

**Cornell University, Office of Sponsored Programs
Awards Received in December 2020**

Principal Investigator	Department	Sponsor	Project Title	OSP#	Amount
Abbaspourrad, Alireza	CALS Food Science	Dairy Management Inc	DESIGNING NEW ION EXCHANGE RESINS TARGETING LACTOFERRIN RECOVERY FROM SWEET WHEY	137842	\$198,000
Abbaspourrad, Alireza	CALS Food Science	Tate & Lyle Plc	METHODS TOWARDS THE HETEROGENEOUS FUNCTIONALIZATION OF STARCH GRANULES	88713	\$170,000
Abbaspourrad, Alireza	CALS Food Science	Pepsico Inc	DESIGNING NEW ION EXCHANGE RESIGN TARGETING PESTICIDES REMOVAL FROM ORANGE ESSENTIAL OIL	137889	\$246,000
Abbaspourrad, Alireza	CALS Food Science	Dairy Management Inc	IMPROVEMENT OF LACTOFERRIN THERMAL STABILITY AND FUNCTIONALITY BY COMPLEX COACERVATION AND ENCAPSULATION	137434	\$102,000
Acimovic, Dana	CALS Entomology	New York Wine and Grape Foundation	CABERNET FRANC CLONE AND ROOTSTOCK SELECTION SUITABLE FOR HUDSON VALLEY AVA AND VITICULTURAL TECHNIQUES FOR SUPERIOR FRUIT QUALITY	83799	\$29,192
Andarawis-Puri, Nelly	Mechanical & Aerospace Engineering	HHS -> PHS -> National Institutes of Health	NOVEL MECHANISM FOR REPAIR OF TENDON FATIGUE DAMAGE INJURIES	136663	\$475,855
Brito, Ilana	Biomedical Engineering	European Commission (Through: Vlaams Instituut voor Biotechnologie)	VIB FELLOWSHIP	138153	\$19,525
Bruyere, Susanne	Yang Tan Institute	HHS -> PHS -> NIH -> NIH Eunice Kennedy Shriver National Institute of Child Health and Human Development (Through: UTS -> The University of Texas Medical Branch at Galveston)	CENTER FOR LARGE DATA RESEARCH AND DATA SHARING IN REHABILITATION	84403	\$17,590
Bruyere, Susanne	Yang Tan Institute	NSF -> NSF Office of Integrative Activities (Through: Vanderbilt University)	B1: INCLUSION AI FOR NEURODIVERSE EMPLOYMENT	136067	\$382,083
Bunker, Jane	CU Press	National Endowment for the Humanities	OPEN ACCESS EDITION OF XUANHE CATALOGUE OF PAINTINGS BY AMY MCNAIR	137143	\$5,500
Bunker, Jane	CU Press	National Endowment for the Humanities	OPEN ACCESS EDITION OF THOMAS MANN'S WAR: LITERATURE, POLITICS, AND THE WORLD REPUBLIC OF LETTERS BY TOBIAS BOES	137132	\$5,500
Bunker, Jane	CU Press	National Endowment for the Humanities	OPEN ACCESS EDITION OF MORE THAN MEDALS: A HISTORY OF THE PARALYMPICS AND DISABILITY SPORTS IN POSTWAR JAPAN BY DENNIS J. FROST	137141	\$5,500
Bunting-Howarth, Katherine	CALS Sea Grant	NYS -> New York State Department of Environmental Conservation (Through: SUNY -> SUNYRF -> The Research Foundation for the State University of New York Stony Brook)	NEW YORK SEA GRANT EXTENSION SUPPORT FOR NEW YORK OCEAN ACTION PLAN AND DEC MARINE PROGRAM	87326	\$379,775
Centrella, Mary	CALS Cornell Cooperative Extension	Environmental Protect Agency (Through: eXtension Foundation)	2021 PESTICIDE MANAGEMENT EDUCATION PROGRAM	138083	\$18,300

Childs-Sanford, Sara	Clinical Sciences	LANDOLAKES -> Mazuri Exotic Animal Nutrition	VITAMIN D METABOLISM AND CALCIUM HOMEOSTASIS IN THE HOFFMANN'S TWO-TOED SLOTH (CHOLEPUS HOFFMANNI)	136260	\$9,925
Daniel, Susan	Chemical & Biomolecular Engineering	HHS -> PHS -> National Institutes of Health (Through: Tufts University)	SINGLE-PARTICLE ANALYSIS OF HSV-1 MEMBRANE FUSION MECHANISM	90887	\$109,482
Danko, Charles	Baker Institute for Animal Health	HHS -> PHS -> NIH -> NIH National Institute of Allergy and Infectious Diseases (Through: University of Washington)	ROLE OF THE PROSTAGLANDIN D2 RECEPTOR CRTH2 IN HELMINTH-INDUCED TYPE 2 INFLAMMATION IN THE INTESTINE	90546	\$302
Deitcher, David	Neurobiology and Behavior	HHS -> PHS -> National Institutes of Health (Through: University of Pittsburgh)	DENSE-CORE VESICLE CIRCULATION, CAPTURE AND SYNAPTIC NEUROPEPTIDE RELEASE	79528	\$15,152
Diel, Diego	Population Medicine & Diagnostic Science	USDA -> USDA National Institute of Food and Agriculture	EARLY DETECTION OF TRANSBOUNDARY AND EMERGING BOVINE PATHOGENS THROUGH NEXT-GENERATION SEQUENCING	136295	\$1,000,000
Fallon, Kathleen	CALS Sea Grant	US DOC -> National Oceanic and Atmospheric Administration (Through: Maracoos)	DEVELOPING A RIP CURRENT NETWORK FOR LONG ISLANDS OCEAN BEACHES	136433	\$16,042
Fuchs, Marc	CALS School of Integrative Plant Science	New York Wine and Grape Foundation	IDENTIFYING CLEAN NURSERY STOCKS FOR A SUSTAINABLE NEW YORK VITICULTURE - PHASE 2	89144	\$27,534
Goddard, Julie	CALS Food Science	USDA -> USDA National Institute of Food and Agriculture	IMPROVING QUALITY OF NONTRADITIONAL WATER SOURCES BY BIOREMEDIATION OF MICROPLASTICS IN SEWAGE AND WASTEWATER	93071	\$499,982
Gore, Michael	CALS School of Integrative Plant Science	NSF -> NSF Directorate for Biological Sciences (Through: Michigan State University)	RESEARCH-PGR: A GENOME-LEVEL APPROACH TO BALANCING THE VITAMIN CONTENT OF MAIZE GRAIN	76820	\$47,279
Greer, Ian	Labor Relations, Law, & History	TOMPKINS CTY -> Workforce Development Board of Tompkins County	PANDEMIC LABOR MARKET ANALYSIS AND SKILLS MAPPING	137932	\$50,000
Hadad, Robert	CALS Cornell Cooperative Extension	USDA -> USDA National Institute of Food and Agriculture (Through: University of Vermont)	MEET THE CLEANING AND SANITATION REQUIREMENTS OF THE PRODUCE SAFETY RULE	93017	\$43,719
Hormozi, Sarah	Chemical & Biomolecular Engineering	National Science Foundation	CAREER: SUSPENSIONS OF NONCOLLOIDAL PARTICLES IN YIELD STRESS FLUIDS: FLUID MECHANICS, RHEOLOGY AND MICROSTRUCTURE	93144	\$281,323
Hyster, Todd	Chemistry and Chemical Biology	Eli Lilly and Company	2020 ACC LILLY GRANTEE AWARD	138313	\$100,000
Ju, Wendy	JTC Research	Nissan Motor Co. Ltd.	ACTIVE LEARNING TO UNDERSTAND FAMILY SOCIAL BEHAVIORS IN THE AUTOMOBILE	137344	\$54,495
Jung, Sunghwan	CALS Biological & Environmental Engr	National Aeronautics and Space Administration	ENHANCED PARTICLE TRACKING IN STDC DATA AND ITS INDUSTRIAL APPLICATION OF MARANGONI CONVECTION	92133	\$200,000
Karim, Sabrina	Government	Geneva Centre For The Democratic Control Of Armed Forces	ELSIE INITIATIVE FOR WOMEN IN PEACE OPERATIONS	88408	\$433,408
Knepper, Richard	Center for Advanced Computing	National Science Foundation (Through: Trustees of Indiana University)	CATEGORY 1- JETSTREAM 2: ACCELERATING SCIENCE AND ENGINEERING ON-DEMAND	91673	\$400,000

Lee, Daniel	Tech Research	HHS -> PHS -> National Institutes of Health (Through: The President and Fellows of Harvard College)	SENSORIMOTOR PROCESSING, DECISION-MAKING, AND INTERNAL STATES: TOWARDS A REALISTIC MULTISCALE CIRCUIT MODEL OF THE LARVAL ZEBRAFISH BRAIN	89559	\$56,000
Levy, Karen	Information Science	John D and Catherine T MacArthur Foundation	AI, POLICY, AND PRACTICE	136906	\$750,000
Lewis, Nikole	Center Astrophysics-Planetary Science	NASA -> Jet Propulsion Laboratory	DEVELOPMENT OF A 2D CIRCULATION MODEL FOR RAPID EXPLORATION OF EXOPLANET ATMOSPHERES	92787	\$55,271
Liepe, Matthias	Cornell Lab Accelerator Sciences & Ed	DOE -> DOE Office of Science	NEXT STEPS IN THE DEVELOPMENT OF TURN-KEY SRF TECHNOLOGY	93078	\$1,110,000
Liepe, Matthias	Cornell Lab Accelerator Sciences & Ed	United States Department of Energy (Through: Niowave Inc)	DEVELOPMENT OF HIGH-Q SRF STRUCTURES BY NITROGEN DOPING FOR SUPERCONDUCTING ELECTRON LINACS	88128	\$84,157
Liepe, Matthias	Cornell Lab Accelerator Sciences & Ed	United States Department of Energy (Through: Fermi National Accelerator Laboratory)	NB3SN VAPOR DEPOSITION TECHNOLOGY	137258	\$449,317
Lindau, Manfred	Applied & Engineering Physics	HHS -> PHS -> NIH -> NIH National Institute of General Medical Sciences	MOLECULAR MECHANISMS OF EXOCYTOTIC VESICLE FUSION AND RELEASE	92258	\$2,050,000
Lis, John	CALS Molecular Biology & Genetics	HHS -> PHS -> National Institutes of Health	HIGH-THROUGHPUT FUNCTIONAL CHARACTERIZATION OF HUMAN ENHANCERS	79660	\$750,521
Lovette, Irby	CALS Lab of O - Programs	The American Ornithological Society	FIELD STUDIES OF WILD BIRDS: AOS KESSEL FELLOWSHIP FOR ORNITHOLOGICAL RESEARCH - DR. CARRIE BRANCH	138271	\$15,000
Lunine, Jonathan	Center Astrophysics-Planetary Science	National Aeronautics and Space Administration (Through: NASA -> Jet Propulsion Laboratory)	DISTINGUISHED VISITING SCIENTIST	89600	\$80,376
Mabaya, Edward	CALS Global Development	Bill and Melinda Gates Foundation (Through: Development Gateway Inc)	THE TASAI-VISTA PROJECT 11/1/2020-10/31/2022	138041	\$109,657
MacMartin, Douglas	Mechanical & Aerospace Engineering	National Science Foundation	WHAT ARE THE FUNDAMENTAL LIMITS / TRADE-OFFS OF STRATOSPHERIC AEROSOL GEOENGINEERING?	136360	\$398,143
MacMartin, Douglas	Atkinson Center for a Sustainable Future	SilverLining	STRATOSPHERIC AEROSOL GEOENGINEERING (CLIMATE INTERVENTION)	138011	\$500,000
Mahowald, Natalie	Earth & Atmospheric Sciences	United States Department of Energy (Through: UCAL -> The Regents of the University of California on behalf of its Irvine Campus)	INTERACTION BETWEEN LAND USE, FIRE AND DUST AS A FUTURE DRIVER OF GLOBAL CLIMATE CHANGE	92953	\$405,344
Mahowald, Natalie	Earth & Atmospheric Sciences	National Aeronautics and Space Administration (Through: NASA -> Jet Propulsion Laboratory)	EARTH SURFACE MINERAL DUST SOURCE INVESTIGATION (EMIT)	88424	\$75,000
Martinson, Tim	CALS School of Integrative Plant Science	New York Wine and Grape Foundation	VERAISON TO HARVEST NEWSLETTER	70812	\$19,171
Martinson, Tim	CALS School of Integrative Plant Science	New York Wine and Grape Foundation	BUD HARDINESS AND WINTER INJURY ASSESSMENT	74080	\$15,036
Matias, J.	CALS Communication	John D and Catherine T MacArthur Foundation	GROWING AND PROTECTING CIVIC PARTICIPATION ONLINE THROUGH CITIZEN SCIENCE	137531	\$300,000
Mattson, Neil	CALS School of Integrative Plant Science	NYS -> New York State Energy Research and Development Authority (Through: Ensave Inc)	DEVELOPING AND DISSEMINATING ENERGY-RELATED AGRICULTURE BEST PRACTICES	90723	\$8,263

Mazourek, Michael	CALS School of Integrative Plant Science	United States-Israel Binational Agricultural Research and Development Fund	COMPARATIVE GENOMIC AND GENETIC ANALYSES OF CARBOHYDRATE ACCUMULATION IN PUMPKIN AND MELON FRUIT	91211	\$165,000
McFadden, Joseph	CALS Animal Science	USDA -> USDA National Institute of Food and Agriculture	EFFECTS OF SERINE PALMITOYLTRANSFERASE INHIBITION ON INSULIN SENSITIVITY AND MILK PRODUCTION IN DAIRY COWS	92847	\$500,000
Mellon, Michael	Center Astrophysics-Planetary Science	National Aeronautics and Space Administration	THERMAL CHARACTERISTICS OF ICE REGOLITH	92440	\$606,259
Neill, Clinton	Population Medicine & Diagnostic Science	USDA -> USDA National Institute of Food and Agriculture (Through: Virginia Polytechnic Institute and State University)	COMMUNICATING CIDER QUALITY: A SENSORY-MARKETING MODEL FOR SMALL- AND MEDIUM-SIZED APPLE AND CIDER PRODUCERS IN THE NORTHEAST AND MID-ATLANTIC	137584	\$59,049
Phillips Russo, Jennifer	CALS Cornell Cooperative Extension	New York Wine and Grape Foundation	EVALUATING THE EFFECTS OF CROPPING LEVELS ON BUD HARDINESS TO MITIGATE RISK IN LAKE ERIE GRAPE PRODUCTION FOR VITIS LABRUSCA, VITIS VINIFERA, AND HYBRID CULTIVARS	92375	\$14,096
Phillips Russo, Jennifer	CALS Cornell Cooperative Extension	New York Wine and Grape Foundation	INCREASING THE RELIABILITY AND SCOPE OF NEWA WEATHER AND PEST MODEL INFORMATION IN THE LAKE ERIE REGION	83820	\$35,312
Rahm, Brian	CALS Biological & Environmental Engr	NYS -> New York State Department of Environmental Conservation	HUDSON RIVER ESTUARY PROGRAM WATER RESOURCE MANAGEMENT ASSISTANCE WITH THE CORNELL WATER RESOURCES INSTITUTE	93213	\$10,711,577
Reed, Patrick	Civil & Environmental Engineering	United States Department of Energy (Through: Pacific Northwest National Laboratory)	INTEGRATED MULTISECTOR, MULTISCALE MODELING (IM3) SCIENTIFIC FOCUS AREA	92069	\$1,439,994
Reid, Matthew	Civil & Environmental Engineering	Natural Resources Canada	LONG-TERM VARIABILITY OF METHANE EMISSIONS FROM ABANDONED OIL AND GAS WELLS	138163	\$19,081
Reisch, Bruce	CALS School of Integrative Plant Science	New York Wine and Grape Foundation	BREEDING AND EVALUATION OF NEW WINE GRAPE VARIETIES WITH IMPROVED COLD TOLERANCE AND DISEASE RESISTANCE	69282	\$24,062
Robbins, Kelly	CALS Global Development	Bill and Melinda Gates Foundation (Through: CGIAR -> Centro Internacional De Mejoramiento de Maiz y Trigo)	THE LEADERSHIP OF MODULE 5: BIOINFORMATICS AND DATA MANAGEMENT TOOLS AND SERVICES	138359	\$1,254,029
Rohwer, Vanya	CALS Ecology & Evolutionary Biology	nuttall ornithological club	FROM PATTERN TO PROCESS: THE EVOLUTION OF USING SHED SNAKE SKIN IN BIRD NESTS	137247	\$3,525
Rose, Jocelyn	CALS School of Integrative Plant Science	USDA -> USDA National Institute of Food and Agriculture	DYNAMICS OF THE SELF-HEALING CUTIN MATRIX AS A TRANSPIRATION BARRIER IN TOMATO FRUIT	93013	\$495,000
Sacks, Gavin	CALS Food Science	New York Wine and Grape Foundation	DEVELOPMENT OF RAPID APPROACHES FOR QUANTIFYING KEY FLAVOR COMPOUNDS AND THEIR PRECURSORS IN GRAPES	72600	\$117,698
Sacks, Gavin	CALS Food Science	New York Wine and Grape Foundation	EXPANDING OPPORTUNITIES FOR CANNED WINES - DEVELOPING AND VALIDATING MODELS FOR PREDICTING FOR CORROSION AND OFF-AROMA FORMATION	92383	\$72,795
Samaranayake, Samitha	Civil & Environmental Engineering	National Science Foundation (Through: Vanderbilt University)	SCC-IRG TRACK 1: MOBILITY FOR ALL HARNESSING EMERGING TRANSIT SOLUTIONS FOR UNDERSERVED COMMUNITIES	90854	\$359,999
Schmit, Todd	Dyson - Sponsored Activity	USDA -> USDA National Institute of Food and Agriculture	IMPROVING LIVESTOCK MARKETING RETURNS FOR SMALL- AND MEDIUM-SCALE FARMS THROUGH INNOVATIVE DATA COLLECTION AND ANALYTICAL TOOLS	135977	\$500,000
Schmit, Todd	Dyson - Sponsored Activity	USDA -> USDA Agricultural Marketing Service (Through: Practical Farmers of Iowa)	GROWING PASTURE-RAISED MEAT SUPPLY CHAINS IN IOWA	138088	\$42,120

Schryver, Tom	Center for Economic Advancement	NYS -> New York State Energy Research and Development Authority	DIVERSITY IN CLEAN ENERGY	91728	\$750,000
Scott, Jeffrey	CALS Entomology	New York Wine and Grape Foundation	INSECTICIDE RESISTANCE IS LIMITING CONTROL OF SOUR ROT IN NEW YORK VINEYARDS	89165	\$55,653
Sethi, Suresh	CALS Natural Resources	Alaska Pacific University	MODELING FISHING ACTIVITY AND FISHING GEAR MODIFICATION DYNAMICS FOR BENTHIC ECOSYSTEMS: DEVELOPMENT AND TESTING FOR ALASKAN WATERS	90627	\$62,762
Shepherd, Robert	Mechanical & Aerospace Engineering	USDA -> USDA National Institute of Food and Agriculture	NRI: INT: UBIQUITOUS SOIL SAMPLING ROBOTS FOR CONFLUENT SOIL MONITORING	92603	\$750,000
Sorrells, Mark	CALS School of Integrative Plant Science	USDA -> USDA National Institute of Food and Agriculture (Through: Oregon State University)	DEVELOPING MULTI-USE NAKED BARLEY FOR ORGANIC FARMING SYSTEMS II	92241	\$235,951
Spitz, Judith	Central Research - Unallocated	Pivotal Ventures Llc	BREAK THROUGH TECH AI PROGRAM	137699	\$18,000,000
Steenhuis, Tamme	CALS Biological & Environmental Engr	NYS -> New York State Department of Environmental Conservation	WATER QUALITY MONITORING FOR PESTICIDES IN UPSTATE NEW YORK	136274	\$754,390
Sullivan, Patrick	CALS Natural Resources	NYS -> New York State Department of Environmental Conservation	NEW YORK STATE OCEAN PROGRAM CONSERVATION AND IMPLEMENTATION PLAN WITH CORNELL DEPARTMENT OF NATURAL RESOURCES	137297	\$895,534
Sullivan, Patrick	CALS Natural Resources	NYS -> New York State Department of Environmental Conservation	HUDSON RIVER ESTUARY PROGRAM NATURAL RESOURCE MANAGEMENT ASSISTANCE	136108	\$7,815,985
Tester, Jefferson	Chemical & Biomolecular Engineering	DOE -> DOE Office of Energy Efficiency and Renewable Energy (Through: American Institute for Chemical Engineers)	AN INTEGRATED SYSTEMS MODEL FOR SUSTAINABLY MANAGING DAIRY AND FOOD WASTES TO MAXIMIZE RENEWABLE ENERGY PRODUCTION AND LOWER ENVIRONMENTAL IMPACTS	92209	\$1
Upton, Joanna	Dyson - Sponsored Activity	Catholic Relief Services Inc	MEASUREMENT INDICATORS FOR RESILIENCE ANALYSIS (MIRA): EXPANDING BEST PRACTICES AND PARTNERSHIPS FOR HIGH-FREQUENCY DATA COLLECTION AND RESILIENCE ANALYSIS	92254	\$46,066
Van de Walle, Gerlinde	Baker Institute for Animal Health	Foundation for Food and Agriculture Research	A NOVEL PLATFORM TECHNOLOGY FOR BIOLOGICALS WITH ANTIMICROBIAL AND REGENERATIVE PROPERTIES BASED ON THE STEM CELL REPERTOIRE OF SECRETED BIOMOLECULES	136526	\$642,202
Vanden Heuvel, Justine	CALS School of Integrative Plant Science	New York Wine and Grape Foundation	DETERMINING BUD MORTALITY VIA THERMAL AND MULTISPECTRAL IMAGING TO GUIDE PRUNING PRACTICES	92381	\$12,504
Varner, Jeffrey	Chemical & Biomolecular Engineering	HHS -> PHS -> National Institutes of Health (Through: University of Vermont)	THE INTERACTION OF BASAL RISK, PHARMACOLOGIC OVULATION INDUCTION, PREGNANCY AND DELIVERY ON HEMOSTATIC BALANCE	83839	\$364,295
Vatamaniuk, Olena	CALS School of Integrative Plant Science	USDA -> USDA National Institute of Food and Agriculture	INVESTIGATION INTO THE ROLE OF COPPER IN GRAIN SIZE, STORAGE PROTEIN AND CARBOHYDRATE ACCUMULATION IN CEREALS	92991	\$500,000
Walter-Peterson, Hans	CALS Cornell Cooperative Extension	New York Wine and Grape Foundation	EVALUATION OF METHODS FOR MANAGEMENT OF FIELD BINDWEED IN NEW YORK VINEYARDS	86980	\$17,607
Walter-Peterson, Hans	CALS Cornell Cooperative Extension	New York Wine and Grape Foundation	EVALUATION OF A BERRY CUTICLE SUPPLEMENT TO REDUCE CLUSTER ROTS IN VINEYARDS	89216	\$14,071
Weaver, Russell	Extension Administration	ERIE CTY -> Erie County Department Of Social Services	ANALYZE BARRIERS TO ADEQUATE HOUSING IN ERIE COUNTY	91042	\$50,000

Wiedmann, Martin	CALS Food Science	USDA -> USDA National Institute of Food and Agriculture	DEVELOPMENT OF DATA ANALYTICS PLATFORM TO ALLOW FOR PUBLIC HEALTH CLASSIFICATION OF SALMONELLA SEROVARS AND CLADES AND IMPROVED FOCUS OF CONTROL STRATEGIES TO ACHIEVE BENEFICIAL PUBLIC HEALTH OUTCOMES	93028	\$474,763
Wise, Frank	Applied & Engineering Physics	ISRAEL -> Government of Israel - Israeli Ministry Of Defense, Mission to the USA	TOWARD TERAWATT PEAK POWER FIBER LASERS	92155	\$100,000
Wolfner, Mariana	Molecular Biology and Genetics	HHS -> PHS -> National Institutes of Health	DETERMINING THE ROLE OF THE CONSERVED TRPM ION CHANNEL IN EGG ACTIVATION, USING THE DROSOPHILA MODEL	92868	\$154,959
Won, Andrea	CALS Communication	Association of Public and Land-grant Universities	DESIGNING EQUITABLE IMMERSIVE EXPERIENCES FOR TEACHING	138544	\$3,000
Wrege, Peter	CALS Lab of O - Programs	Hasso Plattner Foundation (Through: SPAC NPC)	DZANGA FOREST ELEPHANT PROJECT: LONG TERM PROTECTION AND DEMOGRAPHIC MONITORING OF A CRITICALLY ENDANGERED SPECIES	136895	\$300,000
Zabih, Ramin	Tech Research	The Computer Vision Foundation Inc	COMPUTER VISION FOUNDATION	88952	\$22,647