



**Andrea Paola Zuluaga Cruz**

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## Summary of CV

This section describes briefly a summary of your career in science, academic and research; the main scientific and technological achievements and goals in your line of research in the medium -and long- term. It also includes other important aspects or peculiarities.

I am a highly experienced and knowledgeable scientist in the fields of plant pathology, epidemiology, ecology, genetics (classical, molecular and population genetics), developmental biology (including host-pathogen interactions in fungi, bacteria and oomycete pathogens), and disease management, as evidenced by my 14 peer-reviewed publications published in respectable scientific journals and conference proceedings presented at international conferences.

Throughout my career as a scientist I have carried out research at a number of international centers in Colombia (Centro Internacional de Agricultura Tropical [CIAT] and Universidad de los Andes), USA (Cornell University), Spain (Centre de Recerca Agrigenómica [CRAG], Universitat de Barcelona [UB] and Sustainable Agro-Solutions [SAS]), Mexico (Universidad Nacional Autónoma de México [UNAM]), and France (Institute National de la Recherche Agronomique [INRA]). As a consequence, I have established a wide network of international collaborators which allows me to engage in high quality innovative research.

I have proven capacity to lead and successfully complete research projects. I have carried out cutting-edge research in plant-microbe interactions, studying a wide range of pathosystems, including: oomycetes (*Phytophthora infestans*-*Solanum lycopersicum* and *S. tuberosum*), bacteria (*Xanthomonas* spp-cassava, pepper and rice; *Ralstonia solanacearum*-*S. commersonii* and *S. tuberosum*), and fungi (*Magnaporthe oryzae*-*Oryza sativa*). The results of my work have contributed to a better understanding of how pathogens manipulate the interaction with their hosts, enabling us to propose novel methods for disease control. Among these methods are cultural practices such as crop rotations, the use of defense inducers such as analogs of salicylic acid and the characterization of various candidate genes to be included in plant breeding programs. Additionally, I have developed a luminescent *R. solanacearum* which is currently used as a high-throughput screening tool in potato germplasm aiding in plant breeding programs in Uruguay.

Resistance to *Magnaporthe oryzae* and abiotic tolerance are two of the main concerns for rice-growing farmers since they represent real threats for rice production and are aggravated by climate change. I am currently working towards the understanding of disease resistance and abiotic stress in Monocots, using rice as a model system, with the goal of releasing elite rice varieties that are able to cope simultaneously with salinity stress as well as the devastating pathogen *M. oryzae* in the near future. These elite rice varieties will allow us to reduce the use of fungicides, mitigating the environmental impact while ensuring food security to the consumer and improving crop productivity to farmers in an ever-changing environment where salty soils are a major threat for crop production.



## General quality indicators of scientific research

This section describes briefly the main quality indicators of scientific production (periods of research activity, experience in supervising doctoral theses, total citations, articles in journals of the first quartile, H index...). It also includes other important aspects or peculiarities.

I have a total of 16 peer-reviewed publications published in scientific journals, 8 of them as first author, with a total of over 100 citations, and a corresponding h-index of 6 according to Researcher ID. Two additional papers are currently under review for publication (as of January 2017). I have assisted to 17 international conferences worldwide, in Belgium, France, Germany, the Netherlands, Spain, the UK, Uruguay and the USA.

I have also acted as a mentor of successful graduate students most of whom are co-authors in my publications. I have taken part in the academic committee of a Ph.D. candidate at Universitat Autònoma de Barcelona (UAB, Spain) and two final year projects, one from Universitat de Barcelona (UB, Spain) and another one from Universidad de la República (Uruguay). Additionally, I serve as a reviewer for the Bio-Protocol Journal and for projects funded by Consejo Nacional de Innovación, Ciencia y Tecnología (CONICYT) in Argentina and Uruguay.

I have successfully conceived and presented projects that have been funded in both academia and industry: the United States Department of Agriculture (USDA, Hatch Grant, USA, 2008), AGAUR (Generalitat Catalunya, Spain, 2011) and Núcleos de Innovación Tecnológica (Generalitat Catalunya, Spain, 2014). In addition, I have been awarded three highly-competitive international grants to pursue my formation as a scientist: ENEA International Fellowship Programme (Italy, 2012), Becas Santander Jóvenes Profesores e Investigadores (Spain, 2013) and Agreenskills (France, 2016).

**Andrea Paola Zuluaga Cruz**

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 ResearcherID: **H-6817-2015**  
 Date of birth: **22/12/1975**  
 Gender: **Female**  
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 City of birth: **Bogota**  
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**Current professional situation**

**Employing entity:** Institut National de la Recherche Agronomique (INRA)

**Professional category:** Postdoctoral Fellow

**Start date:** 01/05/2016

**Type of contract:** Grant Awarded

**Dedication regime:** Full time

**Primary (UNESCO code):** 241502 - Molecular biology of plants; 241706 - Mycology (mushrooms); 241709 - Phytopathology; 241714 - Plant genetics; 241719 - Plant physiology

**Secondary (UNESCO code):** 310303 - Crop management; 310304 - Crop protection; 310804 - Disease control, environmental; 310808 - Plant susceptibility, resistance

**Performed tasks:** I'm currently working in the understanding of rice resistance to both biotic and abiotic stresses. In particular, I focus on salinity and drought stresses and disease resistance against the rice blast fungus *Magnaporthe oryzae*. I am characterizing a rice protein called ZBED which confers resistance to rice against *M. oryzae* and drought when its overexpressed. This gene represents one of the very few cases where disease resistance and drought tolerance are simultaneously improved. This suggests that ZBED is potentially controlling different biological pathways than those known in disease resistance and drought tolerance. The main goal of this project is the identification of novel sources of abiotic and biotic stress resistance in monocots, using rice as a model system. To this end, I am using an holistic approach, combining integrative biology, molecular tools, cytology and bioinformatics.

**Identify key words:** Natural sciences and health sciences

**Previous positions and activities**

	<b>Employing entity</b>	<b>Professional category</b>	<b>Start date</b>
<b>1</b>	Sustainable Agro Solutions (SAS)	Researcher	01/10/2013

	Employing entity	Professional category	Start date
2	Universitat de Barcelona	Postdoctoral Fellow	06/02/2012
3	Cornell University	Graduate research assistant	01/06/2007
4	Cornell University	Master's student	01/01/2004
5	International Center for Tropical Agriculture (CIAT)	Research assistant	01/01/1998

- 1** **Employing entity:** Sustainable Agro Solutions (SAS) **Type of entity:** Business  
**City employing entity:** Lerida, Catalonia, Spain  
**Professional category:** Researcher **Educational Management (Yes/No):** No  
**Start-End date:** 01/10/2013 - 30/04/2016 **Duration:** 2 years - 6 months  
**Type of contract:** Permanent employment contract  
**Dedication regime:** Full time  
**Primary (UNESCO code):** 310300 - Agronomy; 310700 - Horticultura; 310800 - Phytopathology  
**Secondary (UNESCO code):** 241404 - Bacteriology; 241406 - Fungí; 241717 - Plant nutrition; 241719 - Plant physiology; 241790 - Fixing and mobilization of Biological Nutrients; 310108 - Agricultural Products not foodstuffs; 310306 - Field crops; 310391 - Use (management) combined water and fertilizer  
**Performed tasks:** I was in charge of designing, planning and implementing strategies for bacterial control developing non-bactericidal approaches, in particular finding inhibitors of quorum sensing. The prototypes of the products were successfully tested in laboratory conditions with *Pseudomonas syringae*-tomato and *Xanthomonas campestris*-pepper pathosystems, reducing disease significantly. These prototypes are currently being evaluated under field conditions for patent application. Additionally, I also developed products based on natural osmolites to help plants cope with abiotic stress due to salinity and drought. These osmolites increased water potential in plants allowing them to cope better with salt and drought stresses. These prototypes were evaluated by two independent contract research organizations (Anadiag and InnoPLant) giving similar results. These prototypes are currently being evaluated under field conditions for patent application. I demonstrated my excellent group leadership, organizational and interpersonal skills by the formation of high performing motivated teams that successfully achieve the project goals. During this time, I established and managed collaborations between industry and academia. Other achievements: Won a grant from Generalitat de Catalunya, Spain for the sum of 164,295.81 euros in order to aid innovative, cutting edge research in industry to develop a non-bactericidal product to control bacterial diseases in plants.  
**Identify key words:** Plant disease; Plant products; Agricultural product  
**Field of management activity:** Project Manager  
**Applicability in teaching and/or research:** All the work that I did at SAS was in the Research and Development department of the company. The results of my research were pre-prototypes of products to be commercialized as protectors for plant abiotic stress and non-bactericidal products to reduce bacterial diseases. Additionally, I collaborated with Dr. Harumi Shimada-Beltrán at UNAM (León, México), as a lecturer speaker, where I addressed her students at the Agronomical genomics class on-line. In this lectures I taught them plant physiology, virus induced gene silencing and my experience working in a private company vs academia. Additionally, during this time I served as a member of the jury for the PhD Thesis of Marcelo Sebastián Alborno Jover, which was done under the supervision of Dr Maria Coca from CRAG.
- 2** **Employing entity:** Universitat de Barcelona **Type of entity:** University  
**Professional category:** Postdoctoral Fellow **Educational Management (Yes/No):** No  
**Start-End date:** 06/02/2012 - 30/08/2013 **Duration:** 1 year - 6 months  
**Type of contract:** Grant-assisted student (pre or post-doctoral, others)  
**Dedication regime:** Full time  
**Primary (UNESCO code):** 241500 - Molecular biology; 241709 - Phytopathology; 241714 - Plant genetics; 241719 - Plant physiology; 310300 - Agronomy





**Secondary (UNESCO code):** 310300 - Agronomy; 310801 - Bacteria; 310802 - Disease control, biological; 310808 - Plant susceptibility, resistance

**Performed tasks:** I established inoculation methods for the bacterium *Ralstonia solanacearum* with hosts of the Solanaceae family, *Solanum commersonii* and tomato. I was in charge of designing and planning greenhouse experiments to evaluate disease resistance of potato germplasm against *R. solanacearum*. One of the main achievements was to develop an in-vivo system to monitor bacterial colonization of plant tissue as a tool for plant breeding programs. Briefly, I developed a luminescent *R. solanacearum*, transformed with the Lux-operon to monitor its colonization and growth in-planta. In order to study bacterial colonization and carbon sources in plants, I generated bacterial mutants, and identified a novel regulatory signal inducing the type three secretion system which is independent of plant cell contact. In order to gain insight into the molecular mechanism of plant defense against *R. solanacearum*, we used high-throughput Illumina RNA-sequencing technology to study two different genotypes of *S. commersonii*, with contrasting resistance against *R. solanacearum*: susceptible and a partially resistant. I also trained, supervised and mentored undergraduate and graduate students and visiting scholars. Main achievements: • Developed an in-vivo system to monitor bacterial colonization of plant tissue as a tool for plant breeding programs. • Described the first transcriptome of two *S. commersonii* accessions with contrasting resistance to *R. solanacearum*. • Identified that type three secretion system induction is independent of bacterial contact with plant cells.

**Identify key words:** Molecular biology; Bacteriology

**Field of management activity:** General State Administration

**Applicability in teaching and/or research:** As a postdoctoral fellow at Dr. Valls laboratory, I was invited by him twice a year to give a talk on molecular biology and biotechnology at the Universitat de Barcelona.

**3** **Employing entity:** Cornell University **Type of entity:** University

**Department:** Agronomy

**City employing entity:** Ithaca NY, United States of America

**Professional category:** Graduate research assistant

**Start-End date:** 01/06/2007 - 01/08/2011 **Duration:** 4 years - 2 months

**Type of contract:** Grant-assisted student (pre or post-doctoral, others)

**Dedication regime:** Full time

**Primary (UNESCO code):** 240903 - Population genetics; 240992 - Molecular genetics of plants; 241501 - Molecular biology of micro-organisms; 241502 - Molecular biology of plants; 241709 - Phytopathology; 241714 - Plant genetics

**Secondary (UNESCO code):** 310304 - Crop protection; 310808 - Plant susceptibility, resistance; 310899 - Other

**Performed tasks:** I was in charge of designing and planning field and greenhouse experiments to evaluate disease resistance of potatoes, tomatoes and petunias against the oomycete *Phytophthora infestans*. I contributed to the study of pathogen populations of *P. infestans* in both Colombia and the USA. With these studies, we contributed in creating an integrated pest management strategy to control late blight epidemics, using monitoring systems, determination of fungicide resistance and mating type. These new management strategies reduced fungicide application, saving money to the farmers and diminishing the environmental damage. I used high-throughput 454 RNA-sequencing technology to study the interaction between *P. infestans* and its host tomato in a time course experiment to elucidate the transition from biotrophy to necrotrophy in both plant and pathogen. We contributed in the understanding of how the pathogen controls the transition from biotrophy to necrotrophy by secreting small proteins called effectors in a timely regulated manner. Suppressors of plant cell death are secreted during the biotrophy phase and inducers of necrosis are secreted at the transition and necrotrophic phase of the interaction. Additionally, I was involved in mapping Quantitative Trait Loci for resistance against *Hyaloperonospora arabidopsidis* in *Arabidopsis thaliana* using molecular markers including SSLP and CAPS. Main achievements: • Described the first A2 mating type strain of *P. infestans* in Colombia. • Contributed in creating an integrated pest management strategy to control late blight epidemics, using monitoring systems, determination of fungicide resistance and mating type. • Generated insights into how *P. infestans* transitions from biotroph to necrotroph.

**Identify key words:** Molecular biology; Population genetics



**Applicability in teaching and/or research:** As a Graduate student I taught Introductory biology during three years to Science Majors at Cornell University. Additionally, I trained visiting scholars, postdocs and senior scientist who were at Dr. Fry's laboratory for a sabbatical stay.

- 4** **Employing entity:** Cornell University **Type of entity:** University  
**Department:** Biology  
**City employing entity:** Ithaca, NY, United States of America  
**Professional category:** Master's student **Educational Management (Yes/No):** Yes  
**Start-End date:** 01/01/2004 - 31/05/2007 **Duration:** 3 years - 4 months  
**Type of contract:** Grant-assisted student (pre or post-doctoral, others)  
**Dedication regime:** Full time  
**Primary (UNESCO code):** 241501 - Molecular biology of micro-organisms; 241502 - Molecular biology of plants; 241706 - Mycology (mushrooms)  
**Secondary (UNESCO code):** 310304 - Crop protection; 310805 - Fungi; 310808 - Plant susceptibility, resistance  
**Performed tasks:** Improved the transformation protocol of Oomycetes for both *Pythium* and *Phytophthora* species. We adapted an *Arabidopsis thaliana* protocol to produce protoplasts that successfully uptake DNA and regenerate. I used microarray technology to elucidate tomato genes differentially expressed after treatment with a salicylic acid analog (ASM). Candidate genes selected from the array results were silenced on tomato using Virus Induced Gene Silencing (VIGS) technique. The results of these experiments were published in two different articles (McLeod et al 2008 and Zuluaga et al 2013), and I was directly involved in performing the experiments, analyzing the data and writing these articles.  
**Identify key words:** Molecular, cellular and genetic biology
- 5** **Employing entity:** International Center for Tropical Agriculture (CIAT) **Type of entity:** R&D Centre  
**City employing entity:** Cali, Colombia  
**Professional category:** Research assistant  
**Start-End date:** 01/01/1998 - 31/12/1999 **Duration:** 2 years  
**Type of contract:** Temporary employment contract  
**Dedication regime:** Full time  
**Primary (UNESCO code):** 241501 - Molecular biology of micro-organisms; 241502 - Molecular biology of plants; 241709 - Phytopathology; 241714 - Plant genetics  
**Secondary (UNESCO code):** 240903 - Population genetics; 240992 - Molecular genetics of plants; 241400 - Microbiology  
**Performed tasks:** As an undergraduate student doing my thesis at CIAT, I studied the molecular interaction between cassava and *Xanthomonas axonopodis* pv *manihotis* (Xam). The approach was to identify resistant gene candidates (RGC's) in cassava against Xam. I successfully designed degenerate primers and identified 12 different RGC which were further characterized by hybridizing them on Bacterial Artificial Chromosomes (BACs) and mapping them using Restriction Fragment Length Polymorphism (RFLPs). Additionally, I was involved in writing the scientific reports and the article that was published with these results.  
**Identify key words:** Molecular markers and recognition; Plant genetics; Bacteriology



## Education

### University education

#### 1st and 2nd cycle studies and pre-Bologna degrees

- 1** **University degree:** Higher degree  
**Name of qualification:** Master of Science Degree (MSc)  
**City degree awarding entity:** Ithaca, United States of America  
**Degree awarding entity:** Cornell University **Type of entity:** University  
**Date of qualification:** 31/05/2007  
**Standardised degree:** Yes
- 2** **University degree:** Higher degree  
**Name of qualification:** Bachelor in Sciences (BS)  
**City degree awarding entity:** Bogota, Colombia  
**Degree awarding entity:** Los Andes University **Type of entity:** University  
**Date of qualification:** 15/12/1998

### Doctorates

**Doctorate programme:** Plant Pathology and Plant Molecular Biology  
**Degree awarding entity:** Cornell University **Type of entity:** University  
**City degree awarding entity:** Ithaca, United States of America  
**Date of degree:** 15/08/2011  
**European doctorate:** No  
**Thesis director:** William E Fry

### Language skills

Language	Listening skills	Reading skills	Spoken interaction	Speaking skills	Writing skills
French	B2	B2	B1	B1	A2
English	C2	C2	C1	C1	C2
Spanish	C2	C2	C2	C2	C2

## Teaching experience





## General teaching experience

- 1** **Type of teaching:** Unofficial teaching  
**Name of the course:** Biotechnology  
**Type of programme:** Bachelor's degree **Type of teaching:** In person theory  
**Type of subject:** Modular  
**University degree:** Invited Speaker  
**Course given:** Biotechnology and use of Virus induced gene silencing  
**Start date:** 14/03/2012 **End date:** 15/04/2013  
**Entity:** Universitat de Barcelona **Type of entity:** University  
**Department:** Genetics  
**City of entity:** Barcelona, Catalonia, Spain  
**Subject language:** Spanish
- 2** **Type of teaching:** Official teaching  
**Name of the course:** Introductory Biology  
**Type of programme:** Bachelor's degree **Type of teaching:** In person theory  
**Type of subject:** Core  
**University degree:** Teaching Assistant  
**Course given:** Biology **Frequency of the activity:** 2  
**Start date:** 01/01/2006 **End date:** 31/12/2008  
**End date:** 31/12/2008 **Type of hours/ ECTS credits:** Credits  
**Hours/ECTS credits:** 6  
**Entity:** Cornell University **Type of entity:** University  
**Faculty, institute or centre:** Biology  
**Department:** Biology  
**City of entity:** Ithaca, NY, United States of America  
**City assessment entity:** Ithaca, NY, United States of America  
**Funding entity:** Cornell University  
**Subject language:** English
- 3** **Type of teaching:** International teaching  
**Name of the course:** Agrigenomica  
**Related skills:** Biotechnology  
**Type of programme:** Master's degree **Type of teaching:** Virtual  
**Type of subject:** Modular  
**University degree:** Invited Speaker  
**Course given:** Biotechnology and Research in Academia vs Industry **Frequency of the activity:** 2  
**Entity:** Universidad Nacional Autónoma de México (UNAM)  
**Department:** Agronomy  
**City of entity:** León, Mexico  
**Subject language:** Spanish



## Experience supervising doctoral thesis and/or final year projects

- 1 **Project title:** Caracterización de Germoplasma de Solanum commersonii utilizando Ralstonia solanacearum UY031  
**Type of project:** End of course project  
**Co-director of thesis:** Maria Ines Siri; Marc Valls; Andrea Paola Zuluaga Cruz  
**Entity:** Universidad de la República de Uruguay  
**City of entity:** Montevideo, Uruguay  
**Student:** Virginia Ferreira  
**Date of reading:** 2013  
**European doctorate:** No
  
- 2 **Project title:** Classic Genetic Analysis of a Ralstonia solanacearum mutant and expression profiles for virulence genes  
**Type of project:** End of course project  
**Co-director of thesis:** Marc Valls; Andrea Paola Zuluaga Cruz  
**Entity:** Universitat de Barcelona **Type of entity:** University  
**Student:** Marina Puigvert Sanchez  
**Date of reading:** 2012  
**European doctorate:** No

## Scientific and technological experience

### Scientific or technological activities

#### R&D projects funded through competitive calls of public or private entities

- 1 **Name of the project:** The BED protein domain: a new player in plant tolerance to biotic and abiotic stresses?  
**Identify key words:** Molecular, cellular and genetic biology; Plant disease  
**Identify key words:** Molecular markers and recognition; Plant genetics; Plant disease; Agricultural product  
**Type of project:** Research and development, including transfer **Geographical area:** European Union  
**Degree of contribution:** Researcher  
**Entity where project took place:** Institut national de la recherche agronomique (INRA)  
**City of entity:** Montpellier, Languedoc-Roussillon, France  
**Name principal investigator (PI, Co-PI...):** Thomas Kroj; Jean Benoit Morel; Andrea Paola Zuluaga Cruz  
**Nº of researchers:** 3 **Nª people/year:** 3  
**Type of participation:** Team member  
**Name of the programme:** Agreenskills  
**Start-End date:** 02/05/2016 - 30/04/2018 **Duration:** 2 years  
**Total amount:** 100.000 €  
**Percentage as grant:** 100  
**Relevant results:** We are currently working on it. So far, we determined that ZBED localizes to the plant nucleus and binds DNA. Additionally, it causes cell death when is transiently expressed in N. benthamiana.  
**Dedication regime:** Full time



**Applicant's contribution:** I have carried out the implementation of this project, which required as a first step its setup, followed by the development of a research plan and coordination/management of technicians. I have been working in this project for 7 months and we already submitted a commentary paper to *Frontiers in Plant Science*, where I am the first author. I have been able to determine that the ZBED protein localizes to the nucleus and binds DNA. The next step is to perform ChIP-seq to determine the ZBED targets and interactors. Also, I found out that when ZBED is transiently expressed in *N. benthamiana* it causes cell death. Thus, I am currently performing experiments to determine if this cell death is relevant for disease resistance.

## 2 Name of the project: Baqum

**Identify key words:** Bacteriology; Sustainable agriculture; Plant health product; Agricultural product

**Type of project:** Research and development, including transfer

**Geographical area:** European Union

**Degree of contribution:** Researcher

**Entity where project took place:** Sustainable agro solutions SAS

**Type of entity:** Business

**City of entity:** Lleida, Catalonia, Spain

**Name principal investigator (PI, Co-PI....):** Andrea Paola Zuluaga Cruz; Javier Justribo; Esther Alonso; Ricardo Rodriguez; Natalia Olivo

**Nº of researchers:** 5

**Nª people/year:** 5

**Funding entity or bodies:**

Generalitat de Catalunya

**Type of entity:** Government

**City funding entity:** Barcelona, Catalonia, Spain

**Type of participation:** Principal investigator

**Name of the programme:** Nuclis D'innovacio tecnologica (NIT)

**Start-End date:** 07/2014 - 07/2016

**Duration:** 2 years

**Total amount:** 164.290 €

**Sub-project amount:** 164.290 €

**Percentage as grant:** 100

**Relevant results:** I developed a pre-prototype which inhibits quorum sensing in bacterial populations, thus inhibiting the transition from saprophytic to pathogenic. The product protected plants against *Xanthomonas* and *Pseudomonas syringae*.

**Dedication regime:** Full time

**Applicant's contribution:** I conceived the idea based on the needs of the company of having a non-bactericidal product to manage bacterial diseases of crops. I wrote the project, applied to the Generalitat de Catalunya Grant and performed all the experiments. Briefly, I decided to test whether inhibitors of quorum sensing (IQS) will inhibit the transition from saprophytic to pathogenic of two relevant bacterial pathogens: *Xanthomonas campestris* and *Pseudomonas syringae*. By doing a screening with a wide range of IQS in the laboratory, I detected three substances which reduced the pathogenicity of *Pseudomonas syringae* on tomato and *Xanthomonas campestris* on pepper. I did essays and determined that the reduction in the pathogenicity was due to an inhibition of quorum sensing and not a bactericidal effect. The bacterial populations were growing at the same optical density in the presence and absence of the IQS, proving that these substances did not have an antibiotic effect. This is very relevant because it is likely that the bacterial populations will not evolve resistance to such products. In addition, it will be a valuable tool for farmers, since here in Europe the only product that is registered to treat for bacterial diseases is copper and copper-based products.

## 3 Name of the project: Genes involved in potato and tomato bacterial wilt

**Entity where project took place:** Barcelona University

**City of entity:** Barcelona, Catalonia, Spain

**Name principal investigator (PI, Co-PI....):** Marc Valls Matheu; Andrea Paola Zuluaga Cruz

**Nº of researchers:** 2

**Funding entity or bodies:**

Science and Innovation Ministry

**Type of entity:** State agency



**Start-End date:** 2011 - 2013

**Total amount:** 110.000 €

**4 Name of the project:** Genomic studies of the tomato and potato diseases

**Entity where project took place:** Barcelona University

**Type of entity:** University

**City of entity:** Barcelona, Catalonia, Spain

**Name principal investigator (PI, Co-PI....):** Marc Valls Matheu; Andrea Paola Zuluaga Cruz

**Nº of researchers:** 2

**Funding entity or bodies:**

Generalitat de Catalunya. AGAUR

**Type of entity:** Public Research Body

**City funding entity:** Barcelona, Catalonia, Spain

**Start-End date:** 2011 - 2013

**Total amount:** 26.614,29 €

**Applicant's contribution:** Together with Dr. Valls, we conceived and wrote the project which was awarded the grant. Additionally, I brought my expertise in plant pathology and molecular biology and established the *Solanum commersonii*-*Ralstonia solanacearum* pathosystem in Dr Valls laboratory. Additionally, I did the transcriptomic profile of the interaction of *R. solanacearum* with hosts of the Solanaceae family including wild and cultivated potato. Studying *R. solanacearum* carbon and sugar sources in tomato Xylem and apoplast, we identified a novel regulatory signal triggering *hrpG*, a central regulator of the type three secretion system (T3SS). This finding is significant, since we challenged the knowledge available at that time, which stated that the transcriptional induction of *hrpG* was dependent of bacterial contact with plant cells. This was demonstrated by an outer-membrane receptor mutant strain (*prhA*) which was still able to induce *hrpG*.

**5 Name of the project:** Role of QTLs in developing late blight resistant potatoes

**Entity where project took place:** Cornell University

**City of entity:** Ithaca, NY, United States of America

**Name principal investigator (PI, Co-PI....):** William Earl Fry; Andrea Paola Zuluaga Cruz; Walter De Jong

**Nº of researchers:** 3

**Funding entity or bodies:**

United States Department of Agriculture (USDA), Hatch Grant

**Type of entity:** State agency

**Start-End date:** 01/10/2008 - 30/09/2011

**Total amount:** 60.000 €

**6 Name of the project:** GEPR: Characterization of the tomato secretome using integrated functional and computational strategies

**Entity where project took place:** Cornell University

**City of entity:** Ithaca, NY, United States of America

**Name principal investigator (PI, Co-PI....):** Jocelyn Rose; Jim Giovannoni; Lukas Mueller; Andrea Paola Zuluaga Cruz; Theodore William Thannhauser

**Nº of researchers:** 5

**Funding entity or bodies:**

National Science Foundation (USA) Plant Genome

**Type of entity:** Foundation

**Start-End date:** 06/2006 - 05/2011

**Total amount:** 3.761.191 €



## Scientific and technological activities

### Scientific production

**H index:** 6

**Date of application:** 18/01/2017

### Publications, scientific and technical documents

- 1** Marina Puigvert; Rodrigo Guarischi-Sousa; Paola Zuluaga; Nuria S Coll; Alberto P Macho; Joao C Setubal; Marc Valls. Transcriptomes of *Ralstonia solanacearum* during root colonization of *Solanum commersonii*. *Frontiers in Plant Science*. 8 - 370, 03/04/2017.

**Type of production:** Scientific paper

**Format:** Journal

**Corresponding author:** No

- 2** Paola Zuluaga; Boris Szurek; Ralf Koebnik; Thomas Kroj; Jean-Benoit Morel. Effectors mimics and integrated decoys, the never-ending arms race between rice and *Xanthomonas oryzae*. *Frontiers in Plant Science*. 8 - 431, 28/03/2017.

**Type of production:** Scientific paper

**Format:** Journal

**Corresponding author:** No

- 3** Przemyslaw Bidzinski; Elsa Ballini; Aurelie Ducasse; Corinne Michel; Andrea Paola Zuluaga Cruz; Annamaria Genga; Remo Chiozzotto; Jean-Benoit Morel. Molecular basis of drought-induced susceptibility to the rice blast fungus *Magnaporthe oryzae*. *Frontiers in Plant Science*. 7, pp. 1558. 2016.

**Type of production:** Scientific paper

**Format:** Journal

**Corresponding author:** No

- 4** Andrea Paola Zuluaga Cruz; Julio Cesar Vega Arreguín; Zhangjun Fei; Antonio Matas; Sean Patev; William Earl Fry; Jocelyn K.C. Rose. Analysis of the tomato transcriptome during a compatible interaction with the hemibiotrophic pathogen *Phytophthora infestans*. *Molecular Plant Pathology*. 17 - 1, pp. 42 - 54. *APS Journals*, 2015.

**Type of production:** Scientific paper

**Format:** Journal

**Position of signature:** 1

**Degree of contribution:** Author or co-author of article in journal without external admissions assessment committee

**Total no. authors:** 7

**Impact source:** ISI

**Category:** Molecular plant microbe interactions

**Impact index in year of publication:** 4.188

**Relevant results:** As first author, I was involved in designing and performing the experiments and analyzing the data with the other authors. Additionally, I was supervising the experiments done by other authors. Finally I was involved in writing the manuscript.

- 5** Andrea Paola Zuluaga Cruz; Nuria S-Coll; Marc Valls. Evaluation of *R. solanacearum* colonization of potato germplasm using the synthetic luxCDABE operon. *Bio-protocol*. 4 - 9a, pp. 2174. 2015.

**Type of production:** Scientific paper

**Format:** Journal

**Corresponding author:** Yes

- 6** Andrea Paola Zuluaga Cruz; Julio Cesar Vega Arreguin; Zhangjun Fei; Lalit Ponnala; Sang Jik Lee; Antonio J Matas; Sean Patev; William Earl Fry; Jocelyn K.C. Rose. Transcriptional dynamics of *Phytophthora infestans*, during sequential stages of hemibiotrophic infection in tomato. *Molecular Plant Pathology*. 17 - 1, pp. 29 - 41. APS Journals, 2015.

**Type of production:** Scientific paper

**Format:** Journal

**Position of signature:** 1

**Degree of contribution:** Author or co-author of article in journal without external admissions assessment committee

**Total no. authors:** 7

**Corresponding author:** No

**Impact source:** ISI

**Category:** Molecular Plant Pathology

**Impact index in year of publication:** 4.335

**Relevant results:** As first author, I was involved in designing and performing the experiments and analyzing the data with the other authors. Additionally, I was in charge of directing the work that other co-authors were doing. Finally I was involved in writing the manuscript.

- 7** Andrea Paola Zuluaga Cruz; Montserrat Sole; Haibin Lu; Elsa Gongora Castillo; Brienne Vaillancourt; Nuria S-Coll; C Robin Buell; Marc Valls. Transcriptome responses to *Ralstonia solanacearum* infection in the roots of the wild potato *Solanum commersonii*. *BMC Genomics*. 16, pp. 246. 2015.

**Type of production:** Scientific paper

**Format:** Journal

- 8** Andrea Paola Zuluaga Cruz; Virginia Ferreira; Maria Julia Pianzola; Maria Ines Siri; Nuria S-Coll; Marc Valls. A novel sensitive method to evaluate potato germplasm for bacterial wilt resistance using a luminescent *Ralstonia solanacearum* reporter strain. *Molecular Plant Microbe Interactions*. 27 - 3, pp. 277 - 285. APS, 2014.

**Type of production:** Scientific paper

- 9** Andrea Paola Zuluaga Cruz; Marina Puigvert; Marc Valls. Novel plant inputs influencing *Ralstonia solanacearum* during infection. *Frontiers in Microbiology*. 4, pp. 349. 2013.

**Type of production:** Scientific paper

**Format:** Journal

- 10** Andrea Paola Zuluaga Cruz; Julio Cesar Vega Arreguin; William Earl Fry. Transcriptome profile of acibenzolar-S-methyl-induced genes in tomato suggests a complex polygenic effect on resistance to *Phytophthora infestans*. *Physiological and Molecular Plant Pathology*. 81, pp. 97 - 106. Elsevier, 2013.

**Type of production:** Scientific paper

**Format:** Journal

**Position of signature:** 1

**Degree of contribution:** Author or co-author of article in journal without external admissions assessment committee

**Impact source:** ISI

**Impact index in year of publication:** 2.161

**Relevant results:** As first author I was involved in designing and performing the experiments, as well as analyzing the data and writing the manuscript. This paper is currently accepted.

- 11** Guohong Cai; Silvia Restrepo; Kevin Myers; Andrea Paola Zuluaga Cruz; Giovanna Danies; Christine Smart; William Earl Fry. Gene profiling in partially resistant and susceptible near-isogenic tomatoes in response to late blight in the field. *Molecular Plant Pathology*: DOI: 10.1111/j.1364-3703.2012.00841.x. 14 - 2, pp. 171 - 184. Wiley, 2012.

**Type of production:** Scientific paper

**Format:** Journal

**Impact source:** ISI

**Category:** Molecular plant pathology

**Impact index in year of publication:** 3.899

**Position of publication:** 4

**Relevant results:** I did all the VIGS silencing experiments, and helped designing the experiments, analyzing the data and writing the article.





- 12** Maria Julia Pianzzola; Maria Ines Siri; Lucca; Andrea Paola Zuluaga Cruz; Marc Valls. Manejo de enfermedades de la patata en Suramérica y su aplicación al campo Europeo. Tierras Agricultura. 188, pp. 65 - 71. Gestora de Comunicaciones de Castilla y León, 2012. ISSN 1889-0776, 2012.  
**Type of production:** Scientific paper **Format:** Journal  
**Relevant results:** I wrote one third of this review article which deals with the *P. infestans* management strategies and was involved in editing the final draft.
- 13** Angela Vargas; Lina Quesada Ocampo; Maria Catalina Cespedes; Natalia Carreño; Adriana Gonzalez; Alejandro Rojas; Andrea Paola Zuluaga Cruz; Kevin Myers; William Earl Fry; Pedro Jimenez; Adriana Bernal; Silvia Restrepo. Characterization of *Phytophthora infestans* Populations in Colombia: First Report of the A2 Mating Type. *Phytopathology*. 99 - 1, pp. 82 - 88. APS Journals, 2009.  
**Type of production:** Scientific paper **Format:** Journal  
**Impact source:** ISI  
**Impact index in year of publication:** 2.8  
**Relevant results:** Helped writing the article, analyzing the data and the characterization of mating type, RG57 and GPI of *P. infestans*
- 14** Adele McLeod; Barbara Fry; Andrea Paola Zuluaga Cruz; Kevin Myers; William Earl Fry. Toward improvements of oomycete transformation protocols. *Eukaryotic Microbiology*. 55, pp. 103 - 109. Wiley, 2008.  
**Type of production:** Scientific paper **Format:** Journal  
**Impact source:** ISI  
**Impact index in year of publication:** 2.66  
**Relevant results:** Helped in the transformation of *P. infestans*
- 15** Camilo Lopez; Andrea Paola Zuluaga Cruz; Robert Cook; Delseny; Joe Tohme; Valerie Verdier. Isolation of Resistance Gene Candidates (RGCs) and characterization of an RGC cluster in cassava. *Molecular Genetics and Genomics*. 269 - 5, pp. 658 - 667. Springer, 2003.  
**Type of production:** Scientific paper **Format:** Journal  
**Impact source:** ISI **Category:** Cell Biology  
**Impact index in year of publication:** 2.635  
**Relevant results:** Isolated the RGC in cassava and helped writing the article
- 16** Kevin Myers; Sandra Jensen; Andrea Paola Zuluaga Cruz; Ian Small; Sanjoy Guharoy; William E Fry. Characterization of *Phytophthora infestans* isolates from potato/tomato in 2010. *Phytopathology*. 101S:261-262, 2010.  
**Type of production:** Scientific-technical report **Format:** Scientific and technical document or report  
**Corresponding author:** No

### Works submitted to national or international conferences

- 1** **Title of the work:** ZBED as a new player conferring resistance to *Magnaporthe oryzae* and drought stress in rice  
**Name of the conference:** Colloque Resistance  
**Corresponding author:** Yes  
**City of event:** Lauret, Languedoc-Roussillon, France  
**Date of event:** 08/11/2016  
**End date:** 11/11/2016  
**Organising entity:** Institute National de la Recherche Agronomique (INRA)



Andrea Paola Zuluaga Cruz.

- 2** **Title of the work:** Studying the ZBED protein as a new player in plant tolerance to abiotic and biotic stress  
**Name of the conference:** 14th International Symposium on Rice Functional Genomics, Montpellier, France  
**Corresponding author:** Yes  
**City of event:** Montpellier, Languedoc-Roussillon, France  
**Date of event:** 26/09/2016  
**End date:** 29/09/2016  
**Organising entity:** CIRAD, INRA, CNRS, IRD  
Andrea Paola Zuluaga Cruz; Laurent Deslandes; Emilie Chanclud; Jean Benoit Morel.
- 3** **Title of the work:** Phenotypic and Genotypic Characterization of Recent Clonal Lineages of *Phytophthora infestans* in the United States  
**Name of the conference:** American Phytopathological Society  
**City of event:** United States of America  
**Date of event:** 02/08/2012  
**Organising entity:** American Phytopathological Society USA  
**City organizing entity:** United States of America  
Giovanna Danies; Ian Small; Kevin Myers; Andrea Paola Zuluaga Cruz; Richard Childers; Kiersten Bekoscke; Sally Stead; Audrey Teerantanonon; DeÁnna D'attilio; William Earl Fry.
- 4** **Title of the work:** Characterization of *Phytophthora infestans* isolates from potato/tomato in 2010  
**Name of the conference:** The American Phytopathological Society (APS) Northeastern Division  
**City of event:** Northampton, MA, United States of America  
**Date of event:** 28/10/2010  
**Organising entity:** American Phytopathological Society USA  
**City organizing entity:** Northampton, MA, United States of America  
Kevin Myers; Ian Small; Sandra Jensen; Andrea Paola Zuluaga Cruz; Sanjoy Guha Roy; William Earl Fry.
- 5** **Title of the work:** Silencing of Cysteine protease, acidic chitinase or PR1-a individually, does not hamper BTH mediated resistance to *P. infestans* in tomato  
**Name of the conference:** Oomycete Molecular Genetics Network  
**City of event:** Birnam, Eastern Scotland, United Kingdom  
**Date of event:** 06/05/2008  
**End date:** 09/05/2012  
**City organizing entity:** Birnam, Eastern Scotland, United Kingdom  
Andrea Paola Zuluaga Cruz; William Earl Fry.
- 6** **Title of the work:** BTH molecular response assessment in petunia, potato and tomato  
**Name of the conference:** Oomycete Molecular Genetics Network  
**City of event:** Wagening, Holland  
**Date of event:** 04/05/2006  
**End date:** 07/05/2006  
**City organizing entity:** Wagening, Holland  
Andrea Paola Zuluaga Cruz; William Earl Fry.
- 7** **Title of the work:** BTH Molecular Response Assessment in Petunia, Tomato and Potato  
**Name of the conference:** The American Phytopathological Society (APS) Northeastern Division  
**Type of event:** Conference **Geographical area:** Non EU International  
**Type of participation:** Participatory - oral communication  
**City of event:** Geneva, NY, United States of America



**Date of event:** 13/10/2005  
**Organising entity:** American Phytopathological Society USA  
**City organizing entity:** Geneva, NY, United States of America  
Andrea Paola Zuluaga Cruz; William Earl Fry.

### Works submitted to national or international seminars, workshops and/or courses

- 1** **Title of the work:** Use of transcriptomics to understand plant pathogen interactions  
**Name of the event:** Latin American Genetic Congress ALAG  
**Corresponding author:** Yes  
**City of event:** Montevideo, Uruguay  
**Date of event:** 09/10/2016  
**End date:** 12/10/2016  
**Organising entity:** Universidad de la Republica (Uruguay)  
**City organizing entity:** Montevideo, Uruguay  
Andrea Paola Zuluaga Cruz.
  
- 2** **Title of the work:** Ralstonia-potato interaction: what the bacteria eats in plant and which genes are expressed  
**Name of the event:** IV Iberoamerican Workshop in Ralstonia solanacearum  
**Corresponding author:** Yes  
**City of event:** Montevideo, Uruguay  
**Date of event:** 22/11/2012  
**End date:** 25/11/2012  
**Organising entity:** CYTED  
**City organizing entity:** Montevideo, Uruguay  
Andrea Paola Zuluaga Cruz.
  
- 3** **Title of the work:** Characterization of the transition of *P. infestans* from biotrophy to necrotrophy  
**Name of the event:** Ralstop Genomics  
**Corresponding author:** Yes  
**City of event:** Barcelona, Catalonia, Spain  
**Date of event:** 19/10/2011  
**Organising entity:** CONSORCIO CSIC-IRTA-UAB    **Type of entity:** State agency  
CENTRE DE RECERCA AGRIGENOMICA  
Andrea Paola Zuluaga Cruz.



## R&D management and participation in scientific committees

### R&D management

**Name of the activity:** Project manager

**Type of management:** Management of R&D&I actions and projects

**Performed tasks:** Supervise Research and development projects

**Entity:** Sustainable Agro Solutions SAS

**Start date:** 01/10/2013

**Duration:** 2 years - 6 months

## Other achievements

### Stays in public or private R&D centres

- 1** **Entity:** Universidad Nacional Autónoma de México (UNAM) **Type of entity:** University

**Faculty, institute or centre:** Faculty

**City of entity:** León, Mexico

**Start-End date:** 01/04/2013 - 31/05/2013 **Duration:** 2 months

**Goals of the stay:** Guest

**Acquired skills developed:** Bioinformatics

**Relevant results:** Analyzed RNA-sequences from *Solanum commersonii*
- 2** **Entity:** CYTED **Type of entity:** State agency

**Faculty, institute or centre:** Fundation

**City of entity:** Montevideo, Uruguay

**Start-End date:** 19/11/2012 - 23/11/2012 **Duration:** 5 days

**Name of programme:** Course in improving potato plant breeding against *Ralstonia solanacearum* in South America

**Goals of the stay:** Short course

**Acquired skills developed:** Plant breeding, genotyping
- 3** **Entity:** Virginia Tech University **Type of entity:** University

**Faculty, institute or centre:** Faculty

**City of entity:** Blacksburg, Virginia, United States of America

**Start-End date:** 13/11/2010 - 16/11/2010 **Duration:** 4 days

**Name of programme:** Laboratory short course in effector-lipid interactions

**Goals of the stay:** Short Course

**Acquired skills developed:** Cytology, molecular biology, effector-lipid interactions



## Obtained grants and scholarships

- 1** **Name of the grant:** Agreenskills  
**Aims:** Post-doctoral  
**Awarding entity:** Eupean Union and Institute National de la Recherche Agronomique (INRA) France  
**Conferral date:** 01/05/2016 **Duration:** 2 years  
**End date:** 30/04/2018  
**Entity where activity was carried out:** INRA France  
**Faculty, institute or centre:** Institute
- 2** **Name of the grant:** Programa Núcleos de Innovación Tecnológica ACCIO  
**Aims:** Innovation  
**Awarding entity:** Generalitat de Catalunya **Type of entity:** Public  
**Conferral date:** 2014 **Duration:** 2 years  
**End date:** 2016  
**Entity where activity was carried out:** Sustainable Agro Solutions (SAS)  
**Faculty, institute or centre:** Industry
- 3** **Name of the grant:** Travel fellowship: Laboratory short course on effector-lipid interactions  
**Aims:** Pre-doctoral  
**Awarding entity:** The US National Science Foundation **Type of entity:** Foundation  
**Conferral date:** 11/11/2010  
**End date:** 13/11/2010  
**Entity where activity was carried out:** Virginia Tech University
- 4** **Name of the grant:** Graduate Students Grant  
**Aims:** Pre-doctoral  
**Awarding entity:** Cornell University (USA) **Type of entity:** University  
**Conferral date:** 01/01/2009 **Duration:** 1 year  
**End date:** 31/12/2009  
**Entity where activity was carried out:** Cornell University (USA)  
**Faculty, institute or centre:** Plant Pathology and Plant Microbe Biology
- 5** **Name of the grant:** Oomycete Molecular Genetics Network (OMGN) travel fellowship  
**Aims:** Pre-doctoral  
**Awarding entity:** The US National Science Foundation **Type of entity:** Foundation  
**Conferral date:** 08/05/2008  
**End date:** 13/05/2008  
**Entity where activity was carried out:** The US National Science Foundation
- 6** **Name of the grant:** Becas Santander Jóvenes Investigadores  
**Aims:** Collaboration proyect  
**Awarding entity:** BANCO SANTANDER, S.A.  
**Conferral date:** 2013 **Duration:** 2 months  
**Entity where activity was carried out:** Leon, Mexico



**7** **Name of the grant:** ENEA International Fellowship Program

**Aims:** Post-doctoral

**Awarding entity:** Italian National Agency for New Technologies and Sustainable Economic Development

**Type of entity:** State agency

**Conferral date:** 07/2012

**8** **Name of the grant:** Graduate Students Travel Award

**Aims:** Pre-doctoral

**Awarding entity:** Cornell University

**Conferral date:** 21/08/2010