	None	None
Specimens Identified	> 75 percent	100 percent	90 percent
Accessibility	By request, no digital records	By request, no digital records	By request, no digital records

Table 6: Insect Cell Cultures

Collection	BARC Insect Cell Culture Collection	Biological Control of Insects Unit Cell Culture Collection	ABADRL Biting Midges and Mosquito Collection	Biosciences Research Collection of Lepidoptera and Coleoptera
Management Unit	Insect Biocontrol Lab, Beltsville Agricultural Research Center; Beltsville, MD	Biological Control of Insects Research Lab; Columbia, MO	Laramie, WY	Insect Genetics and Biochemistry Research Unit; Fargo, ND
National Program	NP 304 “Crop Protection and Quarantine”	NP 304 “Crop Protection and Quarantine”	NP 104 “Veterinary, Medical and Urban Entomology”	NP 304 “Crop Protection and Quarantine”
Type	Insect cell cultures (mostly pest moth and beetle species) in liquid nitrogen and active culture	Insect cell cultures (mostly pest moth species) in liquid nitrogen and active culture	Insect cell cultures (biting midges and mosquitoes) in liquid nitrogen and active culture	Insect cell cultures (moth and beetle species) in liquid nitrogen and active culture
Use/Importance	Used for insect pathology, especially insect-pathogenic virus research; cells from this collection have also been used in expression vector and developmental biology research	Used for insect pathology, especially insect-pathogenic virus research	Used to study arthropod-borne diseases	Used for insect biocontrol and expression vector.
Size	90 strains	50 strains	10 strains	20 strains
History	1965	1980	1995	1970
Staffing	0.3 FTE Cat. 1 SY 0.5 FTE biol. aid	0.2 FTE Cat. 1 SY 0.4 FTE Cat. 3 support scientists	0.1 FTE Cat. 1 SY	0.1 FTE Cat. 1 SY
Duplications	<25 percent	<25 percent	0 percent	<25 percent
Specimens Identified	100 percent identified	100 percent identified	100 percent identified	100 percent identified
Accessibility	All records digitized; active cultures Web accessible	All records digitized, no Web based listing	All records digitized, no Web based listing	All records digitized

Table 7a: Plant Virus and Viroids

Collection	Quarantine Virus/Viroid Collection	Yellow Dwarf Virus Collection	Potato Virus Y Isolates Collection
Management Unit	NGRL Plant Disease Research Unit; Beltsville, MD	Plant Protection Research; Ithaca, NY	Plant Protection Research; Ithaca, NY
National Program	NP 303 “Plant Diseases”	NP 303 “Plant Diseases”	NP 303 “Plant Diseases”
Type	Living	Living (includes antisera and insect vectors)	Living
Use/Importance	Worldwide	Worldwide	USA and Canada
Size	75 species, strains, isolates/2,000 sq. ft.	Unknown number of accessions/300 sq. ft.	3,000 isolates/-20 C freezer
History	1-20 yrs	20-50 yrs	1-20 yrs
Staffing	3 SY (7 FTE)	1 SY (0.75 FTE)	1 SY
Duplications	1-25 percent	Unknown	Unknown
Specimens Identified	100 percent	75-100 percent	In progress
Accessibility	100 percent electronic database (closed collection)	No electronic database	Unknown

Table 7b: Plant Viruses and Viroids

Collection	Exotic Pathogens of Citrus Collection	Ornamental-associated Plant Virus Collection	Vegetable and Sugarbeet Virus Collection
Management Unit	Fruit Laboratory; Beltsville, MD	Florist and Nursery Plants Research Unit; Beltsville, MD	Crop Improvement and Protection Research; Salinas, CA
National Program	NP 303 “Plant Diseases”	NP 303 “Plant Diseases”	NP 303 “Plant Diseases”
Type	Living (includes antisera)	Living (includes antisera)	Living (includes antisera)
Use/Importance	Worldwide	Worldwide	USA/World-wide
Size	90 species, strains, isolates/3,000 sq. ft.	50 species, strains, isolates/900 sq. ft.	Unknown number of accessions/220 sq. ft.
History	1-20 yrs	1-20 yrs	20-50 yrs
Staffing	1 SY	4 SY	2 SY (6 FTE)
Duplications	Unknown	1-25 percent	26-50 percent

Specimens Identified	75-100 percent	100 percent	75-100 percent
Accessibility	100 percent electronic database	No electronic database	No electronic database

Table 7c: Plant Viruses and Viroids

Collection	Citrus Tristeza Virus Collection	Maize Virus Collection	Cereal Virus Collection
Management Unit	Crop Diseases and Pest Research; Parlier, CA	Corn and Soybean Research; Wooster, OH	Cereal Crops Research; Fargo, ND
National Program	NP 303 "Plant Diseases"	NP 303 "Plant Diseases"	NP 303 "Plant Diseases"
Type	Living (includes antisera)	Living	Living (includes antisera and insect vectors)
Use/Importance	California/ affiliated with CCTEA, Tulare, CA; Fruit Lab, BA; and FDWSRU, Fort Detrick, CA	USA	USA
Size	475 strains	Unknown	Unknown number of accessions/500 sq. ft.
History	1-20 yrs	20-50 yrs	20-50 yrs
Staffing	1 SY (2 FTE)	2 SY (4 FTE)	3 SY
Duplications	1-25 percent	1-25 percent	Unknown
Specimens Identified	75-100 percent	75-100 percent	75-100 percent
Accessibility	No electronic database	76-99 percent electronic database	No electronic database

Table 8a: Invertebrate Systematics

Collection	U.S. National Insect Collection	U.S. Rangeland Grasshopper Collection	Honey Bee Collection	National Pollinating Insect Collection
Management Unit	Systematic Entomology Laboratory; Beltsville, MD	Northern Plains Agricultural Research Laboratory Pest	Bee Research Laboratory; Beltsville, MD	Pollinating Insect Biology, Management, and Systematics

		Management Unit; Sidney, MT		Research Unit; Logan, UT
National Program	NP 304 “Crop Protection Quarantine”	NP 304 “Crop Protection Quarantine”	NP 301 “Plant, Microbial Insect Genetic Res., Genomics, Genetic Improv.”	NP 305 “Crop Production”
Type	Invertebrate zoological arthropods	Invertebrate zoological arthropods	Invertebrate zoological arthropods	Invertebrate zoological arthropods
Use/Importance	Service & Research	Research	Research	Service, research & archive
Size	Over 1 million	9,000	14,000	1,000,000
History	Major historic collection – over 100 years in age	Major historic collection – over 100 years in age	Compiled recently, 1-20 years ago	Compiled over 20-50 years ago
Staffing	20 SYs & 40 full-time staff	1 SY & 1 full-time staff	2 SYs & 4 full-time staff	1 SY, 2 full-time, & 6 part-time staff
Duplications	0.0 percent	26-50 percent	1-25 percent	26-50 percent
Specimens Identified	Well sorted, mostly identified	All sorted, mostly identified	Completely or nearly completely identified	Completely or nearly completely identified
Accessibility	76-99 percent accessible	100 percent	100 percent	76-99 percent

Table 8b: Invertebrate Systematics

Collection	Insect Collection (Flies and Parasitic Wasps, frozen and pinned)	Cereal Insects Genetics Resource Library	Specimen Collections of the Biological Control of Weeds Project	Weed Biocontrol Arthropods
Management Unit	Midwest Livestock Insects Research; Lincoln, NE	Wheat, Peanut, and Other Field Crop Research; Stillwater, OK	Grassland, Soil, and Water Research Laboratory Grassland Protection Research; Temple, TX	Northern Plains Agricultural Research Laboratory Pest Management Research Unit; Sidney, MT
National Program	NP 104 “Arthropod Pests of Animals and Humans”	NP 301 “Plant, Microbial Insect Genetic Res., Genomics, Genetic Improv.” and NP 304 “Crop Protection Quarantine”	NP 304 “Crop Protection Quarantine”	NP 304 “Crop Protection Quarantine”
Type	Invertebrate zoological arthropods	Invertebrate zoological arthropods	Invertebrate zoological arthropods	Invertebrate zoological arthropods
Use/Importance	Research, archive	Service, research, and archive	Research	Research
Size	5,000	>10,000 samples; >1,000,000 specimens	29,000	5,000
History	Compiled recently, 1-20 years ago	Compiled over 20-50 years ago	Compiled over 20-50 years ago	Compiled over 20-50 years ago
Staffing	2 SYs & 3 full-time	3 SYs & 6 full-time	2 full-time staff	2 SYs & 3 full-time
Duplications	26-50 percent	Unknown	Unknown	26-50 percent
Specimens Identified	Well sorted and mostly identified	Well sorted mostly identified	All sorted and mostly identified	Generally sorted and identified to some level
Accessibility	100 percent	100 percent	76-99 percent	100 percent

Table 8c: Invertebrate Systematics

Collection	South American Biological Control Laboratory Insect Collection	Australian Biological Control Laboratory Collection	BIRL Reference Voucher Specimen Collection
Management Unit	South American Biological Control Laboratory; Hurlingham, Argentina	Invasive Weed Management Research; Urbana, IL	Beneficial Insects Introduction Research; Newark, DE
National Program	304 Crop Protection Quarantine	304 Crop Protection Quarantine	104 Arthropod pests of Animals and Humans; 301 Plant, Microbial Insect Genetic Rs., Genomics, Genetics Improv.; 304 Crop Protection and Quarantine; 305 Crop Production; 205 Rangeland, Pasture Forages; 207 Integrated Agricultural Systems
Type	Invertebrate zoological arthropods	Invertebrate zoological arthropods	Invertebrate zoological arthropods
Use/Importance	Research & archive	Research	Service & Research
Size	8,000	5,000-10,000	620,000
History	Compiled over 20-50 years ago	Compiled over 20-50 years ago	Compiled over 50-100 years ago
Staffing	7 full-time staff	5 full-time staff	4 SYs, 12 full-time staff, & 4 part-time staff
Duplications	1-25 percent	51-75 percent	1-25 percent
Specimens Identified	Generally sorted and identified to some level	Generally sorted and identified to some level	All sorted, mostly identified
Accessibility	76-99 percent	26-50 percent	76-99 percent

Table 9a: Vertebrate Germplasm

Collection	NAGP Vertebrate Germplasm and Tissue Collection	Cooperative Dairy DNA Repository	Subtropical Cattle Repository
Management Unit	National Center for Genetic Resources Preservation; Fort Collins, CO	Bovine Functional Genomics Laboratory; Beltsville, MD	Subtropical Agriculture Research Station; Brooksville, FL
National Program	NP 101 “Food Animal Production”	NP 101 “Food Animal Production” and NP103 “Animal Health”	NP 101 “Food Animal Production”
Type	Vertebrate - multispecies (domestic, livestock, poultry, aquatic species)	Vertebrate – single species (dairy cattle)	Vertebrate – two species of beef cattle
Use/Importance	Provide a nationally secure reserve of livestock, poultry and aquatic genetic diversity, source of DNA for diversity and QTL studies	Provide DNA to support national genomic research	Provide genetic security for beef cattle produced in subtropical environments
Size	>300,000 samples	250,000 samples	100,200 samples
History	Collection initiated in 2000, but some samples date back to 1955	Collection compiled during the last 15 years	Collection compiled during the last 15 years but samples may predate collection
Staffing	2 SYs and 2 support staff	2 SYs and 2 support staff	1 SY and 1 support staff
Duplications	1-25 percent	51-75 percent	1-25 percent
Specimens Identified	100 percent - Identification by individual animal, with multiple samples per animal	100 percent - Identification by individual animal, with multiple samples per animal	100 percent - Identification by individual animal, with multiple samples per animal
Accessibility	Collection can be accessed on line and samples requested through curator	Collection can be accessed through curator	Accessed through curator

Table 9b: Vertebrate Germplasm

Collection	Disease Resistant and Susceptible Live Chicken Lines	Live Cattle Germplasm Collection	Multispecies Aquatic Species Collection

Management Unit	Avian Disease and Oncology Laboratory	Livestock and Range Research Laboratory	National Sedimentation Laboratory Water Quality and Ecology Research
National Program	NP101 Food Animal Production NP103 Animal Health	NP101 - Food Animal Production	NP201 – Water Quality Management
Type	Vertebrate - Chickens	Vertebrate – One species of beef cattle	Vertebrates – 124 species
Use/Importance	A biological model to study disease resistance and susceptibility	A biological model to study effects of inbreeding	Documentation of species found in water and wetlands of Mississippi
Size	60 lines multiple birds per line	230 cattle, backed up with semen and embryo stores	10,600 specimens (all dead)
History	Collection developed over last 50 to 100 years	Line developed over the last 50 to 100 years	Compiled during the last 20 to 50 years
Staffing	3 SYs and 6 support staff	1 SY and 1 support staff	2 SYs and 3 support staff
Duplications	None	No similar research lines but industry does use selected individuals	51 to 75 percent duplicated in other collections
Specimens Identified	100 percent - All birds are identified and date recorded	100 percent - All animals identified and electronically recorded	~70 percent of the collection is cataloged
Accessibility	Eggs can be requested from the curator	Industry and researchers can access collection	Researchers can access collection via the curator

Table 10a: Plant Germplasm and Systematics

Collection	National Center for Genetic Resources Preservation Collection	National Small Grains Collection	SRRC - Southern Regional Research Center Collection	Western Regional Plant Introduction Station Collection
Management Unit	National Center for Genetic Resources; Fort Collins, CO	Small Grains and Potato Germplasm; Aberdeen, ID	Food and Feed Safety Research; Griffin, GA	Western Regional Plant Introduction Station (Pullman, WA)
National Program	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement” and NP 302, “Plant Molecular Processes”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 108 “Food Safety”, NP 201 “Water Resource Management”, NP 202 “Soil Resource Management”, NP 206 “Manure and Byproduct Utilization”, NP 303 “Plant Diseases”, NP 305 “Crop Production”, and NP 306 “Quality and Utilization of Agricultural Products”;	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”
Type	Botanical/fungal germplasm	Botanical/fungal germplasm	Botanical/fungal germplasm	Botanical/fungal germplasm
Use/Importance	Service, research, and archive	Service, research	Service, research, and archive	Service, research
Used by	Multiple SYs / CRISes, Regulatory users, University researchers, other scientists outside ARS, scientists globally, museums, and the general public.	Multiple SYs / CRISes, Regulatory users, University researchers, other scientists outside ARS, and scientists globally.	Multiple SYs / CRISes, University researchers, other scientists outside ARS, and scientists globally.	Scientists globally

Size (units and area, in square feet or acres)	12,500 sq. ft.	128,900, 10,000 sq. ft.	2,000, 36 sq. ft. in one lab	4,941 at 4C; 2,572 at -18C; 12.5 acres in field (clonal collection)
History	Compiled recently (1-20 years)	Compiled recently (1-20 years)	Compiled over 20-50 years	Compiled over 50-100 years
Staffing	55 total full-time staff (including SYs), composed of 8 Cat. 1 or 4 Sys, 5 part-time	1.4 total full-time staff (including SYs), composed of 1 Cat. 1 or 4 SYs	1 total full-time staff (including SYs), composed of 1 Cat. 1 or 4 SYs, 2 part-time	11 SYs, 31 full-time, 2 part-time
Duplication	51-75 percent	1-25 percent	26-50 percent	76-99 percent
Specimens Identified	All sorted and mostly identified	Completely or nearly completely identified	All sorted and mostly identified	Completely or nearly completely identified
Accessibility	100 percent digital records, 76-99 percent web accessible	100 percent digital records, 100 percent web accessible	100 percent digital records, None web accessible	76-99 percent of collection web accessible

Table 10b: Plant Germplasm and Systematics

Collection	North Central Regional Plant Introduction Station Germplasm Collection	Northeast Regional Plant Introduction Station Collection	National Clonal Germplasm Repository at Corvallis for Temperate Fruit, Nut, and Specialty Crops	USDA Soybean Germplasm Collection
Management Unit	Plant Introduction Research; Ames, IA	Plant Genetics Resources; Geneva, NY	National Clonal Germplasm Repository; Corvallis, OR	Soybean/Maize Germplasm, Pathology, and Genetics Research Unit; Urbana, IL
National Program	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement,” NP 302, “Plant Molecular Processes,” and NP 303 “Plant Diseases”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”
Type	Botanical/fungal germplasm	Botanical/fungal plant parts	Botanical/fungal germplasm	Botanical/fungal plant parts
Use/Importance	Service, Research, Education	Service, Research	Service, Research, Archive	Service, Research
Used by	Multiple SYs / CRISes, regulatory users, University researchers, other scientists outside ARS, scientists globally, the general public, and educators	Multiple SYs / CRISes, University researchers, other scientists outside ARS, scientists globally, and the general public.	Single SY / CRIS. Multiple SYs / CRISes, regulatory users, University researchers, other scientists outside ARS, scientists globally, museums, and the general public	Multiple SYs / CRISes, University researchers, other scientists outside ARS, and scientists globally

Size (units and area, in square feet or acres)	48,000, 9,000 sq. ft.	13,377 seeds; 5,298 plants, Seeds, 859 sq. ft. 7, 875 cu. ft.; Plants, 19 ha	10000, 10,000 sq. ft. office, 10,000 sq. ft. greenhouse, 20,000 sq. ft. screen house, and 50 acres of field	2617,640 sq. ft.
History	Compiled recently (1-20 years)	Compiled recently (1-20 years)	Major historic collection - over 100 years in age	Compiled recently (1-20 years)
Staffing	21 total full-time staff (including SYs), composed of 4 Cat. 1 or 4 SYs, 20 part-time	20 total full-time staff (including SYs), composed of 5 Cat. 1 or 4 SYs, 3 part-time, 1 part-time volunteer	16 total full-time staff (including SYs), composed of 4 Cat. 1 or 4 SYs, 4 part-time, 2 part-time unpaid	6 total full-time staff (including SYs), composed of 1 Cat. 1 or 4 SYs; part-time varies
Duplication	51-75 percent	1-25 percent	26-50 percent	76-99 percent
Specimens Identified	Completely or nearly completely identified	Completely or nearly completely identified	All sorted and mostly identified	Completely or nearly completely identified
Accessibility	100 percent digital records, 76-99 percent web accessible	100 percent digital records, 100 percent web accessible	100 percent digital records, 100 percent web accessible	100 percent digital records, 100 percent web accessible

Table 10c: Plant Germplasm and Systematics

Collection	National Cotton Germplasm Collection	U.S. Potato Genebank	National Clonal Germplasm Repository
Management Unit	Southern Plains Agricultural Research Center; College Station, TX	Vegetable Crops Research; Madison, WI	U.S. Pacific Basin Agricultural Research Center; Hilo, HI
National Program	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”
Type	Botanical/fungal, plant parts	Botanical/fungal germplasm	Botanical/fungal germplasm
Use/Importance	Research	Service, research	Service, research
Used by	Multiple SYs / CRISes, University researchers, other scientists outside ARS, scientists globally, and the general public	Single SY / CRIS. Multiple SYs / CRISes, regulatory users, University researchers, other scientists outside ARS, scientists globally, and the general public	Single SY / CRIS, other scientists outside ARS, scientists globally, and the general public
Size (units and area, in square feet or acres)	9,330,351 sq. ft.	4,843 seed samples; 12,647 subunits; 815 clones; 3,900 herbaria (14,666 sheets), herb. 196 sq. ft.; clonal storage 378 sq. ft.; seed storage 160 sq. ft.; greenhouse 9,600 sq. ft.; growth chambers 50 sq. ft.; office 1,600 sq. ft.	974, 33 acres field planting
History	Compiled recently (1-20 years)	Compiled recently (1-20 years)	Compiled recently (1-20 years)
Staffing	3.25 total full-time staff (including SYs), composed of 0.75 Cat. 1 or 4 SYs, 0.75 part-time.	7 total full-time staff (including SYs), composed of 3 Cat. 1 or 4 SYs, 3 part-time.	13 total full-time staff (including SYs), composed of 3 Cat. 1 or 4 SYs.
Duplication	26-50 percent	76-99 percent	1-25 percent
Specimens Identified	Completely or nearly completely identified	Completely or nearly completely identified	Generally sorted and identified to some level

Accessibility	100 percent digital records, 100 percent web accessible	100 percent digital records, 100 percent web accessible	51-75 percent digital records, 51-75 percent web accessible
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Table 10d: Plant Germplasm and Systematics

Collection	National Clonal Germplasm Repository	National Clonal Germplasm Repository	National Clonal Germplasm Repository
Management Unit	National Clonal Germplasm Repository, Davis, CA	Tropical Crops and Germplasm; Mayaguez, Puerto Rico	Subtropical Horticulture Research; Miami, FL
National Program	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”
Type	Botanical/fungal germplasm	Botanical/fungal germplasm	Botanical/fungal germplasm
Use/Importance	Archive	Service, research	Service, research
Used by	Scientists globally, museums, and the general public	Single SY / CRIS, multiple SYs / CRISes, University researchers, other scientists outside ARS, scientists globally, museums, the general public, and the Botanical Gardens	Multiple SYs / CRISes, University researchers, other scientists outside ARS, scientists globally, and the general public
Size (units and area, in square feet or acres)	6,000; 70 acres	858; 2,305; 500 sq. ft.	2,177; 973 sq. ft.
History	Major historic collection - over 100 years in age.	Compiled recently (1-20 years)	Compiled recently (1-20 years)
Staffing	14 total full-time staff (including SYs), composed of 2 Cat. 1 or 4 SYs, 2 part-time.	6 total full-time staff (including SYs), composed of 2 Cat. 1 or 4 SYs.	4 total full-time staff (including SYs), composed of 2 Cat. 1 or 4 SYs, 1 part-time.
Duplication	1-25 percent	1-25 percent	1-25 percent
Specimens Identified	Generally sorted and identified to some level	Completely or nearly completely identified	Well sorted, mostly identified
Accessibility	76-99 percent digital records, 76-99 percent web accessible	76-99 percent digital records, 76-99 percent web accessible	76-99 percent digital records, 51-75 percent web accessible

Table 10e: Plant Germplasm and Systematics

Collection	U.S. National Arboretum Herbarium	U. S. National Seed Herbarium
Management Unit	Floral and Nursery Plants Research	Systematic Botany and Mycology Lab
National Program	205, 301 302, 303	NP 301 “Plant Genetic Resources, Genomics and Genetic Improvement”
Type	Botanical/fungal, Plants (other than germplasm)	Botanical / Fungal, Plant parts
Use/Importance	Service, research, archive	Service, Research
Used by	Single SY/CRIS, Multiple SYs/CRISes, University researchers, other scientists outside ARS, scientists globally, museums.	Single SY/CRIS, regulatory users, University researchers, other scientists outside ARS, general public
Size (units and area, in square feet or acres)	650,000, 2,000 sq. ft.	125,000, 665 sq. ft.
History	Compiled recently (1-20 years)	Compiled recently (1-20 years)
Staffing	2 total full-time staff (including SYs), composed of 1 Cat. 1 or 4 SYs, varies part-time unpaid	1 total full-time staff (including SYs), composed of 1 Cat. 1 or 4 SYs.
Duplication	26-50 percent	1-25 percent
Specimens Identified	Completely or nearly completely identified	Completely or nearly completely identified
Accessibility	1-25 percent digital records, 1-25 percent web accessible	No digital records, None web accessible

Table 11a: Plant Cell Cultures

Collection	Petunia Collection	Citrus Collection	Capsicum Collection
Management Unit	Florist and Nursery Plants Research Unit; Beltsville, MD	Horticulture and Breeding Research Unit; Fort Pierce, FL	Vegetable Laboratory; Beltsville, MD
National Program	NP 301, "Plant Genetic Resources, Genomics and Genetic Improvement"	NP 301, "Plant Genetic Resources, Genomics and Genetic Improvement"	NP 301, "Plant Genetic Resources, Genomics and Genetic Improvement"
Type	Living	Living	Living
Use/Importance	Worldwide	Worldwide	Worldwide
Size	50 unique taxa, 500 sq. ft.	750 unique taxa, 300 acres	100 unique taxa, 1 acre
History	1-20 yrs	1-100 yrs	1-50 yrs
Staffing	1 SY (2 FTE)	2 SY (6 FTE)	1 SY (2 FTE)
Duplications	1-5 percent	1-5 percent	1-5 percent
Specimens Identified	100 percent	100 percent	100 percent
Accessibility	No electronic database, closed for some taxa	No electronic database, closed for some taxa	No electronic database, closed for some taxa

Table 11b: Plant Cell Cultures

Collection	Prunus Collection	Peach/Nectarine Collection	Pear Collection
Management Unit	Florist and Nursery Plants Research Unit; Washington, D.C.	Appalachian Fruit Research Station; Kearneysville, WV	Appalachian Fruit Research Station; Kearneysville, WV
National Program	NP 301, "Plant Genetic Resources, Genomics and Genetic Improvement"	NP 301, "Plant Genetic Resources, Genomics and Genetic Improvement"	NP 301, "Plant Genetic Resources, Genomics and Genetic Improvement"
Type	Living	Living	Living – greenhouse and orchard
Use/Importance	Worldwide	Worldwide	Worldwide
Size	30 unique taxa, 8 acres	10 populations; 5 acres	5 populations and 6 clones; 1.5 acres
History	1-50 yrs	1-15 years	1-20 years
Staffing	1 SY (2 FTE)	1 SY (2 FTE)	1 SY (2 FTE)
Duplications	1-5 percent	None	None
Specimens Identified	100 percent	100 percent	100 percent
Accessibility	No electronic database, closed for some taxa	No electronic database information available in house and to specific cooperators	Electronic database information available in- house

Table 12a: Chemical Molecular Reagents

Collection	Soybean Tilling Library	Blueberry EST Library	<i>Solonopsis Invicta</i> EST Library	Bovine Blood and Body Fluid Collection
Management Unit	Crop Protection and Pest Control Research Unit; West Lafayette, IN	Fruit Laboratory; Beltsville, MD	Imported Fire Ant and Household Insect Research Unit; Gainesville, FL	Bovine Functional Genomics Laboratory; Beltsville, MD
National Program	NP 301 “Plant, Microbial Insect Genetics” and NP 302 “Plant Molecular Processes”	NP 302 “Plant Molecular Processes”	NP 104 “Arthropod Pest of Animals and Humans”	NP 101 “Animal Productions and Protection”, NP 103 “Animal Health”
Type	DNA	Genes, gene sequences, BAC libraries, ESTs	ESTs	Blood and Fluid samples
Use/Importance	Research	Research	Research	Research
Size	400 sq. ft.	15 sq. ft.	2 sq. ft.	281 sq. ft.
History	Begun in past 20 years	Begun in past 20 years	Begun in past 20 years	Begun in past 20 years
Staffing	1 FTE	1 FTE Cat1 1 FTE Technician	1 FTE	2 FTE Cat. 1 2FTE Technicians
Duplications	Some duplication	No duplication	100 percent duplication	51-75 percent duplication
Specimens Identified	100 percent	100 percent	100 percent	100 percent
Accessibility	100 percent digitized, no web access	100 percent digitized and on Web	99 percent catalogued, 75 percent in electronic data base, none on Web	76-99 percent, all catalogued samples are in electronic data base but not accessible on Web

Table 12b: Chemicals Molecular Reagents

Collection	Viral Gene Clone Collection	Flavonoid Collection	Semiochemical Collection	Casein Genetic Variants
Management Unit	Floral and Nursery Plants Research Unit; Beltsville, MD	Floral and Nursery Plants Research Unit; Beltsville, MD	Chemistry Research Unit; Gainesville, FL	Dairy Processing and Products Research Unit; Wyndmoor, PA
National Program	NP 301 “Plant, Microbial Insect Genetics” and NP 303 “Plant Diseases”	NP 301 “Plant, Microbial Insect Genetics”	NP 304 “Crop Protection and Quarantine”	NP 306 “Quality and Utilization of Agricultural Products”
Type	Gene, Gene sequences, BAC and EST libraries	Organic chemicals	Organic chemicals	Organic chemicals
Use/Importance	Research	Research	Research	Research
Size	64 sq. ft.	3 sq. ft.	200 sq. ft	5 sq. ft.
History	Begun in past 20 years	Past 20-50 years	Past 20-50 years	Begun in past 20 years
Staffing	2 FTE Cat. 1	1 FTE Cat. 1	4 FTE Cat. 1	2 FTE Cat. 1 ; 1FTE technician
Duplications	None	1-25 percent duplication	1-25 percent	None
Specimens Identified	100 percent	100 percent	100 percent	100 percent
Accessibility	100 percent catalogued; no electronic database	100 percent catalogued; no electronic database	100 percent catalogued; electronic database in place; no Web access	76 percent-99 percent catalogued; no electronic database

Table 12c: Chemistry and Chemical Reagents

Collection	Insect Ecdysteroid Hormone and Reagent Collection	Euphorbiaceae EST Database Collection	NRRL Dextran Phosphomannan Collection
Management Unit	Chemicals Affecting Insect Behavior Research Unit; Beltsville, MD	Plant Science Research Unit; St. Paul, MN	Bioproducts and Biocatalysis Research Unit; Peoria, IL
National Program	NP 104 “Arthropod Pest of Animals and Humans” and NP 304 “Crop Protection and Quarantine”	NP 302 “Plant Molecular Processes” and NP 304 “Crop Protection and Quarantine”	NP 306 “Quality and Utilization of Agricultural Products”
Type	Organic chemicals	EST data base collection	Organic Chemicals
Use/Importance	Research	Research	Research
Size	200 sq. ft.	3 sq. ft.	20 sq. ft.
History	20-50 years	Begun in past 20 years	20-50 years
Staffing	1 FTE, Cat. 1	1 FTE Cat. 1 2 FTE Technicians	1 FTE, Cat. 1
Duplications	1-25 percent	No duplication	none
Specimens Identified	100 percent	100 percent	Generally sorted and identified to some level
Accessibility	100 percent catalogued	76-99 percent catalogued in electronic data base with collection level description on Web	None catalogued