James D. Wuest
Curriculum Vitae

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Education

- A. B., Chemistry and Mathematics, Cornell University (1969)
- Ph. D., Chemistry, Harvard University (1973, with Prof. Robert B. Woodward)

Academic Positions

- Assistant Professor of Chemistry, Harvard University (1973–1979)
- Fellow, Harvard Medical School (1980)
- Associate Professor of Chemistry, Université de Montréal (1981–1986)
- Professor of Chemistry, Université de Montréal (1986–)
- Canada Research Chair in Molecular Materials (2001–2022)
- Member of the Institut Courtois (2022–)

Overview of Research

The unifying goal of research in the Wuest group is to understand and control molecular organization in materials. We rely on a core of expertise in organic chemistry, but our approach is multidisciplinary. With support from the Canada Research Chair in Molecular Materials (2001–2022) and other sources, the scope of our research has broadened to encompass many fields, including materials science, structural analysis, surface science, computation, and the fabrication and testing of opto/electronic devices based on molecular materials, including batteries. This range

of interests gives us a foundation for undertaking ambitious projects, such as those summarized below:

I. Modular Construction

We are pioneers in modular construction, which is a simple and powerful way to make predictably ordered materials by using molecular modules that engage in well-defined association and thereby hold their neighbors in predetermined positions. Our first papers describing this concept (*J. Am. Chem. Soc.* **1991**, *113*, 4696; *J. Org. Chem*. **1988**, *53*, 5787) have received over 1200 citations and continue to be cited more than 30 years after publication. By introducing the strategy of modular construction, we provided a starting point for subsequent development of the vast field of metal-organic frameworks, covalent organic frameworks, hydrogen-bonded organic frameworks, and supramolecular polymers. We remain leaders in the area, as shown by recent publications that include a survey of the field and our contributions to it (*Nat. Commun.* **2020**, *11*, 4652; *Chem. Eur. J.* **2020**, *26*, 7026).

II. Molecular Crystallization

The group is also recognized for its contributions to the broad field of molecular crystallization. The group's expertise includes what we have called an ability to turn to the "dark side of crystal engineering," such as by inhibiting crystallization and making solids amorphous. In addition, we have probed how crystallization is related to other types of organization like gelation, examined the phenomenon of mixed crystallization, in which multiple components occupy random positions in lattices in variable ratios, and studied polymorphism, which is the ability of many compounds to exist in multiple crystalline forms. The forms have different properties, so polymorphism is important in every industry that uses crystalline solids, including drugs, agricultural chemicals, and foods. New polymorphs can be patented, and finding them increases the diversity of available solid forms and allows products to be optimized by selecting them from the widest possible range of options. The Wuest group has become a leader in the field of molecular crystallization by examining the origin of high levels of polymorphism (*Cryst. Growth Des.* **2025***, 24,* 3029; *J. Org. Chem.* **2022**, *87*, 6680; *Acc. Chem. Res.* **2020**, *53*, 2472; *Cryst. Growth Des.* **2019**, *19*, 5390), by seeking rules governing the formation of mixed crystals (*Cryst. Growth Des.* **2025**, *25*, 6408; *Cryst. Growth Des.* **2024**, *24*, 1268; *Cryst. Growth Des.* **2023**, *23*, 273), and by providing new ways to increase polymorphic diversity (*Cryst. Growth Des.* **2025**, *25*, 6370; *Cryst. Growth Des.* **2024**, *24*, 1268; *Cryst. Growth Des.* **2023**, *23*, 7472; *Cryst. Growth Des.* **2023**, *23*, 273; *J. Am. Chem. Soc.* **2020**, *142*, 11873). Our new methods of polymorphic screening have been highlighted (*Chem. Eng. News* **2020**, *98* (29), 9; *Chem. World* (July 29, 2020); *Org. Process Res. Dev.* **2020**, *24*, 1549) and have been patented (CA 3165292, with other patents pending). In addition, three recent papers have explored the subtle relationship between crystallization and gelation (*Langmuir* **2022**, *38*, 5111; *Cryst. Growth Des.* **2022**, *22*, 3505; *Cryst. Growth Des.* **2022**, *22*, 643).

III. Surface Science

We have shown how modular construction can be used in 2D to help control adsorption on surfaces. Papers summarizing our contributions to surface science have appeared in *Chem. Commun*., *CrystEngComm*, *J. Phys. Chem. C*, *J. Am. Chem. Soc*., *Cryst. Growth Des*., and *Langmuir*. This work has shown the special value of a dual approach in which 3D molecular

organization (determined by X-ray diffraction) is compared systematically with 2D organization on surfaces (revealed by scanning probe microscopy). Few research groups skilled in molecular design and synthesis are simultaneously able to use sophisticated tools of structural analysis. Learning how to use these tools required major effort but has delivered a substantial payoff in the form of insights about molecular organization that would not have emerged from studies focused narrowly on 2D or 3D structures alone. The Wuest group has also made key contributions to surface science by collaborating with colleagues in medicine to produce metallic implants with surfaces that are etched or grafted in ways that facilitate osseointegration and minimize bacterial adhesion. Work with stainless steel was published recently (*Colloids Surf. B* **2018**, *161*, 677), our earlier papers on Ti and other metals have now been collectively cited over 200 times, and our research in this area has led to multiple patents.

IV. Batteries and Other Devices Based Sustainably on New Organic Materials

Our experience and multidisciplinary perspective make us well placed to develop advanced organic materials for use in batteries and other devices, as well as to build and test the devices themselves. Recent papers have explored how components such as fullerenes can be organized in optoelectronically active materials (*J. Am. Chem. Soc.* **2022**, *144*, 556; *Cryst. Growth Des.* **2020**, *20*, 1319; *J. Am. Chem. Soc.* **2019**, *141*, 18740; *Cryst. Growth Des.* **2019**, *19*, 5418; *J. Org. Chem.* **2017**, *82*, 5034). Other papers have reported how organic materials made by the group have performed in photovoltaic devices and light-emitting diodes (*Can. J. Chem.* **2020**, *98*, 582, 575, 564; *J. Polym. Sci., Part B: Polym. Phys*. **2017**, *55*, 1479). Our work in these areas is guided by principles of sustainability and green chemistry, as illustrated by our emphasis on optimal solvents for depositing thin layers (*ACS Sustain. Chem. Eng.* **2017**, *5*, 5994) and on methods of recycling (*Thin Solid Films* **2017**, *638*, 236). Our current priority in this area is to develop novel redox-active organic materials for use in batteries (*J. Org. Chem.* **2023**, *88*, 16302; *Cryst. Growth Des.* **2023**, *23*, 8865; *J. Org. Chem.* **2022**, *87*, 15796; *J. Org. Chem.* **2022**, *87*, 7673; *J. Org. Chem*. **2018**, *83*, 15426). *A distinctive element of our work is the use of advanced skills in molecular design and organic synthesis to make new redox-active compounds that have unusual structures and properties, yet can easily be made from abundant renewable resources such as biomass.*

Research Publications

- Al Ahmad, A. R.; Maris, T.; Wuest, J. D. "Hiding in Plain Sight: Polymorphs of Riluzole." *Cryst. Growth Des.* **2025**, *25*, 3029−3036.

- Nunez Avila, A. G.; Maris, T.; Wuest, J. D. "A Workplan for Using Heteroseeded Crystallizations to Produce New Polymorphs, as Illustrated by a Study of Cinnamic Acids." *Cryst. Growth Des.* **2025**, *25*, 6370−6381.

- Al Ahmad, A. R.; Maris, T.; Wuest, J. D. "$ArOCF_3$, $ArOCHF_2$, $ArOCH_2F$, and $ArOCH_3$: What the F Does to Control the Crystallization of Riluzole and Analogous Fluoromethyl Ethers." *Cryst. Growth Des.* **2025**, *25*, 6408−6420.

- Patel, J.; Leduc, Z.; Nunez Avila, A. G.; Glover, J. A.; Wu, K.; Zhang, Y.; Zhang, J.; Zhai, X.; Jing, H.; Chen, A. M.; Chartrand, D.; Maris, T.; Day, G. M.; Wuest, J. D. "Exploring Polymorphism: Hydrochloride Salts of Pitolisant and Analogues." *Cryst. Growth Des.* **2024**, *24*, 1268−1283.

- Sosoe, J. O. E.; Maris, T.; Wuest, J. D. "Strongly Hydrogen-Bonded Networks Formed by Sulfate and Bisulfate Salts of Benzenetetramines." *Cryst. Growth Des.* **2023**, *23*, 8865−8874.

- Al Ahmad, A. R.; Maris, T.; Pellerin, C.; Wuest, J. D. "Adding a Pinch of Salt: Using Ionic Mixed-Crystal Seeds to Search for New Solid Forms." *Cryst. Growth Des.* **2023**, *23*, 7472−7481.

- Sosoe, J. O. E.; Malveau, C.; Maris, T.; Iftimie, R.; Wuest, J. D. "Refreshing the Legacy of Rudolf Nietzki: Benzene-1,2,4,5-tetramine and Related Compounds." *J. Org. Chem.* **2023**, *88*, 16302−16314.

- Villeneuve, N. M.; Dickman, J. T.; Maris, T.; Day, G. M.; Wuest, J. D. "Seeking Rules Governing Mixed Molecular Crystallization." *Cryst. Growth Des.* **2023**, *23*, 273−288.

- Néron, S.; Morency, M.; Malveau, C.; Maris, T.; Iftimie, R.; Wuest, J. D. "Diphenoquinhydrones and Related Hydrogen-Bonded Charge-Transfer Complexes." *J. Org. Chem.* **2022**, *87*, 15796−15805.

- Néron, S.; Morency, M.; Chen, L.; Maris, T.; Rochefort, D.; Iftimie, R. I.; Wuest, J. D. "Diphenoquinones Redux." *J. Org. Chem.* **2022**, *87*, 7673−7695.

- Nunez Avila, A. G.; Deschênes-Simard, B.; Arnold, J. E.; Morency, M.; Chartrand, D.; Maris, T.; Berger, G.; Day, G. M.; Hanessian, S.; Wuest, J. D. "Surprising Chemistry of 6-Azidotetrazolo[5,1-*a*]phthalazine: What a Purported Natural Product Reveals about the Polymorphism of Explosives." *J. Org. Chem.* **2022**, *87*, 6680−6694.

- Li, P.; Zhang, M.; Maris, T.; Zhu, X. X.; Wuest, J. D. "Probing the Relationship between Crystallization and Gelation by Using Ammonium Salts of Bile Acids." *Cryst. Growth Des.* **2022**, *22*, 3505−3517.

- Petrov, N. G.; Chartier, P.; Maris, T.; Wuest, J. D. "Designing Tetraoxa[8]circulenes To Serve as Hosts and Sensors." *J. Am. Chem. Soc.* **2022**, *144*, 556−572.

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- Li, P.; Malveau, C.; Zhu, X. X.; Wuest, J. D. "Using Nuclear Magnetic Resonance Spectroscopy to Probe Hydrogels Formed by Sodium Deoxycholate." *Langmuir* **2022**, *38*, 5111−5118.

- Morency, M.; Néron, S.; Iftimie, R.; Wuest, J. D. "Predicting pK_a Values of Quinols and Related Aromatic Compounds with Multiple OH Groups." *J. Org. Chem.* **2021**, *86*, 14444−14460.

- Wuest, J. D. "Atoms and the Void: Creating Ordered Porous Solids by Design." *Nat. Commun.* **2020**, *11*, 4652 (Contribution invited as part of the 10th anniversary of *Nat. Commun*.).

- Lévesque, A.; Maris, T.; Wuest, J. D. "ROY Reclaims Its Crown: New Ways to Increase Polymorphic Diversity." *J. Am. Chem. Soc*. **2020**, *142*, 11873−11883.

- Heskia, A.; Maris, T.; Wuest, J. D. "Phosphangulene: A Molecule for All Chemists." *Acc. Chem. Res.* **2020**, *53*, 2472−2482.

- Khadivjam, T.; Che-Quang, H.; Maris, T.; Ajoyan, Z.; Howarth, A. J.; Wuest, J. D. "Modular Construction of Porous Hydrogen-Bonded Molecular Materials from Melams." *Chem. Eur. J.* **2020**, *26*, 7026−7040.

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- Heskia, A.; Maris, T.; Wuest, J. D. "Bis(phosphangulene)iminium Salts. Holding on to Fullerenes with Phangs." *Cryst. Growth Des.* **2020**, *20*, 1319−1327.

- Brunner, P.-L. M.; Masse, J.-P.; L'Espérance, G.; Wuest, J. D. "Imaging Layers in Thin-Film Molecular Devices by Transmission Electron Microscopy, Using Milling by Focused Ion Beams and Deposition on NaCl and Si." *Can. J. Chem.* **2020**, *98*, 582−588 (Contribution to a special issue celebrating the 100th anniversary of the Département de Chimie at the Université de Montréal).

- Brunner, P.-L. M.; Laliberté, D.; Dang, M. T.; Wantz, G.; Wuest, J. D. "Dependence of the Performance of Light-Emitting Diodes on the Molecular Weight of the Electroluminescent Polymer PFO-MEH-PPV." *Can. J. Chem.* **2020**, *98*, 575−581 (Contribution to a special issue celebrating the 100th anniversary of the Département de Chimie at the Université de Montréal).

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Patents and Patent Applications

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Honors and Awards

- Canadian Light Source T. K. Sham Award in Materials Chemistry (Canadian Society for Chemistry, 2021)
- Prix Marie-Victorin (Gouvernement du Québec, 2013)
- Canada Research Chair in Molecular Materials (2008−2022)
- Prix Urgel-Archambault (Association francophone pour le savoir, 2008)
- Arthur C. Cope Scholar Award (American Chemical Society, 2005)
- Canada Research Chair in Supramolecular Materials (2001-2008)
- Alfred Bader Award in Organic Chemistry (Canadian Society for Chemistry, 2001)
- Guggenheim Fellowship (1999)
- Fellow of the Royal Society of Canada (1996)
- Life Member of the Royal Society of Canada (2022)
- Rutherford Memorial Medal (Royal Society of Canada, 1992)
- Killam Research Fellowship (Canada Council, 1992)
- Merck Sharp & Dohme Award (Canadian Society for Chemistry, 1988)

Other Major Activities (1995-2023)

- Member of the Institut Courtois (2023-)
- Member of the Scientific Advisory Board of the Institut Courtois (2022−)
- Directeur, *Réseau québécois de recherche en synthèse organique* (2002−2007)
- Member of the Advisory Board of *Materials Chemistry Frontiers*, a new international journal resulting from collaboration of the Royal Society of Chemistry and the Chinese Chemical Society (2019−)
- Director, *Major Central Research Facility for the Study of Nanostructured Molecular Materials* (2007−2014)
- Member, Selection Panel, Steacie Prize for Natural Sciences (2007−2010)
- Holder of the Canada Research Chair in Molecular Materials (2001−2022)
- Member, Selection Committee, NSERC AGENO Program (2003)
- Member, Scientific Advisory Board, NanoQuébec (2005−2010)
- Editor, *Canadian Journal of Chemistry* (1992−1997)
- Membre, Comité d'évaluation, Établissement de nouveaux chercheurs, FCAR (1996−1999)
- Member, Advisory Board of the *Journal of Organic Chemistry* (1995−1999)
- Member, Consulting Board of Editors, *Tetrahedron* and *Tetrahedron Letters* (2002−2012)
- Member, Selection Committee (Mathematical and Physical Sciences), Royal Society of Canada
- Member, Selection Committee, NSERC Gerhard Herzberg Canada Gold Medal for Science and Engineering (2008−2011)
- Member, Selection Committee, NSERC Brockhouse Canada Prize (2008−2011)
- Member, Selection Committee, NSERC CIAM Program (2008)
- Member, Expert Committee in Energy and Materials, Canada Foundation for Innovation (2008−2010)

Research Grants (2017−2025)

Funding Agency	Program	Period	Total Amount	Title
FRQNT	Regroupements stratégiques	2024−2030	$3,000,000	Centre québécois sur les matériaux fonctionnels
NSERC	Discovery Grants	2025−2030	$305,000	Engineering New Molecular Materials
NSERC	Alliance Advantage	2025−2028	$380,000	New Ways to Control Crystallization and Optimize the Solid Forms of Drugs
Federal Government	Canada Research Chairs	2015−2022	$1,400,000	Tier 1 Canada Research Chair in Molecular Materials
FRQNT	Regroupements stratégiques	2020−2026	$2,900,000	Centre en chimie verte et catalyse
MITACS	Accelerate International	2021−2022	$47,500	Screening for Polymorphs of Active Pharmaceutical Ingredients
NSERC	I2I Grants	2021−2022	$124,000	Using Mixed Crystals to Increase Polymorphic Diversity
CFI	Leaders Fund	2021−2022	$237,895	Tools for Creating Crystalline Molecular Materials
MITACS	Accelerate	2021	$60,000	Methods for Polymorphic Screening,
NSERC	RTI	2020−2021	$150,000	700 MHz NMR Cryoplatform
NSERC	CREATE	2014−2020	$1,650,000	Training Program in Continuous Flow Science
NSERC	RTI	2019−2020	$149,711	Photon III X-Ray Detector for MetalJet Diffractometer
NSERC	RTI	2017−2018	$122,000	Montréal Centre for Structural Analysis by X-Ray Diffraction
FRQNT	Équipes	2023−2026	$190,000	Organic Molecules for Sustainable Large-Scale Energy Storage with Aqueous Redox Flow Batteries
CQDM	Quantum Leap	2025−2026	$759,000	New Ways to Control Crystallization and Optimize the Solid Forms of Drugs

Supervision of Students and Postdoctoral Fellows

The Wuest group offers a multidisciplinary environment that exposes trainees to many concepts and techniques. The environment is enhanced by multiple academic collaborations and industrial partnerships, which let the group acquire new skills from outside experts and later use them independently. The group thereby helps prepare students for successful careers in an unusually wide range of fields. Overall, nearly 100 graduate students and postdoctoral fellows have been trained in the group, as well as dozens of undergraduate researchers. In the last decade alone, four companies have been founded by former members of the group. The new companies are Spectrafy (a Canadian manufacturer of solar spectral sensors, founded by Dr. Richard Beal, a former

postdoctoral fellow), COFOVO Energy (a Canadian manufacturer of solar panels, also founded by Dr. Beal), Solaris Chem (a Canadian manufacturer of compounds for the electronics industry, co-founded by Drs. Pierre-Louis Brunner and Dominic Laliberté, both former Ph. D. students in the group), and SynArchive (an organic synthesis archive, founded by Dr. Daniel Beaudoin, a former Ph. D. student). Apellis Pharmaceuticals, which was co-founded by Dr. Pascal Deschatelets, a former Ph. D. student, is currently valued at $5B and has over 500 employees.

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