Curriculum Vitae

Peter James Facchini, B.Sc., Ph.D.

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1. Education

Doctor of Philosophy	**University of Toronto**	1991
Bachelor of Science	**University of Toronto**	1986

2. Employment

Professor	**University of Calgary** Department of Biological Sciences	1995-present
Chief Scientific Officer	**Willow Biosciences, Inc.** Calgary, Alberta	2019-2020
Chief Scientific Officer	**Sertürner, Inc.** Calgary, Alberta	2016-2019
Chief Operational Officer	**Vindolon, Inc.** Calgary, Alberta	2015-2019
Chief Scientific Officer	**Epimeron, Inc.** Calgary, Alberta	2014-2019
Visiting Professor	**Université de Tours** Département de biologie végétale	2001
Postdoctoral Research Fellow	**Université de Montréal** Institut de recherche en biologie végétale	1992-1995
Postdoctoral Research Fellow	**University of Kentucky** Agronomy Department	1991-1992

3. Teaching (major courses)

Instructor 2008-present
BIOL 505 '*Medicinal Plant Biochemistry'*
- 30 students per year

Instructor 2002-present
PLBL 401 *'Plant Molecular Biology and Biotechnology'*
- 60 students per year

Instructor 1995-present
PLBL 403 (formerly BOTA 303) *'Plant Physiology'*
- 80 students per year

Instructor 1998-2007
BIOL 233 *'Introduction to Biology'*
- 750 students per year

Instructor 1998-2007
BOTA 503 *'Biochemistry of Plant Metabolism'*
- 12 students per year

4. Scholarship

4.1. Scholarships, Fellowships, and Awards

Innovate Calgary Achievement Award
2019
Awarded by Innovate Calgary in recognition of my contributions to Willow Biosciences, Inc.

Parex Resources Innovation Fellow
2019-2021
Awarded by the Faculty of Science in recognition of entrepreneurship and innovation

C.D. Nelson Award – Outstanding Young Researcher in Canada
2003
Awarded by the Canadian Society of Plant Physiologists

Celebration of Excellence Awards – University of Calgary
2002, 2003
In recognition of my Canada Research Chair and C.D. Nelson Award

Canada Research Chair in Plant Metabolic Processes Biotechnology
2002-2012

Undergraduate Students Union Teaching Excellence Award Nomination
1999
Nomination made by undergraduate students in my BOTA 303 lectures.

Graduate Students Association Teaching Excellence Award Nomination
1995
Nomination made by graduate students in the Botany Division.

Molson Breweries Young Investigator Award
1995
Received at the University of Calgary to assist with the establishment of my laboratory.

Arthur Neish Young Investigator Award – Phytochemical Society of North America
1995

Natural Sciences and Engineering Research Council of Canada Postdoctoral Fellowship,
1992-1994

Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship,
1989-1991

Wilton R. Earle Award and Student Travel Award
1988
Received for the best paper presented at the Tissue Culture Association Annual Meeting

4.2. Refereed Publications

154. Chen, R., Chen X., Hagel, J.M., **Facchini, P.J.** (2020) Virus-induced gene silencing to investigate alkaloid biosynthesis in opium poppy. In: *Virus-Inducd Gene Silencing in Plants: Methods and Protocols* (Courdavault, V. and Besseau, S., eds). Methods in Molecular Biology doi:10.1007/978-1-0716-0751-0_7
153. Li, Q., Ramasamy, S., Singh, P., Hagel, J.M., Dunemann, S., Chen, X., Chen, R., Yu, L., Tucker, J.E., **Facchini, P.J.**, Yeaman, S. (2020) Gene clustering and copy number variation in alkaloid metabolic pathways of opium poppy. Nature Communications 11, 1190
152. Menéndez-Perdomo, I.M., **Facchini, P.J.** (2020) Isolation and characterization of two *O*-methyltransferases involved in benzylisoquinoline alkaloid biosynthesis in sacred lotus (*Nelumbo nucifera*). Journal of Biological Chemistry 295, 1598-1612
151. Singh, A., Menéndez-Perdomo, I.M., **Facchini, P.J.** (2019) Benzyisoquinoline alkaloid biosynthesis in opium poppy - an update. Phytochemistry Reviews 18, 1457-1482
150. Morris, J.S., Yu, L., **Facchini, P.J.** (2019) A single residue determines substrate preference in benzylisoquinoline *N*-methyltransferases. Phytochemistry 170, 112193
149. Dastmalchi, M., Chang, L., Chen, R., Yu, L., Chen, X., Hagel, J.M., **Facchini, P.J.** (2019) Purine permease-type benzylisoquinoline alkaloid transporters in opium poppy. Plant Physiology 181, 916-933
148. Lang, D.E., Morris, J.E., Rowley, M., Torres, M.A., Maksimovich, V.A., **Facchini, P.J.**, Ng, K.K.S. (2019) Structure-function studies of tetrahydroprotoberberine *N*-methyltransferase reveal the molecular basis of stereoselective substrate recognition. Journal of Biological Chemistry 294, 14482-14498
147. Morris, J.S., **Facchini, P.J.** (2019) Molecular origins of functional diversity of benzylisoquinoline alkaloid methyltransferases. Frontiers in Plant Science doi:10.3389/fpls.2019.01058
146. Dastmalchi, M., Chen, X., Hagel, J.M., Chang, L., Chen, R., Ramasamy, S., Yeaman, S., and **Facchini, P.J.** (2018) Neopinone isomerase is involved in codeine and morphine biosynthesis in opium poppy. Nature Chemical Biology 15, 384-390.
145. Menendez-Perdomo, I. and **Facchini, P.J.** (2018) Benzylisoquinoline alkaloids in sacred lotus (*Nelumbo nucifera*). Molecules **23**, 2899.
144. Hagel, J.M., Chen, X., and **Facchini, P.J.** (2018) Production of methylparaben in *Escherichia coli*. Journal of Industrial Microbiology and Biotechnology **46**, 91-99.
143. Morris, J.S., Groves, R.A., Hagel, J.M., and Facchini, P.J. (2018) An *N*-methyltransferase from *Ephedra sinica* catalyzing the formation of ephedrine and pseudoephedrine enables microbial phenylalkylamine production. Journal of Biological Chemistry **293**, 13364 –13376.
142. Dastmalchi, M., Chang, L., Torres, M., Ng, K.K.S., and **Facchini, P.J.** (2018) Codeinone reductase isoforms with differential stability, efficiency and product selectivity in opium poppy. Plant Journal **95**, 631-647.
141. Park, M.R., Chen, X., Lang, D.E., Ng, K.K.S., and **Facchini, P.J.** (2018) Heterodimeric *O*-methyltransferases involved in the biosynthesis of noscapine in opium poppy. Plant Journal **95**, 252-267.
140. Chen, X., Hagel, J.M., Chang, L., Tucker, J.E., Shiigi, S.A., Yelpaala, Y., Chen, H.-Y., Estrada, R., Colbeck, J., Enquist-Newman, M., Ibáñez, A.B., Cottarel, G., Vidanes, G.M., and **Facchini, P. J.** (2018) A patheogenesis-related 10 protein catalyzes the final step in thebaine biosynthesis. Nature Chemical Biology **14**, 738-743.
139. Hagel, J.M. and **Facchini, P.J.** (2018) Expanding the roles for 2-oxoglutarate-dependent oxygenases in plant metabolism. Natural Products Reports doi: 10.1039/c7np00060j.
138. Dastmalchi, M., Park, M.R., Morris, J.S., and **Facchini, P.J.** (2017) Family portraits – The enzymes behind benzylisoquinoline alkaloid diversity. Phytochemistry Reviews **17**, 249-277.

137. Hagel, J.M. and **Facchini, P.J.** (2017) Tying the knot - Occurrence and possible significance of gene fusions in plant metabolism and beyond. Journal of Experimental Botany **68**, 4029-4043.
136. Li, J., Lee, E.-J., Chang, L., **Facchini, P.J.** (2016) Genes encoding norcoclaurine synthase occur as tandem fusions in the Papaveraceae. Scientific Reports **6,** 39256.
135. Dastmalchi, M. and **Facchini, P.J.** (2016) Plant metabolons assembled on demand. Science **354**, 829-830.
134. Morris, J.S., and **Facchini, P.J.** (2016) Isolation and characterization of reticuline *N*-methyltransferase involved in biosynthesis of the aporphine alkaloid magnoflorine in opium poppy. Journal of Biological Chemistry **291,** 23416-23427.
133. Torres, M.A., Hoffarth, E., Eugenio, L., Savtchouk, J., Chen, X., Morris, J.S., **Facchini, P.J.** and Ng, K.K.S. (2016) Structural and functional studies of pavine *N*-methyltransferase from *Thalictrum flavum* reveal novel insights into substrate recognition and catalytic mechanism. Journal of Biological Chemistry **291,** 23403-23415.
132. Morris, J.S., Dastmalchi, M., Li, J., Chang, L., Chen, X., Hagel, J.M, and **Facchini, P.J.** (2016) Plug-and-play benzylisoquinoline alkaloid biosynthetic gene discovery in engineered yeast. Methods in Enzymology **575,** 143-178.
131. Kilpatrick, K., Agnieszka, P., Hagel, J.M., Sumarah, M., Lewinsohn, E., **Facchini, P.J.** and Marsolais, F. (2016) Characterization of aromatic aminotransferases from *Ephedra sinica* Stapf. Amino Acids **48,** 1209-1220.
130. Hagel, J., Lee, E.-J., Desgagné-Penix, I., Morris, J., Bross, C., Chang, L., Chen, X., Farrow, S.C., Zhang, Y., Sensen, C.W., and **Facchini, P.J.** (2015) Transcriptome analysis of 20 taxonomically related benzylisoquinoline alkaloid-producing plants. BMC Plant Biology **15**, 227.
129. Hagel, J.M., Morris, J.S., Mandal, R., Han, B., Han, J., Dinsmore, D., Borchers, C.H., Wishert, D.S., and **Facchini, P.J.** (2015) Metabolomics analysis of 20 taxonomically related benzylisoquinoline alkaloid-producing plants. BMC Plant Biology **15**, 220.
128. Chang, L., Hagel, J.M., and **Facchini, P.J.** (2015) Isolation and characterization of *O*-methyltransferases involved in the biosynthesis of glaucine in *Glaucium flavum*. Plant Physiology **169**, 1127-1140.
127. Farrow, S.C. and **Facchini, P.J.** (2015) Papaverine 7-*O*-demethylase, a novel 2-oxoglutarate/ Fe^{2+}-dependent dioxygenase from opium poppy. FEBS Letters **589**, 2701-2706
126. Farrow, S.C., Hagel, J.M., Beaudoin, G.A.W., Burns, D.C. and Facchini, P.J. (2015) Stereochemical inversion of (*S*)-reticuline by a cytochrome P450 fusion in opium poppy. Nature Chemical Biology **11**, 728-732.
125. Groves, R., Hagel, J.M., Zhang, Y., Kilpatrick, K., Levi, A., Marsolais, F., Lewinsohn, E., Sensen, C.W., and **Facchini, P.J.** (2015) Transcriptome profiling of khat (*Catha edulis*) and *Ephedra sinica* reveals gene candidates putatively involved in amphetamine-type alkaloid biosynthesis. PLOS ONE doi: 10.1371/journal.pone.0119701
124. Chen, X., Dang, T.T.T., and **Facchini, P.J.** (2015) Noscapine comes of age. Phytochemistry **111,** 7-13.
123. Dang, T.T.T., Chen, X., and **Facchini, P.J.** (2015) Acetylation serves as a protective group in noscapine biosynthesis in opium poppy. Nature Chemical Biology **11,** 104-106.
122. Farrow, S.C. and **Facchini, P.J.** (2014) Functional diversity of 2-oxoglutarate/Fe(II)-dependent dioxygenases in plant metabolism. Frontiers in Plant Science **5**, 524.
121. Beaudoin, G.A.W. and **Facchini, P.J.** (2014) Alkaloid biosynthesis in opium poppy. Planta **240**, 19-32.
120. Fossati, E., Ekins, A., Narcross, L., Zhu, Y., Falgueyret, J.-P., Beaudoin, G., **Facchini, P.J.,** and Martin, V.J.J. (2014) Reconstitution of the plant benzylisoquinoline alkaloid dihydrosanguinarine pathway in *Saccharomyces cerevisiae*. Nature Communications **5,** 3283.
119. Dang. T.T.T. and **Facchini, P.J.** (2014) Characterization of *N*-methylcanadine 1-hydroxylase, a cytochrome P450 catalyzing the first committed step of noscapine biosynthesis in opium poppy. Journal of Biological Chemistry **289**, 2013-2026.

118. Dang, T.T.T. and **Facchini, P.J.** (2014) Characterization of canadine synthase, a cytochrome P450 involved in noscapine biosynthesis, from opium poppy. FEBS Letters **588**, 198-204.
117. Chen, X. and **Facchini, P.J.** (2014) Short-chain dehydrogenase/reductase catalyzing the final step of noscapine biosynthesis is localized to laticifers in opium poppy. Plant Journal **77**, 173-184.
116. Onoyovwe, A., Hagel, J.M., Chen, X., Khan, M.F., Schriemer, D., and **Facchini, P.J.** (2013) Morphine biosynthesis in opium poppy involves two cell types, sieve elements and laticifers. Plant Cell **25,** 4110-4122.
115. Farrow, S.C. and **Facchini, P.J.** (2013) Dioxygenases catalyze *O*-demethylation and *O,O*-demethylenation with widespread roles in protopine and protoberberine alkaloid metabolism in opium poppy. Journal of Biological Chemistry **288**, 28997-29012.
114. Lee, E.-J., Hagel, J., and **Facchini, P.J.** (2013) Role of the phloem in the biochemistry and ecophysiology of benzylisoquinoline alkaloid metabolism. Frontiers in Plant Physiology **4**, 182.
113. Xiao, M., Zhang, Y., Lee, E.-J., Chen, X., Barber, C.J.S., Chakrabarty, R., Desgagné-Penix, I., Haslam, T.M., Kim, Y.-B., Liu, E., Masada-Atsumi, S., MacNevin, G., Reed, D.W., Stout, J.M., Zerbe, P., Zhang, Y., Bohlmann, J., Covello, P.S., De Luca, V., Page, J.E., Ro, D.-K., Martin, V.J.J., **Facchini, P.F.**, and Sensen, C.W. (2013) Transcriptome analysis based on next-generation sequencing of non-model plants producing specialized metabolites of biotechnological interest. Journal of Biotechnology **166**, 122-134.
112. Hagel, J.M. and **Facchini, P.J.** (2013) Benzylisoquinoline alkaloid metabolism: a century of discovery and a brave new world. Plant Cell Physiology **54,** 647-672.
111. Beaudoin, G.A.W. and **Facchini, P.J.** (2013) Isolation and characterization of a cDNA encoding (*S*)-*cis*-*N*-methylstylopine 14-hydroxylase from opium poppy, a key enzyme in sanguinarine biosynthesis. Biochemical and Biophysical Research Communications **431**, 597-603.
110. Hagel, J.M., Beaudoin, G., Fossati E., Ekins, A., Martin, V.J.J., and **Facchini, P.J.** (2012) Characterization of a flavoprotein oxidase from opium poppy catalyzing the final steps in sanguinarine and papaverine biosynthesis. Journal of Biological Chemistry **287**, 42972-42983.
109. Desgagné-Penix, I. and **Facchini, P.J.** (2012) Systematic silencing of benzylisoquinoline alkaloid biosynthetic genes reveals the major route to papaverine in opium poppy. Plant Journal **72,** 331-344.
108. Krizevski, R., Bar, E., Shalit, O., Levi, A., Hagel, J.M., Kilpatrick, K., Marsolais, F., **Facchini, P.J.**, Ben-Shabat, S., Sitrit, Y., and Lewinsohn, E. (2012) Benzaldehyde is a precursor of phenylpropylamino alkaloids as revealed by targeted metabolic profiling and comparative biochemical analyses of *Ephedra* spp. Phytochemistry **81,** 71-79.
107. Dang, T.T.T., Onoyovwe, A., Farrow, S.C., and **Facchini, P.J.** (2012) Biochemical genomics for gene discovery in benzylisoquinoline alkaloid biosynthesis in opium poppy and related species. Methods in Enzymology 515, 231-266.
106. Hagel, J.M., Krizevski, R., Marsolais, F., Lewinsohn, E., and **Facchini, P.J.** (2012) Biosynthesis of amphetamine analogues in plants. Trends in Plant Science **17,** 404-412.
105. Hagel, J.M., Onoyovwi, A., Yeung, E.C., and **Facchini, P.J.** (2012) Interplay between phloem cell types in the production and deployment of plant defense responses. In: *Phloem: Molecular Cell Biology, Systemic Communication, Biotic Interactions* (Thompson, G. and van Bel, A., eds.), John Wiley and Sons, Ames, Iowa, ISBN 978-0-470-95860-5, pp. 251-270.
104. Dang, T.T.T. and **Facchini, P.J.** (2012) Characterization of three *O*-methyltransferases involved in noscapine biosynthesis in opium poppy. Plant Physiology **159,** 618-631.
103. Desgagné-Penix, I., Farrow, S.C., Cram, D., Nowak, J., and **Facchini, P.J.** (2012) Integration of deep transcript and targeted metabolite profiles for eight cultivars of opium poppy. Plant Molecular Biology **79**, 295-313.
102. Farrow, S.C., Hagel, J.M. and **Facchini, P.J.** (2012) Transcript and metabolite profiling in cell cultures of 18 plant species that produce benzylisoquinoline alkaloids. Phytochemistry **77,** 79-88.
101. Hagel, J.M. and **Facchini, P.J.** (2012) Subcellular localization of sanguinarine biosynthetic enzymes in cultured opium poppy cells. In Vitro Cellular and Developmental Biology – Plant **48**, 233-240.
100. Wijekoon, C. and **Facchini, P.J.** (2012**)** Systematic knockdown of morphine biosynthesis in opium poppy using virus-induced gene silencinng. Plant Journal **69,** 1052–1063.

99. **Facchini, P.J.,** Bohlmann, J., Ro, D.K., Page, J.E., Covello, P.S., De Luca, V., Mahadevan, K., Sensen, C.W., Storms, R., and Martin, V.J.J. (2012) Synthetic biosystems for the production of high-value plant metabolites. Trends in Biotechnology **30,** 127-131.
98. Lee, E.-J. and **Facchini, P.J.** (2011) Tyrosine aminotransferase contributes to benzylisoquinoline alkaloid biosynethsis in opium poppy. Plant Physiology **157,** 1067–1078.
97. Hagel, J.M., Krizevski, R., Kilpatrick, K., Sitrit, Y., Marsolais, F., Lewinsohn, E., and **Facchini, P.J.** (2011) Expressed sequence tag analysis of khat (*Catha edulis*) provides a putative molecular biochemical basis for the biosynthesis of phenylpropylamino alkaloids. Genetics and Molecular Biology **34,** 640-646.
96. Desgagne-Penix I. and **Facchini, P.J.** (2010) Benzylisoquinoline alkaloids. In *Plant Metabolism and Biotechnology*, (Crozier, A., Ashihara, H., Komamine, A., eds), John Wiley and Sons, New York, pp. 233-253.
95. Lee, E.-J. and **Facchini, P.J.** (2010) Norcoclaurine synthase, a novel enzyme catalyzing the first step in benzylisoquinoline alkaloid biosynthesis, is a member of the PR10 protein family. Plant Cell **22**, 3489-3503.
94. Desgagne-Penix, I., Khan, M.F., Sharpe, A., Cram, D., Nowak, J., Schreimer D., and **Facchini, P.J.** (2010) Integration of deep transcriptome and proteome analyses reveals the components of alkaloid metabolism in opium poppy cell cultures. BMC Plant Biology **10**, 252.
93. Hagel, J.M. and **Facchini, P.J.** (2010) Biochemistry and occurrence of *O*-demethylation in plant metabolism. Frontiers in Plant Physiology **1**, 14.
92. Hagel, J.M. and **Facchini, P.J.** (2010) Dioxygenases catalyze the *O*-demthylation steps of morphine biosynthesis in opium poppy. Nature Chemical Biology **6,** 273-275.
91. Desgagne–Penix, I., Hagel, J.M. and **Facchini, P.J.** (2009) Mutagenesis as a functional genomics platform for pharmaceutical alkaloid biosynthetic gene discovery in opium poppy. In: *Induced Plant Mutations in the Genomics Era (*Shu, Q.Y., ed.). Food and Agriculture Organization of the United Nations, Rome, pp. 411-418.
90. Liscombe, D.K., Ziegler, J., Schmidt, J., Ammer, C., and **Facchini, P.J.** (2009) Isolation of novel *N*-methyltransferases from three benzylisoquinoline alkaloid-producing species by targeted metabolite and transcript profiling. Plant Journal **60**, 729–743.
89. Ziegler, J., **Facchini, P.J.**, Geißler, R., Schmidt, J., Ammer, C., Kramell, R., Voigtländer, S., Gesell, A., Pienkny, S., and Brandt, W. (2009) Evolution of morphine biosynthesis in opium poppy. Phytochemistry **70**, 1696-1707.
88. Ziegler, J., Brandt, W., Geißler, R., and **Facchini, P.J.** (2009) Removal of substrate inhibition and increase in maximal velocity in the short chain dehydrogenase/reductase salutaridine reductase involved in morphine biosynthesis. Journal of Biological Chemistry **284**, 26758–26767.
87. Lee, E.-J., Shaykhutdinov, R., Park, S.-U., Kim, Y.-K., Yang, T.-J., Vogel, H.J., and **Facchini, P.J.** (2009) Quality assessment of ginseng by ^{1}H NMR metabolite fingerprint and profile analyses. Journal of Food and Agricultural Chemistry **57**, 7513-7522.
86. Zulak, K.G., Khan, M.F., Alcantara, J., Schreimer D., and **Facchini, P.J.** (2009) Defense response in opium poppy cell cultures revealed by LC-MS/MS proteomics. Molecular and Cellular Proteomics **8**, 86-98.
85. Jain A., Ziegler, J., Liscombe, D.K., **Facchini, P.J.,** Tucker, P.A. and Panjikar S. (2008) Purification, crystallization and preliminary X-ray diffraction analysis of pavine *N*-methyltransferase from *Thalictrum flavum.* Acta Crystallographica Section F: Structural Biology and Crystallization **F64**, 1066-1069.
84. Hagel, J.M., Yeung, E.C., and **Facchini, P.J.** (2008) Got milk? - The secret life of laticifers. Trends in Plant Sciences **13**, 631-639.
83. Hagel, J.M., Weljie, A., Vogel, H.J., and **Facchini, P.J.** (2008) Quantitative ^{1}H-NMR metabolomics as a biochemical genomics platform to study alkaloid biosynthesis in opium poppy. Plant Physiology **147**, 1805-1821.
82. Hagel, J. and **Facchini, P.J.** (2008) Plant metabolomics: Analytical platforms and integration with functional genomics. Phytochemistry Reviews **7**, 479-497.

81. **Facchini, P.J.** and De Luca, V. (2008) Opium poppy and Madagascar periwinkle as model non-model sytems to investigate alkaloid biosynthesis in plants. Plant Journal **54**, 763-784.
80. Liscombe, D.K. and **Facchini, P.J.** (2008) Evolutionary and cellular webs in benzylisoquinoline alkaloid biosynthesis. Current Opinion in Biotechnology **19**, 173-180.
79. Zulak, K.G., Weljie, A., Vogel, H.J., and **Facchini, P.J.** (2008) Quantitative ^{1}H-NMR metabolomics reveals extensive reprogramming of primary and secondary metabolism in elicitor-treated opium poppy cell cultures. BMC Plant Biology **8**, 5.
78. **Facchini, P.J.**, Loukanina, N., and Blanche, V. (2008) Genetic transformation via somatic embryogenesis to establish herbicide-resistant opium poppy. Plant Cell Reports **27,** 719-727.
77. Ziegler, J. and **Facchini, P.J.** (2008) Alkaloid biosynthesis: metabolism and trafficking. Annual Review of Plant Biology **59**, 735-769.
76. Berkner, H., Engelhorn, J., Liscombe, D.K., Schweimer K., Wöhrl, B.M., **Facchini, P.J.**, Rösch P., and Matecko, I. (2007) Spectroscopic analysis and molecular modeling suggest norcoclaurine synthase is a true member of the PR10-protein family. Protein Expression and Purification **56**, 197-204.
75. Luk, L.Y.P., Bunn, S., Liscombe, D.K., **Facchini, P.J.**, and Tanner, M. (2007) Mechanistic studies on norcoclaurine synthase of benzylisoquinoline alkaloid biosynthesis: an enzymatic Pictet-Spengler reaction. Biochemistry **46**, 10153-10161.
74. Hagel, J., MacLeod, B.P., and **Facchini, P.J.** (2007) *Opium poppy.* In: *Biotechnology in Agriculture and Forestry: Tropical Crops II.* E.C. Pua and M.R. Davey (eds.), Springer-Verlag, Heidelberg, Germany, pp. 169-187.
73. Liscombe, D.K. and **Facchini, P.J.** (2007) Molecular cloning and characterization of tetrahydroprotoberberine *cis*-*N*-methyltransferase, an enzyme involved in alkaloid biosynthesis in opium poppy. Journal of Biological Chemistry **282**, 14741-14751.
72. Zulak, K.G., Cornish, A., Daskalchuk, T., Deyholos, M., Goodenowe, D., Gordon, P., Klassen, D., Pelcher, L., Sensen, C., and **Facchini, P.J.** (2007) Gene transcript and metabolite profiling of elicitor-induced opium poppy cell cultures reveals the coordinate regulation of primary and secondary metabolism. Planta **225**, 1085-1106.
71. **Facchini, P.J.**, Hagel, J.M., Liscombe, D.K., Loukanina, N., MacLeod, B.P., Samanani, N., and Zulak, K.G. (2007) Opium poppy: blueprint for an alkaloid factory. Phytochemistry Reviews **6**: 97-124.
70. Hagel, J.M., Page, J.E., and **Facchini, P.J.** (2007) Impact of whole genome and expressed sequence tag databases on the study of plant secondary metabolism. In: *Medicinal Plant Biotechnology*. O Kayser and WJ. Quax (eds.), Wiley-VCH Verlag, Weinheim, Germany, pp. 203-236.
69. Samanani, N., Alcantara, J., Bourgault, R., Zulak, K.G., and **Facchini, P.J.** (2006) Role of sieve elements and laticifers in the biosynthesis and accumulation of alkaloids in opium poppy. Plant Journal **47**, 547-564.
68. Samanani, N. and **Facchini, P.J.** (2006) Cellular and subcellular aspects of alkaloid biosynthesis in plants. In: *Recent Advances in Phytochemistry, Volume 40*. J.T. Romeo (ed.), Elsevier Academic Press, Amsterdam, The Netherlands, pp. 53-83.
67. **Facchini, P.J.** (2006) Regulation of alkaloid biosynthesis in plants. In: *The Alkaloids*. G.A. Cordell (ed.), Elsevier Academic Press, Amsterdam, The Netherlands, pp. 1-45.
66. Zulak, K.G., Liscombe, D.K., Ashihara, H., and **Facchini, P.J.** (2006) Alkaloids. In: *Plant Secondary Metabolism in Diet and Human Health*. A. Crozier, M. Clifford, H. Ashihara (eds.), Blackwell Publishing, Oxford, U.K., pp. 102-136.
65. Warner, H., **Facchini, P.J.**, Hagel, J., De Ruyver B., van Puyenbroeck, L., Aziz Ali Ahmad, A., Babury, O., Ali Cheragh, C., Yasin Mohsini, M., Canas, V., Aureliano, N., Patel, S., Fischer, B., Culbert, T., Rehm, J., Bos, J., Pegge, S., Wardak, A., Archer, G., Arjona, J., Bryant, L., Das Gupta, M., Elmirzaev, F., Fournier, G., Francis, J., Ionnidou, T., Jensema, E., Kamio Badiella, M., Kamminga, J., Pothier, F., Reinert E., Spivack, D., Werb, D. (2005) Feasibility study on opium licensing in Afghanistan for the production of morphine and other essential medicines: The Senlis Council Drug Policy Advisory Forum, MF Publishing, London, ISBN 0-9550798-2-9.

64. MacLeod, B.P. and **Facchini, P.J.** (2005) Methods for regeneration and transformation in *Eschscholzia californica* – a model plant to investigate alkaloid biosynthesis. In: *Plant Cell Culture Protocols, Second Edition*. V.M. Loyola-Vargas and F. Vasquez-Flota (eds.), Humana Press, Totowa, NJ, USA, pp. 361-372.
63. Bourgault, R., Zulak, K., and **Facchini, P.J.** (2005) Applications of genomics in plant biology. In: *Handbook of Genome Research*, C. Sensen (ed.), Wiley-VCH Verlag, Weinheim, Germany, pp 59-80.
62. **Facchini, P.J.**, Bird, D.A., Bourgault, R., Hagel, J.M., Liscombe, D.K., MacLeod, B.P., and Zulak, K.G. (2005) Opium poppy: a model system to investigate alkaloid biosynthesis in plants. Canadian Journal of Botany **83**, 1189-1206.
61. **Facchini, P.J.** and St-Pierre, B. (2005) Synthesis and trafficking of alkaloid biosynthetic enzymes. Current Opinion in Plant Biology **8**, 657-666.
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53. **Facchini, P.J.** and Park, S.-U. (2003) Developmental and inducible expression of gene transcripts nvolved in alkaloid biosynthesis in opium poppy. Phytochemistry **64**, 177-186.
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10. **Facchini, P.J.** and DiCosmo, F. (1990) Immobilization of cultured *Catharanthus roseus* cells using a fibreglass substratum. Applied Microbiology and Biotechnology **33**, 36-42.
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8. DiCosmo, F., **Facchini, P.J.**, and Neumann, A.W. (1990) Plant cell adhesion to polymer surfaces as predicted by a thermodynamic model and modified by electrostatic interaction. Colloids and Surfaces **42**, 255-269.
7. **Facchini, P.J.**, DiCosmo, F., Radvanyi, L.G., and Neumann, A.W. (1990) Immobilization of cells by spontaneous adhesion. In: J.W. Pollard and J.M. Walker (eds), *Methods in Molecular Biology, Vol. 6, Plant Cell and Tissue Culture*, Humana Press, Clifton, New Jersey, pp 513-523.

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3. **Facchini, P.J.,** Neumann, A.W., and DiCosmo, F. (1988) Thermodynamic aspects of plant cell adhesion to polymer surfaces. Applied Microbiology and Biotechnology **29**, 346-355.
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4.4. Patents

23. **Facchini, P.J.** (2019) Compositions and methods for making alkaloid morphinans (16/657,183).
22. **Facchini, P.J.** and Hagel, J.M., (2019) ABC-transport proteins and methods of use in the production of secondary metabolites (62/807,829).
21. **Facchini, P.J.** and Hagel, J.M. (2018) Chalcone isomerase-fold proteins and methods of use in the production of cannabinoids (62/945,914).
20. **Facchini, P.J.**, Hagel, J.M., and Yu, D. (2018) Multi antibacterial extrusion proteins and methods of use in making alkaloids (62/965,385).
19. **Facchini, P.J.**, Hagel, J.M., and Yu, D. (2018) Methods of making cells for modulated biosynthetic production of benzylisoquinoline compounds (62/838,970).
18. **Facchini, P.J.** and Hagel, J.M. (2018) Alkaloid biosynthesis facilitating proteins and methods of use (WO2019165551A1).
17. **Facchini, P.J.,** Farrow, S.C., and Beaudoin, G.A.W. (2018) Compositions and methods for making (*R*)-reticuline (16/213,037).
16. **Facchini, P.J.** (2018) Improved methods for making and using polynucleotide sequences in the synthesis of alkaloid compounds (16,657,183).
15. **Facchini, P.J.** (2018) Compositions and methods for making (*S*)-norcoclaurine and (*S*)-norlaudanosoline, and synthesis intermediates thereof (16/122,050).
14. **Facchini, P.J.,** Hagel, J.M. and Chang, L. (2017) Purine permeases and methods of using (WO2019113710A1).
13. **Facchini, P.J.** and Chen, X. (2017) Neopinone isomerase and methods of using (WO2019109170A1).
12. **Facchini, P.J.**, Hagel, J.M, and Morris, J.S. (2017) *N*-Alkylation of alkaloid compounds (16/635,224).
11. **Facchini, P.J.** and Chen, X. (2016) Compositions and methods for making benzylisoquinoline alkaloid compounds, morphinan alkaloids, thebaine and derivatives thereof (WO2018005553A1).
10. **Facchini, P.J.** and Tucker, J.E. (2016) Polynucleotides and polypeptides useful for making alkaloid compounds (WO2018000089A1).
9. **Facchini, P.J.** and Hagel, J.M. (2016) Methods and compositions for making ephedrine and related alkaloid compounds (WO2016205939A1).
8. **Facchini, P.J.** (2014) Compositions and methods for making alkaloid morphinans (US10,227,353B2).
7. **Facchini, P.J.** (2014) Compositions and methods for making (*S*)-norcoclaurine and (*S*)-norlaudanosoline, and synthesis intermediates thereof (US10,119,155B2).
6. **Facchini, P.J.** (2014) Improved methods for making and using polynucleotide sequences in the synthesis of alkaloid compounds (US10,487,345B2).
5. **Facchini, P.J.,** Farrow, S.C., and Beaudoin, G.A.W. (2013) Compositions and methods for making

(*R*)-reticuline (US10,190,141B2).

4. **Facchini, P.J.**, Dang, T.T.T., and Chen, X. (2013) Compositions and methods for making noscapine and synthesis intermediates thereof (WO2015021561A1).
3. **Facchini, P.J.,** Hagel, J.M., Martin, V., Ekins, A., Fossati, E., Lauzon, J.F., and Farrow, S.C. (2010) Thebaine 6-*O*-demethylase and codeine *O*-demethylase from *Papaver somniferum* (UNTI.P0096WO).
2. **Facchini, P.J.** (2001) Glutathione-*S*-transferase nucleic acids and polypeptides, and methods of use thereof. (WO/2001/053501).
1. DiCosmo, F., **Facchini, P.J.**, Neumann, A.W., and Zingg, W. (1991) A method of immobilizing cells onto a solid support (WO9114774A1).

5. Service

5.1. University Service

Greenhouse Committee Chair Department of Biological Sciences, University of Calgary	2012 - 2014
Graduate Policy and Admissions Committee Department of Biological Sciences, University of Calgary	2011 - 2014
Director, Plant Growth Facilities Department of Biological Sciences, University of Calgary	2007 - 2008
Departmental Facilities Committee Department of Biological Sciences, University of Calgary	2006 - 2007
Scholarship Review Committee Department of Biological Sciences, University of Calgary	2002 - 2003
Curriculum Redesign Committee Department of Biological Sciences, University of Calgary	2000 - 2001
Chair, Division of Botany Department of Biological Sciences, University of Calgary	1996 - 2000
Head's Advisory Committee Member Department of Biological Sciences, University of Calgary	1996 - 2000
Faculty Liason Officer Biology Undergraduate Students Association, University of Calgary	1996 - 1998
Selection Committee Member Department of Biological Sciences, University of Calgary	1997, 2005, 2007, 2008
Highly Qualified Personnel – Supervisor University of Calgary (**bold** are current)	1995 - present

	Siyu Liang PDF 2019-present Current	**Jacinta Watkins** PDF 2019-present Current
Jeremy Morris Res. Assoc. 2019-present Current	**Kristian Caldo** Res. Assoc. 2019-present Current	**Natali Ozber** PDF 2019-present Current
Moiz Kapasi M.Sc. 2019-present Current	Aparna Singh PDF 2018-2019 Private sector	Mehran Dastmalchi Res. Assoc. 2017-present PDF, Brock University

Sukanya Ramasamy
PDF
2015 - 2017
Private sector

Mehran Dastmalchi
PDF
2015 - 2017
Epimeron Inc.

Jeremy Morris
Ph.D.
2013 - 2019
Res. Assoc., Univ. Calgary

Limei Chang
Res. Assoc.
2012 - 2019
Scientist, Willow Biosciences

Crystal Bross
M.Sc.
2011 - 2014
Private Sector

Andrew Stopford
PDF
2010
Private sector

Jill Hagel
Res. Assoc.
2010 - 2019
VP, Willow Biosciences

Thuy Tuy Dang
Ph.D.
2009 - 2014
Professor, UBC

Joerg Ziegler
PDF
2006 - 2009
Res. Assoc., Germany

Nailish Samanani
PDF
2005 - 2006
Private sector, Calgary

David Liscombe
Ph.D.
2003 - 2008
Res. Assoc., Vineland Res. Ctr.

Sang-Un Park
PDF
2002 - 2004
Professor, Chungnam Natl. Univ.

Jill Hagel
M.Sc.
2001 - 2004

Lisa Yu
Res. Assoc.
2016 - 2019
Scientist, Willow Biosciences

Myung Park
PDF
2016 – 2017
Deceased

Jing Li
PDF
2013 - 2015
Instructor, Mount Royal University

Xue Chen
Res. Assoc.
2012 - 2019
Scientist, Willow Biosciences

Donald Dinsmore
M.Sc.
2011 – 2014
Private Sector

Diana Le
Technician
2010 - 2011
Optometry School, Univ. Waterloo

Guillaume Beaudoin
M.Sc.
2010 – 2014
Gingko BioWorks, USA

Champa Wijekoon
Ph.D.
2008 - 2012
PDF, AAFC Lethbridge

Shoabo Wu
PDF
2010
Private sector

Natalia Loukanina
PDF
2004 - 2006
Prairie Plant Systems, Inc.

Richard Bourgault
PDF
2004 - 2005
PDF, Nara Inst. of Technol.

Benjamin McLeod
M.Sc.
2002 - 2006
Research Asst., Univ. Calgary

Katherine Zulak
Ph.D.
2001 - 2007

Rongji Chen
Res. Assoc.
2016 - 2019
Scientist, Willow Biosciences

Ivette Menendez
PhD
2016 - present
Current

Perpetua Uzuegbu
M.Sc. (co-supervised)
2011-2014
Private Sector

Ryan Groves
M.Sc.
2012 - 2015
Private Sector

Eun-Jeong Lee
Res. Assoc.
2008 - 2013
Private Sector

A.K. Onoyovwi
M.Sc.
2010 – 2012
Technician, Univ. Calgary

Scott Farrow
Ph.D.
2010 - 2015
PDF, John Innes Centre, UK

Isabel Desgagne-Penix
PDF
2008 - 2012
Professor, UQTR

Jill Hagel
Ph.D.
2006 – 2009
Res. Assoc., Univ. Calgary

Katy Nour
Technician
2003 - 2004
Private sector, USA

Joenel Alcantara
PDF
2003 – 2005
Res. Assoc., Univ. Calgary

Tim Daskalchuk
PDF
2002 - 2003
Ag Canada, Saskatoon

Nailish Samanani
Ph.D.
1998 - 2004

Ph.D., Univ. Calgary	Res. Assoc., Univ. Western Australia	Private sector, Calgary
David Bird Ph.D. 1997 – 2003 Professor, Mount Royal Univ.	Sang-Un Park Ph.D. 1997 – 2002 Professor, Chungnam Natl. Univ.	Alison Johnson M.Sc. 1996 – 1997 Unknown
Yinping Shang Technician 1999 – 2000 Research Asst., Univ. Calgary	Min Yu Technician 1997 – 1999 Ag Canada, Saskatoon	Catherine Penzes Technician 1995 – 1997 Private sector, USA

5.2. Professional Service

5.2.1. Grant Selection Committees

Evaluation Group Member	Natural Sciences and Engineering Research Council of Canada – Discovery Grant Competition (1501 – Genes, Cells and Molecules)	2012 – 2015

5.2.2. Executive Committee Memberships

Conference Chair & Organizer	4th Banff Conference on Plant Metabolism	2014
Conference Organizer	3rd Banff Conference on Plant Metabolism	2012
Conference Organizer	2nd Banff Conference on Plant Metabolism	2010
Conference Chair & Organizer	1st Banff Conference on Plant Metabolism	2008
Awards Selection Committee	Canadian Society of Plant Physiologists	2005 – 2008
Organizational Committee	Natural Product Genomics Initiative (NAPGEN)	2005 – 2010
Program Development Alberta Committee Member	Network for Proteomics Innovation (ANPI)	2002 – 2008
Newsletter Editor	Phytochemical Society of North America	2000 – 2005
Secretary	Phytochemical Society of North America	2000 – 2005
Conference Chair	Canadian Society of Plant Physiologists 2002 Annual Meeting	2002

5.2.3. Editorial Board Member of Scientific Journals

Associate Editor	Frontiers in Metabolism and Chemodiversity	2011 - 2017
Editorial Board	Plant Signaling and Behavior	2010 - 2015
Associate Editor	Frontiers in Plant Physiology	2010 - 2011
Associate Editor	Botany	2001 - 2014
Associate Editor	In Vitro Cellular and Developmental Biology: Plant	1997 - 2003

5.2.4. Ad Hoc Reviewer for Scientific Papers

Nature Communications; Plant Cell; Plant Journal; Plant Cell Reports; Plant Molecular Biology; Trends in Plant Sciences; Plant Physiology; Canadian Journal of Botany; Archives of Biochemistry and Biophysics; Phytochemistry; Plant Physiology and Biochemistry; Plant Cell Tissue and Organ Culture; Plant Tissue Culture and Biotechnology; In Vitro Cellular and Developmental Biology - Plant; Plant Tissue Culture and Biotechnology; FEMS Letters; Physiological and Molecular Plant Pathology; Biotechnology and Bioengineering; Applied Microbiology and Biotechnology; European Journal of Biochemistry; Planta; more — 1989 - present

5.2.5. Ad Hoc Reviewer for Research Grant Applications

Danish Agency for Science	2009
Canada Research Chairs Program	2004-2009
Natural Sciences and Engineering Research Council of Canada	1996-2009

Binational Agricultural Research and Development, USA	1995-2009
Israeli Ministry of Agriculture Fund for Biotechnology	2000
United States Department of Energy, Energy Biosciences Program	2000
United States National Science Foundation	2001-2009
United States Department of Agriculture	2002-2005

5.2.6. Invited Seminars

110. *Milk of the poppy: More than meets the eye*. **University of California – Riverside**, Riverside, CA, January 17, 2020.
109. *Achieving high-efficiency production of pharmaceutical opiates in engineered yeast.* **Society for Microbial Biotechnology Annual Meeting**, Washington, DC, July 21-24, 2019.
108. *Milk of the Poppy: A brave new world for old medicine.* **Cornell University**, Ithaca, New York, November 9, 2018.
107. *Opium poppy – an update.* **Phytochemical Society of North America Annual Meeting**, Universidad Autónoma de San Luis Potosi, San Luis Potosi, Mexico, August 4-8, 2018.
106. *Tricks of the trade – the unique specialized metabolism in opium poppy.* **University of North Texas**, Lubbock, Texas, March 22, 2017
105. *Loose screws – alkaloid metabolism in opium poppy*. Plant Omics for Biotechnology and Human Health Symposium, **University of Ghent**, Belgium, November 21-24, 2016
104. *High-value plant metabolite manufacturing: A case study.* Plant Biology and Agriculture in the 21st Century, **NSERC-Embassy of Israel to Canada**, Ottawa, ON, November 2-4, 2015.
103. *Milk of the poppy: Alkaloid biosynthesis in plants and beyond.* Plant Biotechnology for Health and Sustainability Symposium, **Michigan State University**, East Lansing, MI, October 9-10, 2015.
102. *Milk of the poppy: Alkaloid biosynthesis in plants and beyond.* **Plant Canada Conference**, Edmonton, AB, July 25-29, 2015.
101. *Milk of the poppy: Alkaloid biosynthesis in plants and beyond.* **Joint Genome Institute** Plant-Microbe Interaction Workshop, Walnut Creek, California, April 28-29, 2015.
100. *Milk of the poppy: Alkaloid biosynthesis in plants and beyond.* **Intrexon Incorporated**, San Francisco, California, April 21-22, 2015.
99. *Parts, pathways and performance: Toward the commercialization of high-value plant metabolite production.* **Genome Alberta Annual Board Meeting**, Calgary, Alberta, December 15, 2014.
98. *What's left to learn from opium poppy?* **97th Canadian Chemistry Conference**, Vancouver, British Columbia, June 1-5, 2014.
97. *What's left to learn from opium poppy?* **University of Alberta**, Edmonton, Alberta, March 20, 2014.
96. *Benzylisoquinoline alkaloid biosynthesis: Parts, pathways and performance*. **Biorefining Conversion Network Retreat**, Banff, Alberta, November 5-7, 2013.
95. *Nature's pharmacy: Alkaloid biosynthesis in opium poppy*. **University of York**. York, United Kingdom, September 26, 2013.
94. *Benzylisoquinoline alkaloid metabolism: A century of discovery and a brave new world.* **1st European Conference on Natural Products**. Frankfurt am Main, Germany, September 22-25, 2013.
93. *Unlocking Pandora's Box: The metabolic elegance and complexity of benzylisoquinoline alkaloid biosynthesis.* **Gordon Research Conference – Plant Metabolic Engineering**. Waterville Valley, New Hampshire, July 7 – 12, 2013.
92. *Opium poppy.* **University of Alberta Guest Lecture**. Edmonton, Alberta, March 19, 2013.
91. *The plant alkaloid factory: Should we modernize or move to a new location?* **PlantEngine COST Action FA1006 WG2 Meeting**, Porto, Portugal, February 28 – March 1, 2013.
90. *God's Own medicine - how a plant makes morphine.* **Universidade do Porto**, Porto, Portugal, February 27, 2013.
89. *Opium poppy biochemical genomics and synthetic biology – plug-and-play drug manufacturing?* **8th International Symposium on Biocatalysis and Agricultural Biotechnology**. Sonoma, California, October 28-31, 2012.

88. *Benzylisoquinoline alkaloid metabolism: Back to the future.* **3rd Banff Conference on Plant Metabolism**, Banff, Alberta, June 28 – July 2, 2012.
87. *How plants make morphine and whether we can teach this trick to a microorganism.* **95th Canadian Chemistry Conference**, Calgary, Alberta, May 26-30, 2012.
86. *How plants make morphine – can we teach this trick to a microorganism?* **Building Biology – A Symposium on Synthetic Biology**, Montréal, Québec, May 21, 2012.
85. *How plants make morphine – can we teach this trick to a microorganism?* **8th Canadian Plant Biotechnology Conference**, Guelph, Ontario, May 14-17, 2012.
84. *"God's Own Medicine" – The biochemistry and biotechnology of opium poppy.* **University of Puerto Rico**, San Juan, Puerto Rico, April 30, 2012.
83. *Phytochemical genomics and synthetic biology shed new light on alkaloid biosynthesis in opium poppy.* **Kyoto University**, Kyoto, Japan, March 14, 2012.
82. *PhytoMetaSyn: Harnessing the power of the world's best chemists*. **Japanese Society of Plant Physiologists**, Kyoto, Japan, March 16-19, 2012
81. *Functional genomics using non-model plants and synthetic biosystems for gene discovery in specialized metabolism.* **50th Phytochemical Society of North America Annual Meeting**. Kona, Hawaii, December 10-15, 2011.
80. *Functional genomics using non-model plants and synthetic biosystems for gene discovery in specialized metabolism.* **SmartCell Symposium**, Strasbourg, France, December 7, 2011.
79. *Harnessing the power of the world's best chemists*. **Biorefining Conversions Network 3rd Annual Retreat**, Banff, Alberta, November 30-December 2, 2011.
78. *He's the one they call "Dr. Feelgood."* **Calgary Chamber of Commerce** – iF Event, Calgary, Alberta, November 21, 2011.
77. *Functional genomics using non-model plants and synthetic biosystems for gene discovery in natural product metabolism.* **8th Canadian Plant Genomics Workshop**, Niagara Falls, Ontario, August 22-25, 2011.
76. *The Sorcerer's Apprentice: biochemical wizardry in opium poppy.* **MENSA Canada Annual Gathering**, Banff, Alberta, March 19-21, 2011.
75. *Biochemical wizardry in opium poppy.* **McGill University**, Montréal, Québec, January 20, 2010.
74. *God's Own Medicine: How He did it (and how we can do better).* **Southern Alberta Cancer Research Centre**, University of Calgary, Calgary, Alberta, November 19, 2010.
73. *God's Own Medicine: How He did it (and how we can do better).* **Concordia University**, Montréal, Québec, October 1, 2010.
72. *Le medicine de Dieu; comment Il a fait*. **Université de Montréal**, Montréal, Québec, July 23, 2010.
71. PhytoMetaSyn – Production of valuable plant metabolites in synthetic biosystems. **University of Mississippi**, Oxford, Mississippi, March 25, 2010.
70. *God's Own Medicine: How He did it.* **Washington State University**, Pullman, Washington, February 18, 2010.
69. *God's Own Medicine: How He did it.* **Virginia Technical University**, Blacksburg, Virginia, February 5, 2010.
68. *Opening Pandora's Box: Alkaloid biosynthesis in opium poppy and related plants.* **6th National Meeting on Natural Products Research**, Irapuato, Mexico, October 21-23, 2009.
67. *Opening Pandora's Box: Genes and alkaloids galore.* **Italian Federation of Life Sciences,** Riva del Garda, Italy, September 24-27, 2008.
66. *Mutagenesis as a functional genomics platform for pharmaceutical alkaloid biosynthetic gene discovery in opium poppy.* **International Atomic Energy Agency** - International Symposium on Induced Mutations in Plants, Vienna, Austria, August 12-15, 2008.
65. *Opening Pandora's Box: Genes and alkaloids galore – now what?* **Canadian Society of Plant Physiologists** 50th Anniversary Meeting, Ottawa, Ontario, June 2008.
64. *Biotechnology and the cash crop potential of opium poppy*. **Alberta Institute of Agrologists**, Banff, Alberta, March 5, 2008.

63. *God's own medicine and the Panglossian paradigm*. Department of Biological Sciences, **Organismal Biology Banquet**, University of Calgary, Alberta, February 1, 2008.
62. *Opium poppy: Science, business, politics and the paparazzi.* **Science Café**, Calgary, Alberta, January 22, 2008.
61. *Pharmaceutical alkaloid biosynthesis in opium poppy: metabolism and trafficking.* **University of California, Berkeley**, Berkeley, California, November 20, 2007.
60. *Pharmaceutical alkaloid biosynthesis in opium poppy: metabolism and trafficking.* **4th Solanaceae Genomics Workshop**, Jeju Island, Korea, September 9-13, 2007.
59. *Opium poppy as a model system to investigate pharmaceutical alkaloid biosynthesis in plants.* **Phytochemical Society of Europe**, Helsinki, Finland, August 26-29, 2007
58. *Opium poppy: blueprint for an alkaloid factory*. **Phytochemical Society of Europe**, Gargnano, Italy, June 6-9, 2007.
57. *Pharmaceutical alkaloid biosynthesis in opium poppy.* **Institute of Plant Biochemistry – Martin Luther University**, Halle, Germany, June 4, 2007
56. *Pharmaceutical alkaloid biosynthesis in opium poppy.* **Northeast Agricultural University**, Harbin, China, May 16-18, 2007
55. *Pharmaceutical alkaloid biosynthesis in opium poppy.* **August 1st University**, Daxing, China, May 14-15, 2007
54. *Opium poppy: blueprint for an alkaloid factory*. **Canadian Society of Plant Physiologists**, Kelowna, British Columbia, February 16-17, 2007.
53. Comparative genomics of benzylisoquinoline alkaloid-producing plants. **NAPGEN Workshop, Plant Biotechnology Institute-National Research Council**, Saskatoon, Saskatchewan, December 7, 2006.
52. *Opium poppy: blueprint for an alkaloid factory*. **Cornell University**, Ithica, New York, October 27, 2006.
51. *Pharmaceutical alkaloid biosynthesis in opium poppy.* **Chungnam National University**, Chungnam, Korea, August 29, 2006
50. *Opium poppy: blueprint for an alkaloid factory*. **International Symposium on Plant Metabolism**, **Kyung Hee University**, Suwon, Korea, August 31, 2006.
49. *Opium poppy: blueprint for an alkaloid factory*, **Phytochemical Society of Europe Annual Meeting**, Antalya, Turkey, April 25-28, 2006.
48. *Opium poppy: blueprint for an alkaloid factory*. **University of Massachusetts**, Amherst, Massachusetts, March 30, 2006
47. *Opium poppy: blueprint for an alkaloid factory*. **University of Western Ontario**, London, Ontario, March 17, 2006
46. *Opium poppy: blueprint for an alkaloid factory*. **Stanford University**, Stanford, California, February 24, 2006
45. *Opium poppy: blueprint for an alkaloid factory*. **University of Manitoba**, Winnipeg, Manitoba, November 4, 2005.
44. *Opium poppy: blueprint for an alkaloid factory*. **University of California, Berkeley**, Berkeley, California, October 28, 2005.
43. *Blueprint for an alkaloid factory.* **Ceres, Inc.**, Thousand Oaks, California, August 4, 2005.
42. *Applications of genomics to study alkaloid biosynthesis in opium poppy.* **Third Canadian Plant Genomics Workshop**, Saskatoon, Saskatchewan, August 28-31, 2005.
41. *Cellular and subcellular compartmentalization of benzylisoquinoline alkaloid biosynthesis*, **Phytochemical Society of North America Annual Meeting**, Salk Institute, La Jolla, California, June 30-August 3, 2005.
40. *Cellular and subcellular compartmentalization of benzylisoquinoline alkaloid biosynthesis*, **Gordon Conference on Plant Metabolic Engineering**, Tilton, Hew Hampshitre, July 10-15, 2005.
39. *Alkaloid biosynthesis in opium poppy – an evolutionary playground.* **Université de Tours**, Tours, France, June 20, 2005.
38. *Alkaloid biosynthesis in opium poppy – an evolutionary playground.* **Universität Bayreuth**, Bayreuth, Germany, June 7, 2005.

37. *Alkaloid biosynthesis in opium poppy: myths and magic.* **University of British Columbia - Okanagan**, Kelowna, British Columbia, October 21, 2004.
36. *Biochemical profile of a heavenly demon: alkaloid biosynthesis in opium poppy*. **Université de Tours**, Tours, France, June 29, 2004.
35. *Biochemical profile of a heavenly demon: alkaloid biosynthesis in opium poppy*. **Technische Universität Braunschweig**, Braunschweig, Germany, June 10, 2004.
34. *Biochemical profile of a heavenly demon: alkaloid biosynthesis in opium poppy*. **Max Planck Institute for Chemical Ecology**, Jena, Germany, June 8, 2004.
33. *Biochemical profile of a heavenly demon: alkaloid biosynthesis in opium poppy*. **University of Lethbridge**, Lethbridge, AB, March 17, 2004.
32. *Biochemical profile of a heavenly demon: alkaloid biosynthesis in opium poppy*. **University of British Columbia**, Vancouver, BC, March 8, 2004.
31. *A tale of three cell types: alkaloid biosynthesis is localized to sieve elements in opium poppy.* **Salk Institute of Biological Sciences**, La Jolla, California, October 16, 2003.
30. *A tale of three cell types: alkaloid biosynthesis is localized to sieve elements in opium poppy.* **INRA**, Dijon, France, June 18, 2003
29. *A tale of three cell types: alkaloid biosynthesis is localized to sieve elements in opium poppy.* **Université de Tours**, Tours, France, June 16, 2003.
28. *A tale of three cell types: The continuing adventures of the world's most controversial plant.* **Brock University**, St-Catharines, Ontario, March 13, 2003.
27. *A tale of three cell types: The continuing adventures of the world's most controversial plant.* **Guelph University**, Guelph, Ontario, March 11, 2003.
26. *Confessions of an opium poppy grower: How a plant makes medicine*. **National Research Council - Plant Biotechnology Institute**, Saskatoon, Saskatchewan, April 20, 2002.
25. *Confessions of an opium poppy grower: How a plant makes medicine*. Distinguished Lecture Series, **University of Calgary**, Calgary, Alberta, March 13, 2002.
24. *Biochemistry, molecular biology, and metabolic engineering of benzylisoquinoline alkaloid biosynthesis.* **Université de Tours**, Tours, France, October 23, 2001.
23. *Biochemistry, molecular biology, and metabolic engineering of benzylisoquinoline alkaloid biosynthesis.* **Centro de Investigacion Cientifica de Yucatan**, Mérida, México, September 4, 2001.
22. *Alkaloid biosynthesis.* Plant Biochemistry Summer Course. **Plant Biochemistry Research and Training Center - Washington State University**, Pullman, Washington, July 8-21, 2001.
21. *The opium wars: Biochemistry, cell biology, and metabolic engineering of benzylisoquinoline alkaloid biosynthesis in plants.* **Monsanto Company**, St-Louis, Missouri, May 3, 2001.
20. *Biochemistry, molecular biology, and metabolic engineering of benzylisoquinoline alkaloid biosynthesis.* **Seoul National University**, Suwon, Korea, October 31, 2000.
19. *Biochemistry, molecular biology, and metabolic engineering of benzylisoquinoline alkaloid biosynthesis.* **Chungbuk National University**, Cheongju, Korea, November 3, 2000.
18. *The pleasures and pains of opium: The biochemistry, cell biology, and metabolic engineering applications of alkaloid biosynthesis in plants.* **United States Department of Agriculture - University of Mississippi**, Oxford, Mississippi, April 27, 2000.
17. *The pleasures and pains of opium: The biochemistry, cell biology, and metabolic engineering applications of alkaloid biosynthesis in plants.* **McGill University**, Montréal, Québec, March 2, 2000.
16. *Metabolic engineering of cell wall biochemistry to improve disease resistance in crop plants.* **Performance Plants, Inc.**, Saskatoon, Saskatchewan, November 12, 1999
15. *Regulation and subcellular targeting of alkaloid biosynthetic enzymes in opium poppy: Prospects for metabolic engineering in plants.* **Université de Montréal**, Montréal, Québec, June 22, 1998.
14. *Regulation and compartmentation of alkaloid biosynthetic enzymes in opium poppy: Prospects for metabolic engineering in plants.* **Canadian Society of Plant Molecular Biologists Annual Meeting**. Edmonton, Alberta, June 17, 1998.

13. *Regulation and subcellular targeting of alkaloid biosynthetic enzymes in opium poppy: Prospects for metabolic engineering in plants.* **Samuel Roberts Noble Foundation**, Ardmore, Oklahoma, May 4, 1998.
12. *Regulation and subcellular targeting of alkaloid biosynthetic enzymes in opium poppy: Prospects for metabolic engineering in plants*. **Texas A&M University**, College Station, Texas, May 6, 1998.
11. *The opium wars: Regulation of alkaloid biosynthetic genes in opium poppy*. **University of British Columbia**, Vancouver, British Columbia, April 1, 1997.
10. *The opium wars: Regulation of alkaloid biosynthesis in opium poppy*. **University of Alberta**, Edmonton, Alberta, January 31, 1997.
9. *Differential regulation of alkaloid biosynthetic genes in the opium poppy*. **Washington State University**, Pullman, Washington, February 2, 1996.
8. *Regulation of alkaloid biosynthesis in opium poppy: Differential, tissue-specific, and elicitor-induced expression of a tyrosine/dopa decarboxylase gene family.* **Phytochemical Society of North America Annual Meeting**. Sault Sainte Marie, Ontario, August 15, 1995
7. *Alkaloid biosynthesis in opium poppy: Differential, tissue-specific, and elicitor-induced expression of a tyrosine/dopa decarboxylase gene family.* **Université Laval**, Québec, Québec, May 18, 1995.
6. *Mysteries of the opium poppy: Molecular regulation of alkaloid biosynthesis in* Papaver somniferum. **University of Calgary**, Calgary, Alberta, May 4, 1995.
5. *Regulation of alkaloid biosynthesis in the opium poppy.* **Concordia University**, Montréal, Québec, April 24, 1995.
4. *Alkaloid biosynthesis in opium poppy: Gene family for tyrosine/dopa decarboxylase.* **Technische Universität Braunschweig**, Braunschweig, Germany, June 27, 1994.
3. *Regulation of sesquiterpenoid biosynthesis in plants: A gene family for an elicitor-inducible sesquiterpene cyclase from tobacco.* **Université de Montréal**, Montréal, Québec, September 11, 1992.
2. *Bypassing the plant: Prospects and limitations of plant cell culture biotechnology for the production of phytochemicals.* **University of Kentucky**, Lexington, Kentucky, March 5, 1992.
1. *Immobilization of cultured plant cells by spontaneous adhesion for the production of secondary metabolites.* **University of Kentucky**, Lexington, Kentucky, February 14, 1991.

5.3. Selected Media Appearances

CTV News – Calgary synthetic cannabinoid company lists on the TSX (2020-01-15)
Global News – Calgary scientists believe they're close to producing non-addictive opiates (2019-04-06)
CBC Radio One – The Homestretch guest (2013-11-21)
Toronto Star Canada advances into the brave new world of synthetic biology (2012-03-12)
Découverte – Radio-Canada Le pavot pour des medicaments moins coûteux (2010-09-12)
The Independent (U.K.) Pain-killing secrets of the opium poppy revealed (2010-03-15)
The Guardian (U.K.) Researchers discover genes that allow the opium poppy to make codeine and morphine (2010-03-15)
Times of India Cheaper painkillers soon thanks to opium breakthrough (2010-03-15)
Sydney Morning Herald Scientists crack opium poppy's genetic code (2010-03-15)
Toronto Star Genetic secrets of poppies' painkillers unlocked (2010-03-15)
Montreal Gazette Scientists crack opium poppy's genetic code (2010-03-15)
Calgary Herald U of C researchers find elusive opium gene (2010-03-15)
Globe and Mail Canadian scientists uncover poppy's painkilling power (2010-03-15)
CBC National News report on opium gene discovery in opium poppy (2010-03-14)
Calgary Herald feature article "Researcher looking to grow pain reliever" (2009-05-21)
University Affairs feature article (2008)
Discovery Channel featured on *Daily Planet* (2008-02-06)
CityTV – Breakfast Television guest (2008-01-22)
CBC Radio One – The Homestretch guest (2008-01-22)

Calgary Herald feature article "Researcher's grant goes to pot" (2007-11-23)
Global News report (2007-11-19)
Canadian Business Magazine feature article "Cowboy junkies?" (2007-02-26).
National Post feature article "First marijuana – next poppies?" (2007-02-10).
CTV News interview about a potential poppy industry (2007-02-26).
CBC Radio – Manitoba interview about a potential poppy industry (2007-03-21).
CBC Radio – Saskatchewan interview about a potential poppy industry (2007-03-07).
CBC Radio – Alberta interview about a potential poppy industry (2007-02-06).
U Magazine feature article "Research blossoms in poppy lab" (2007-02-06).
Shaw Cable TV interview about the effect of the weather on crops (2006-07-21).
CBC Radio Wild Rose Country interview about my research (2006-05-09).
Globe and Mail feature article "Canada's attack on Afghan smack". (2006-01-21).
Chemical and Engineering News interview – appeared in the story "Top 10 pharmaceuticals that changed the world" (2005-06-20).
The Gauntlet U of C student newspaper "He's the one they call Dr. Feelgood" (2004-12-09).
On Campus U of C newspaper: ISEEE Supplement "Turning plants into factories" (2004-11-22).
Drug Discovery Today interview as an opium poppy expert (2004-11-25).
New Scientist interview as an opium poppy expert (2004-11-15).
Newsweek International interview as an opium poppy expert (2004-10-04).
Science News interview as an opium poppy expert (2004-09-25).
CBC Radio Wild Rose Forum radio debate "Genetically modified crops" (2004-02-06).
Calgary Herald front-page article (2002-01-17) "U of C poppy crop seeds opium study".
Calgary Herald article "Grant helps in poppy research" (2002-05-31).
Globe and Mail full-page feature article "To defang the poppy's kiss". (2002-08-24).
Discovery Channel fifteen-minute segment on *@discovery.ca*, first aired 2002-05-07, repeated frequently. Won a 2003 Gemini Award for Best Photography in an Information Program.
CBC Calgary News interview as an expert on plants (2002-05-23).
Toronto Star Starship article "Do poppy seeds come from real poppies?" (2002-05-26).
A-Channel news segment on opium poppy research (2002-06-04).

5.4. Selected Community Service

Guest Speaker	Calgary Nerd Night	May 18, 2017
Guest Speaker	Public Lecture – Dept. of Biological Sciences	November 28, 2015
Guest Speaker	Calgary Chamber of Commerce – iF Event	November 21, 2011
Guest Expert	Science Café – Edmonton	May 4, 2011
Guest Expert	Science Café – Montréal	September 29, 2010
Guest Expert	Science Café – Calgary (Teacher's Edition)	February 14, 2008
Guest Expert	Science Café – Calgary	January 22, 2008
Guest Speaker	University of Calgary Chancellor's Club	December 4, 2007
Guest Speaker	Spring into U of C	March 25, 2006
Guest Speaker	Calgary Science Centre	May 12, 2005
Guest Speaker	Calgary Science Centre	April 21, 2005
Guest Speaker	Spring into U of C	March 26, 2005
Guest Speaker	St. Rita School, Calgary	May 31, 2002
Guest Speaker	Bishop Carroll High School, Calgary	March 26, 2002
Guest Speaker	St. Rita School, Calgary	June 15, 2001
Guest Speaker	Calgary Science Network Junior High School Science Forum	May 10, 2001
Guest Lecturer	Western Canada High School, Calgary	May 04, 1999
Invited Speaker	Women in Science and Engineering W.I.S.E. Research Night, Univ. of Calgary	March 10, 1999
Juge de Foire des Sciences	Ecole Sainte Margarite-Bourgeoys	Feb 25, 1999

Guest Lecturer	Western Canada High School, Calgary	Nov 25, 1998
Invited Speaker	Calgary Garden Club	April 10, 1998