

# Jean-Michel M. Ané

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## Education

University of Lyon (France)	B.S.	Molecular and Cellular Biology	1995
University of Toulouse (France)	M.S.	Plant Cellular and Molecular Biology	1997
University of Toulouse (France)	Ph.D.	Plant Cellular and Molecular Biology	2002

## Professional Experience

2010- present	Associate Professor	University of Wisconsin Madison
2004-2010	Assistant Professor	University of Wisconsin Madison
2002-2004	Postdoctoral Researcher	University of California Davis
1998-2002	Graduate Fellow	French Ministry of Research
	Teaching Assistant	University of Toulouse, France
1993-1997	Undergraduate Fellow	ENS - Lyon, France

## Peer-Reviewed Publications (H-index = 12)

### *As an Associate Professor*

- Capoen W., Sun J., Wysham D., Otegui M.S., Venkateshwaran M., Hirsch S., Miwa H., Downie J.A., Morris R.J., Ané J.M., Oldroyd G.E.D. The nuclear membranes control symbiotic calcium signalling of legumes. **Proceedings of the National Academy of Sciences USA**, 108(34) 14348-14353.
- Horváth B., Yeun L.H., Domonkos A., Halász G., Gobbato E., Ayaydin F., Míró K., Hirsch S., Sun J., Tadege M., Ratet P., Mysore K., Ané J.M., Oldroyd G.E.D., Kaló P. (2011) *Medicago truncatula* IPD3 is a member of the common symbiotic signaling pathway required for rhizobial and mycorrhizal symbioses. **Molecular Plant-Microbe Interactions**, *in press*.
- Furseth B.J., Conley S.P., Ané J.M. (2011). Soybean Response to Rhizobia on Previously Flooded Sites in Southern Wisconsin. **Agronomy Journal**, 103:573-576.
- Riely B.K., He H., Venkateshwaran M., Sarma B., Schraiber J., Ané J.M., Cook D.R. (2011) Identification of legume RopGEF gene families and characterization of a *Medicago truncatula* RopGEF mediating polar growth of root hairs. **The Plant Journal**, 65:230-243.
- Venkateshwaran M., Ané J.M. (2011) Legumes and nitrogen fixation: physiological, molecular, evolutionary perspectives and applications. **The Molecular Basis of Nutrient Use Efficiency in Crops** (eds Hawkesford M.J. and Barraclough P.B), John Wiley & Sons, Inc., Hoboken, NJ, USA. pp 457-489. ISBN: 978-0-8138-1992-1.
- Mukherjee, A. and Ané, J.M. (2011) Plant Hormones and Initiation of Legume Nodulation and Arbuscular Mycorrhization, in **Ecological Aspects of Nitrogen Metabolism in Plants** (eds J. C. Polacco and C. D. Todd), John Wiley & Sons, Inc., Hoboken, NJ, USA. pp 354-396. ISBN:

978-0-8138-1649-4.

- Mukherjee, A., Ané J.M. (2011) Germinated spore exudates from arbuscular mycorrhizal fungi: molecular and developmental responses in higher land plants and their regulation by ethylene. **Molecular Plant-Microbe Interactions**, 24:2, 260-270.

*As an Assistant Professor*

- Furseth B.J., Conley S.P., Ané J.M. (2010) Enumeration of Soybean-Associated Rhizobia with Quantitative Real-Time Polymerase Chain Reaction. **Crop Science**. 50: 2591-2596.
- Wang B., Yeun L.H., Xue J., Liu Y., Ané J.M., Qiu, Y.L. (2010) Presence of three mycorrhizal genes in the common ancestor of land plants suggests a key role of mycorrhizas in the colonization of land by plants. **New Phytologist**, 186: 514-525
- Grimsrud P.A., den Os D., Wenger C.D., Schwartz D., Sussman M.R., Ané J.M., Coon J. (2010) Large-scale analysis of protein phosphorylation in *Medicago truncatula* roots, **Plant Physiology**, 152: 19-28.
- Bhaskar, B.P., Venkateshwaran M., Wu, L., Ané J.M., Jiang, J. (2009) *Agrobacterium*-mediated transient gene expression and silencing in potato, **PLoS ONE**, 4(6): e5812.
- Chen C., Ané J.M., Zhu H. (2008) Os-IPD3, an ortholog of the *Medicago truncatula* DMI3 interacting protein IPD3, is required for mycorrhizal symbiosis in rice. **New Phytologist**, 180: 311-315.
- Brelles-Mariño G., Ané J.M. (2008) Nod factors and the molecular dialogue in the rhizobia - legume interaction. In: **Nitrogen Fixation Research Progress**, 173-227, Editor: Couto G.N. Nova Science Publishers, Inc. ISBN: 978-1-60456-402-0.
- Ané J.M., Zhu H., Frugoli J. (2008) Recent advances in *Medicago truncatula* genomics. **International Journal of Plant Genomics**, vol. 2008, Article ID 256597.
- Kevei Z., Loughon G., Mergaert P., Horváth G.V., Kereszt A., Jayaraman D., Zaman N., Marcela F., Regulski K., Kiss G.B., Kondorosi A., Endre G., Kondorosi E., Ané J.M. (2007) A 3-hydroxy-3-methylglutaryl coenzyme A reductase interacts with NORK in the nodulation signaling pathway. **The Plant Cell**, 19:3974-3989.
- Peiter E., Sun J., Heckmann A.B., Venkateshwaran M., Riley B.K., Otegui M.S., Edwards A., Freshour G., Hahn M.G., Cook D.R., Sanders D., Oldroyd G.E.D., Downie J.A., Ané J.M. (2007) *Medicago truncatula* DMI1 modulates calcium signaling. **Plant Physiology**, 145(1): 192–203.
- Messinese E., Mun J.H., Yeun L.H., Jayaraman D., Rougé P., Barre A., Loughon G., Schornack S., Bono J.J., Cook D.R., and Ané J.M. (2007) A novel nuclear protein interacts with the symbiotic DMI3 CCaMK of *Medicago truncatula*. **Molecular Plant-Microbe Interactions**, 20 (8): 912-921.
- Riely B.K., Loughon G., Ané J.M., Cook D.R. (2007) The symbiotic ion channel homolog DMI1 functions in the nuclear membrane of *Medicago truncatula* roots. **The Plant Journal**, 49 (2), 208–216.
- Zhu H., Riely B.K., Burns N.J., Ané J.M. (2006) Tracing non-legume orthologs of legume genes required for nodulation and arbuscular mycorrhizal symbioses. **Genetics**, 172:2491-2499.
- Riely B.K., Mun J.H., Ané J.M. (2006) Unravelling the molecular basis for symbiotic signal transduction in legumes. **Molecular Plant Pathology**, 7(3): 197-207.

#### As a postdoc

- Riely, B.K., Ané, J.M., Penmetsa, R.V., and Cook, D.R. (2004) Genetic and genomic analysis in model legume systems bring Nod factor signaling to center stage. **Current Opinion in Plant Biology**, 7:408-413.
- Ané J.M., Kiss G.B., Riely B.K., Penmetsa R.V., Oldroyd G.E.D., Ayax C., Lévy J., Debellé F., Baek J.M., Kaló P., Rosenberg C., Roe B.A., Long S.R., Dénarié J., Cook D.R. (2004). *Medicago truncatula* *DMI1* required for bacterial and fungal symbioses in legumes. **Science**, 303:1364-1367.
- Lévy J., Bres C., Geurts R., Chalhoub B., Kulikova O., Duc G., Journet E.P., Ané J.M., Lauber E., Bisseling T., Dénarié J., Rosenberg C., Debellé F. (2004). A calcium calmodulin dependent protein kinase is required for nodulation and endomycorrhization. **Science**, 303:1361-1364.

#### As a PhD student

- Ané J.M., Lévy J., Thoquet P., Kulikova O., de Billy F., Penmetsa V., Kim D.J., Debellé F., Rosenberg C., Cook D., Bisseling T., Huguet T., Dénarié J. (2002). Genetic and cytogenetic mapping of *DMI1*, *DMI2* and *DMI3* genes of *Medicago truncatula* involved in Nod factor transduction, nodulation and mycorrhization. **Molecular Plant-Microbe Interactions**. 15 (11), 1108-1118.
- Thoquet P., Ghérardi M., Journet E.P., Kereszt A., Ané J.M., Prospéri J.M. and Huguet T. (2002). The molecular genetic linkage map of the model legume *Medicago truncatula*: an essential tool for comparative legume genomics and the isolation of agronomically important genes. **BMC Plant Biology**. 2, 1.

#### Conference proceedings

- Goodrich-Blair, H., Ané, J.M., Bever, J.D., Bordenstein, S., Bright, M., Chaston, J.M., Clay, K., Currie, C.R., Douglas, A.E., Gerardo, N., Harrison, M.J., Ley, R.E., McFall-Ngai, M., Mukherjee, A., Rader, B., Raffa, K.F., Ruby, E.G., Saffo, M.B., Selosse, M.A., Sonnenburg, J.L., Stock, S.P., Suen, G., Turnau, K., Udvardi, M., Visick, K.L., Weis, V (2010), Symbiosis research, technology, and education: Proceedings of the 6th International Symbiosis Society Congress held in Madison Wisconsin, USA, August 2009, **Symbiosis**. 51: 1-12 DOI 10.1007/s13199-010-0076-0.
- Venkateshwaran M., Riely B.K., Peiter E., Otegui M.S., Sun J., Heckmann A., Lougnon G., Edwards A., Freshour G., Hahn M., Sanders D., Oldroyd G.E.D., Downie J.A., Cook D.R., Ané J.M. (2008) The putative ion channel *DMI1* localizes to the nuclear envelope and regulates nuclear calcium spiking during early symbiotic signaling. **Phytopathology** 98:S163-S163.
- Riely B.K., Messinese E., Mun J.H., Yeun L.H., Jayaraman D., Venkateshwaran M., Lougnon G., Rougé P., Barre A., Bono J.J., Cook, D.R., Ané J.M. (2007). The nucleus as a central player in symbiotic signaling . **Biology of Plant-Microbe Interactions (Volume 6)**. E. Sanchez. International Society for Molecular Plant Microbe Interactions.

#### Patent Information

Ané J.M., Kiss G.B., Penmetsa R.V., Dénarié J., Cook D.R. A gene controlling the establishment of rhizobial and mycorrhizal symbioses. United States Patent Application Publication No. **20050081262** published April 14, 2005.

## Invited Research Presentations

### *As an Associate Professor*

- Utilizing Symbiotic Signals and Signaling Pathways to Improve Crop Productivity and Agricultural Sustainability, Valent Biosciences (August 29, 2011)
- Sweet talks in plant-microbe symbioses. American Society for Microbiology 2011. New Orleans, LA (May 24, 2011).
- Sweet talks in plant-microbe symbioses. Biology Colloquium. University of Wisconsin Madison (October 28, 2010)
- Sweet talks in plant-microbe symbioses. Department of Plant Sciences. University of California Davis (October 15, 2010)
- Sweet talks in plant-microbe symbioses. 24<sup>th</sup> Annual Raper Symposium. Department of Bacteriology. University of Wisconsin Madison (August 30, 2010)
- A recent evolution in the filter region of nuclear cation channels changed the genetic basis of symbiotic signaling. 21st North American Symbiotic Nitrogen Fixation Conference. Saint Louis, Missouri (June 13-18, 2010).

### *As an Assistant Professor*

- Underground peace talks in plant-microbe symbioses. Department of Plant Sciences. University of Arizona (February 1-3, 2010)
- Conserved signaling pathways in plant – microbe symbioses. 6<sup>th</sup> International Symbiosis Society Congress 2009. Madison, Wisconsin (August 9-15, 2009)
- *Medicago* DMI1 and the *Lotus* twins. Model Legume Conference 2009. Asilomar, California (July 12-16, 2009)
- Protein interactions in Plant – Microbe Symbiotic Signaling. Samuel Roberts Noble Foundation, Oklahoma (March 3, 2009).
- Protein interactions in Plant – Microbe Symbiotic Signaling. Clemson University, South Carolina (February 13, 2009).
- Underground peace talks in plant-microbe symbioses. Wilfrid Laurier University, Waterloo, Ontario, Canada (November 7, 2008).
- Underground peace talks in plant-microbe symbioses. Southern Crop Protection and Food Research Centre, London, Ontario, Canada (November 6, 2008).
- Underground peace talks in plant-microbe symbioses. University of Missouri - Columbia (November 3, 2008).
- Underground peace talks in plant-microbe symbioses. Distinguished Lectures in Microbiology. Bacteriology Department, University of Wisconsin Madison (October 30, 2008).
- Underground peace talks in plant-microbe symbioses. California State Pomona Polytechnic University, Pomona, CA (October 17, 2008)
- Underground peace talks in plant-microbe symbioses. ASM Conference on Beneficial Microbes, San Diego, CA (October 16, 2008)
- Plant – microbe symbioses: the Good, the Bad and the Cheater! Forum on Microbial Threats. Board on Global Health. Institute of Medicine. US National Academy of Science (May 20, 2008).
- Underground peace talks in plant-microbe symbioses. The Donald Danforth Plant Science Center (December 5, 2007)
- The nucleus as a central player in symbiotic signaling. University of Minnesota (October 15, 2007).
- The nucleus as a central player in symbiotic signaling. International Society for Molecular Plant Microbe Interactions. Sorrento, Italy (July 22, 2007).

- *Medicago truncatula* DMI1 localizes to the nuclear envelope and regulates Nod factor-induced calcium spiking. North American Symbiotic Nitrogen Fixation Conference. Milwaukee (July 14, 2007).
- The nucleus as a central player in symbiotic signaling. Plant Biology & Botany Joint Congress. Chicago (July 11, 2007).
- Underground peace talks in plant-microbe symbioses. CEA Cadarache, France (May 17, 2007).
- *Medicago truncatula* DMI1 localizes to the nuclear envelope and regulates Nod factor-induced calcium spiking. LIPM, INRA-CNRS, Toulouse, France (May 16, 2007).
- The nucleus as a central player in symbiotic signaling. Model Legumes Conference (MLC) 2007. Tunis (March 28, 2007).
- Underground peace-talks in plant-microbe symbioses. University of Michigan (February 15, 2007).
- Technology platforms for improvement of *Medicago* germplasm. International Workshop on Genomics-Enabled Improvement of Legumes. Asilomar Conference Grounds, USA (August 30, 2006).
- Identification of new symbiotic players in *Medicago truncatula* via protein interactions. JSPS/NSF Joint Workshop. Genetic approach to elucidate molecular mechanism of symbiotic nitrogen fixation. JSPS/NSF Joint Workshop. Tokyo, Japan (August 19, 2006)
- Recent advances on plant-microbe symbioses. Symbiosis colloquium. UW Madison (June 14, 2006).
- Underground peace-talks in plant-microbe symbioses. University of Wisconsin Madison Agronomy colloquium (February, 2006).
- Plant genes required for bacterial and fungal symbioses. University of Wisconsin Madison Genetics Colloquium (October 20, 2005).
- Plant genes required for bacterial and fungal symbioses. University of Wisconsin Madison Entomology Colloquium (October 7, 2005).

#### *As a postdoc*

- The *Medicago truncatula* DMI1 gene encodes a novel protein that is required for the early steps of bacterial and fungal symbioses. 5th European Conference on grain legumes / ICLGG 2004: Dijon, France (June 9, 2004).
- Genetic and molecular dissection of Nod factor signaling in *Medicago truncatula*. Institut des Sciences du Végétal, Gif-sur-Yvette, France (March 20, 2004).
- Genetic and molecular dissection of Nod factor signaling in *Medicago truncatula*. Institut de Recherche pour le Développement. Montpellier, France (March 15, 2004).
- The *Medicago truncatula* DMI1 gene encodes a novel protein that is required for the early steps of bacterial and fungal symbiosis. *Medicago* Genomics: New Tools for Legume Biology and Breeding. Labège, France (November 13, 2003).

#### *As a PhD student*

- Genetic analysis of Nod factor perception and transduction. *Medicago truncatula* workshop. San Diego. 2<sup>nd</sup> *Medicago truncatula* Workshop. San Diego (January 8, 2000).

## Funding

### Ongoing Research Support:

- Role of a 3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase in plant-microbe symbiotic signaling pathways. **NSF – Division of Integrative and Organismal Biology**. (PI: Dr. Jean-Michel Ané): \$450,000 from September 2010 to August 2013.
- Dynamin Related Proteins of *Medicago truncatula*. **USDA Hatch Grant**, \$58,797 from October 2009 to September 2012. PI: Sebastian Bednarek. CoPI: Jean-Michel Ané.
- GEPR: An Interdisciplinary Approach to deciphering the molecular dialogue between the plasma membrane and cytoplasm of *Medicago truncatula*, **NSF – Plant Genome Research Program**, \$4,410,481 from September 2007 to August 2012. PI: Michael R. Sussman, CoPIs: Jean-Michel Ané, Joshua Coon and Gheorghe Craciun.
- A nuclear putative ion channel crucial for bacterial and fungal symbioses with plant roots, **USDA Hatch Grant**, \$85,956 from October 2007 to September 2012. PI: Jean-Michel Ané.
- Improved Microbial-Plant Interactions (section 4.2), **Great Lakes Bioenergy Research Center**, \$450,012 to J.M. Ané from January 2008 to November 2011.

### Completed Research Support

- Plant Responses to the Colonization by *Escherichia coli* O157:H7 and *Salmonella*. **Joint Institute for Food Safety and Applied Nutrition**, \$184,632 from March 2009 to February 2011. PI: Jean-Michel Ané. CoPI: Charles Kaspar and Eric Brown.
- Characterizing Soybean Yield Response to Rhizobial Inoculants: \$25,000. **Wisconsin Soybean Marketing Board** from March 2009 to February 2010. PI: Shawn Conley. CoPI: Jean-Michel Ané.
- A calcium and calmodulin dependant protein kinase that is required for the early steps of bacterial and fungal symbioses, **USDA - CSREES**, \$361,155, from 2005 to 2008. PI: Jean-Michel Ané.
- Soybean genes required for nodulation and mycorrhization, **Wisconsin Soybean Marketing Board**, \$79,992, from 2005 to 2008. PI: Jean-Michel Ané.
- Characterization of a novel plant protein that is required for the early steps of bacterial and fungal symbioses, **USDA Hatch Grant**, \$35,215, from 2005 to 2007. PI: Jean-Michel Ané.

## Honors and Awards Information

- 2009, Honored Instructors Award, University Housing, University of Wisconsin-Madison
- 1998, “Agrégation de Biochimie – Genie biologique”, French National Education, Competitive entry in the French National Education System for permanent teaching positions.
- 1993, ENS-Lyon Fellow, French National Education, Ecole Normale Supérieure de Lyon (ENS-Lyon)

## Professional Service

- Member of the American Society of Plant Biologists (ASPB), the International Society of Molecular Plant Microbes Interactions (IS-MPMI), the Wisconsin Soybean Association, the International Symbiosis Society (ISS) and the American Association for the Advancement of Science (AAAS).
- Member of the organizing committee for the 6<sup>th</sup> International Symbiosis Society (6-ISS) conference.
- Member of the UW Madison Symbiosis Cluster steering committee.
- Elected member of the International *Medicago truncatula* steering committee

- Panel member for the USDA-NRI Biology of Plant-Microbe Associations (2006), the NSF-GRFP (2007) Panel member for the USDA-NRI Biology of Plant-Microbe Associations (2006), the NSF-GRFP (2007) and the US Department of Energy (2009).
- Grant proposal reviewer for the NSF Plant Genome Research Project, the NSF-MCB Gene and Genome Systems, the University of Wisconsin Madison Graduate School, the Netherlands Organization for Scientific Research (Earth and Life Sciences section) and the California Department of Food and Agriculture.
- Associate Editor for *Frontier in Plant Sciences*.
- Article reviewer for *Proceedings of the National Academy of Sciences USA (PNAS)*, *Trends in Plant Sciences*, *Plant Cell*, *FEBS letters*, *Molecular Plant-Microbe Interactions (MPMI)*, *New Phytologist*, *Plant Physiology and Biochemistry*, *The Plant Journal*, *Plant Physiology*, *Plant Science*, *Plant and Soil*, *Plant Cell and Environment*, *BioMed Central Plant Biology*, *BioMed Central Biology*, *Symbiosis*, and *Wiley Editions*.
- Outreach activities for the Wisconsin Soybean Marketing Board, the Wisconsin Crop Improvement Association, the Family Horticulture day, the Science Expeditions, Darwin day and the Madison Children's Museum.

### **Teaching and Training**

- Teaching of a new course on Plant Biotechnology Principles and Techniques (AGRONOMY / HORTICULTURE / BOTANY 339) including both 3 hours laboratory sessions and lectures (2x75 minutes/week).
- Invited lectures / presentations on plant – microbe symbioses for BIOCHEMISTRY / BOTANY / GENETICS 840, MEDICAL MICROBIOLOGY & IMMUNOLOGY 677, BOTANY / HORTICULTURE / SOIL SCIENCES 626, PLANT PATHOLOGY 505, BIOLOGY 150 (Ways of Knowing Biology) and the Annual University of Wisconsin Conference on Interdisciplinarity.
- Graduate training: affiliation to the interdepartmental Plant Breeding and Plant Genetics (PBPG), the interdepartmental Cellular and Molecular Biology (CMB), the Microbiology Doctoral Training Program (MDTP), the Biotechnology Training Program (BTP), the Genetics Ph.D. training program and the Plant Pathology graduate programs for which he gives lectures on plant-microbe symbiotic associations.
- Member of the Microbiology Doctoral Training Program steering committee.
- Undergraduate training through Summer Research Programs (Symbiosis SRP and Plant Biology SRP) which offers training and research experience to undergraduate students of underrepresented groups. These students are generally coming from other universities. Training of UW Madison undergraduate students doing directed studies, honor thesis or affiliated to the Undergraduate Research Scholars (URS) program.

### **Other Affiliations**

#### Graduate and Postdoctoral Advisors

- Jean Dénarié and Charles Rosenberg (Graduate Advisors, INRA Toulouse, France)
- Douglas R. Cook (Postdoctoral Advisor, U. of California Davis).

#### Postdoctoral Advisees

4 current post-docs

- Muthusubramanian Venkateshwaran (April 2010 – present)
- Arijit Mukherjee (January 2008 – present)
- Dhileepkumar Jayaraman (May 2011 – present)

2 former post-docs

- Désirée Den Os (January 2008 – April 2010)

- Kannan Iyyemperumal (September 2005 – September 2006)

#### Thesis Advisees

2 current Ph.D. students and 1 current M.S. student:

- Audrey Wiley (Ph.D. expected in 2015) (Plant Pathology, UW Madison)
- Kari Forshey (Ph.D. expected in 2014) (Genetics, UW Madison)
- David Marburger (M.S. expected in 2013, co-advised with Dr. Shawn Conley) (Agronomy, UW Madison)

5 former Ph.D. students and 1 former M.S. student:

- Dhileepkumar Jayaraman (Ph.D. completed in May 2011) (Plant Breeding Plant Genetics, UW Madison)
- Li Huey Yeun (Ph.D. completed in May 2011) (Plant Breeding Plant Genetics, UW Madison)
- Branden Furseth (M.S. completed in January 2011, co-advised with Dr. Shawn Conley) (Agronomy, UW Madison)
- Muthusubramanian Venkateshwaran (Ph.D. completed in March 2010) (Plant Pathology, UW Madison)
- Géraldine Lougnon (Ph.D. completed in May 2007, University of Paris XI, France)
- Elsa Messinese (Ph.D. completed in May 2007, University of Toulouse, France)

**Language Skills:** English and French