

# Ferenc Balogh

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<https://ferenc-balogh-math.github.io>

## Research Interests

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Random matrices, orthogonal polynomials, Riemann–Hilbert problems  
Equilibrium measures, quadrature domains, conformal mappings  
Integrable hierarchies,  $\tau$ -functions, symmetric functions

## Current position

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**Teacher of Mathematics** Aug. 2015 - present  
John Abbott College, Ste-Anne-de-Bellevue

## Past employment

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<b>Research assistant professor</b> Concordia University, Montréal	<b>Jan. 2015 - Aug. 2015</b>
<b>Postdoctoral research assistant</b> Mathematics Area, SISSA, Trieste	<b>Sept. 2012 - Dec. 2014</b>
<b>Research assistant professor</b> Concordia University, Montréal	<b>Sept. 2011 - June 2012</b> <b>Jan. 2011 - May 2011</b>
<b>Postdoctoral researcher</b> Centre des recherches mathématiques (CRM), Montréal	<b>Jan. 2011 - July 2012</b>

## Visiting positions

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<b>Invited participant</b> Thematic semester on Random Matrices and Scaling Limits Mittag-Leffler Institute, Stockholm, Sweden	<b>Dec. 2024</b>
<b>Summer research internship</b> Centre for Nonlinear Studies, Los Alamos National Laboratory	<b>May - July 2008</b>

## Consulting activities

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<b>External consultant</b> <i>Development of a standard food authenticity testing workflow for honey using non-targeted LC/MC analysis</i> , NSERC Alliance program grant Principal investigator: Prof. Stéphane Bayen Department of Food Science and Agricultural Chemistry, McGill University	<b>June 2022 - June 2024</b>
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## Professional affiliations

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<b>Affiliate Assistant Professor</b> Department of Mathematics and Statistics Concordia University, Montréal	<b>June 2016 - June 2019</b>
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## Education

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<b>Ph.D in Mathematics</b>	<b>2010</b>
Concordia University, Montréal (Supervisor: Prof. John Harnad)	
<b>M.Sc in Mathematics</b>	<b>2004</b>
with distinction University of Szeged, Hungary (Supervisor: Prof. László Kérchy)	

## Grants

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<b>FRQNT research grant</b>	<b>2018 - 2021</b>
Programme de recherche pour les chercheurs et les chercheuses de collège	
<i>Asymptotics of eigenvalue statistics in planar random matrix models</i>	

2019-CO-261822

## Honors and awards

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<b>The 2011 Distinguished Doctoral Dissertation Prize in Engineering and Natural Sciences</b>	<b>2011</b>
Concordia University	
<b>Mathematics and Statistics Graduate Scholarship</b>	<b>2009</b>
Department of Mathematics and Statistics, Concordia University	
<b>Campaign for Concordia – Graduate Award</b>	<b>2008</b>
Concordia University	
<b>Campaign for a new Millennium – Student Contribution Graduate Scholarship</b>	<b>2008</b>
Concordia University	
<b>Best Student Award</b>	<b>2008</b>
Mathematical Physics Laboratory, Centre de Recherches Mathématiques	
<b>Campaign for a new Millennium – Graduate Scholarship</b>	<b>2006</b>
School of Graduate Studies, Concordia University	
<b>ISM Scholarship for Graduate Studies</b>	<b>2006</b>
Institut des Sciences Mathématiques, Montréal	<b>2005</b>
<b>Excellent Student of the Faculty of Science</b>	<b>2004</b>
Faculty of Science, University of Szeged	

## Academic service

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<b>Department co-chair</b>	<b>Sept. 2020 - June 2023</b>
Mathematics Department, John Abbott College	
<b>Seminar co-organizer</b>	<b>Sept. 2020 - Dec. 2021</b>
Séminaire Physique Mathématique, CRM	
<b>Conference organizer</b>	<b>Sept. 2015 - Dec. 2015</b>
ASIDE 2016, CRM, Montréal	
<b>Seminar organizer</b>	<b>Sept. 2013 - Aug. 2014</b>
Integrable systems and Mathematical Physics Seminar, SISSA	
<b>Journal referee</b>	<b>2010 - present</b>
Nonlinearity, Stud. Appl. Math., Math. Rev.	
<b>Webmaster</b>	<b>Jan. 2011 - June 2012</b>
Homepage of the Mathematical Physics Laboratory, CRM	

**Published research articles**

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- [1] S. Chahal, L. Tian, S. Bilamjian, F. Balogh, L. De Leoz, T. Anumol, D. Cuthbertson, S. Bayen. Rapid Convolutional Algorithm for the Discovery of Blueberry Honey Authenticity Markers via Nontargeted LC-MS Analysis, *Anal. Chem.* 96, 45 (2024) 17922–17930  
doi:10.1021/acs.analchem.4c01778
  - [2] F. Balogh. On longest increasing subsequences in words in which all multiplicities are equal, *J. Integer Seq.* 26 (2023) Article 23.7.3  
Preprint: arxiv:1505.01389
  - [3] F. Balogh, J. Harnad, J. Hurtubise. Isotropic Grassmannians, Plücker and Cartan maps. *J. Math. Phys.* 62 (2): 021701 (2021)  
doi:10.1063/5.0021269, Preprint: arxiv:2007.03586
  - [4] F. Balogh, D. Yang. Geometric interpretation of Zhou's explicit formula for the Witten-Kontsevich tau function, *Lett.Math.Phys.* 107 (2017) 10, 1837-1857  
doi:10.1007/s11005-017-0965-8, Preprint: arxiv:1412.4419
  - [5] F. Balogh, T. Grava, D. Merzi. Orthogonal polynomials for a class of measures with discrete rotational symmetries in the complex plane. *Constr. Approx.* 46, 109-169 (2017)  
doi:10.1007/s00365-016-9356-0, Preprint: arxiv:1509.05331
  - [6] F. Balogh, M. Bertola, T. Bothner. Hankel Determinant Approach to Generalized Vorob'ev-Yablonski Polynomials and Their Roots, *Constr. Approx.* 44, 417-453 (2016)  
doi:10.1007/s00365-016-9328-4, Preprint: arxiv:1504.00440
  - [7] S.T. Ali, F. Balogh and N. M. Shah. On Some Families of Complex Hermite Polynomials and their Applications to Physics. *Operator Algebras and Mathematical Physics, Series: Operator Theory: Adv. and Appl.*, 157-171 (2015)  
doi:10.1007/978-3-319-18182-0, Preprint: arxiv:1309.4163
  - [8] F. Balogh. Discrete matrix models for partial sums of conformal blocks associated to Painlevé transcendents. *Nonlinearity*, **28** (1):43-55 (2015)  
doi:10.1088/0951-7715/28/1/43, Preprint: arxiv:1405.1871
  - [9] F. Balogh, T. Fonseca, and J. Harnad. Finite dimensional KP tau-functions. I. Finite Grassmannians. *J. Math. Phys.*, **55**:083517 (2014)  
doi:10.1063/1.4890818, Preprint: arxiv:1403.5835
  - [10] F. Balogh and É. Krauczi. Weighted quantile correlation test for the logistic family. *Acta Sci. Math. (Szeged)*, **80**:307-326 (2014)  
doi:10.14232/actasm-013-809-8, Preprint: arxiv:1402.0369
  - [11] F. Balogh and D. Merzi. Equilibrium measures for a class of potentials with discrete rotational symmetries. *Constr. Approx.* **42** (3), 399-424 (2015)  
doi:10.1007/s00365-015-9283-5, Preprint: arxiv:1312.1483
  - [12] T. Fonseca and F. Balogh. The higher spin generalization of the 6-vertex model with domain wall boundary conditions and Macdonald polynomials. *J. Algebraic Combin.* **41** (3): 843-866 (2015)  
doi:10.1007/s1080-014-0555-0, Preprint: arxiv:1210.4527
  - [13] F. Balogh, M. Bertola, S. Y. Lee, and K. D. T.-R. McLaughlin. Strong asymptotics of the orthogonal polynomials with respect to a measure supported on the plane. *Comm. Pure Appl. Math.*, **68**: 112-172 (2015)  
doi:10.1002/cpa.21541, Preprint: arxiv:1209.6366

- [14] F. Balogh and J. Harnad. Superharmonic perturbations of a Gaussian measure, equilibrium measures and orthogonal polynomials. *Complex Anal. Oper. Theory*, **3** (2): 333-360 (2009) doi:10.1007/s11785-008-0101-y, Preprint: arxiv:0808.1770
- [15] F. Balogh and M. Bertola. Regularity of a vector potential problem and its spectral curve. *J. Approx. Theory*, **161** (1): 353-370 (2009) doi:10.1016/j.jat.2008.10.010, Preprint: arxiv:0804.4700

## Books

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- [16] J. Harnad and F. Balogh. *Tau Functions and Their Applications*. Cambridge University Press (2021)

## Conference and seminar talks, poster presentations

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- [1] *From Ptolemy to Plöcker, Grassmann, Schur, and beyond*, (MD)<sup>2</sup>, August 18, 2023, John Abbott College
- [2] *Where do the rational solutions of the Painlevé II hierarchy come from?*, Painlevé Equations in the Midwest, August 24, 2019, U. of Michigan - Ann Arbor, MI
- [3] *On the distribution of poles of rational solutions to the Painlevé II hierarchy*, Séminaire Physique Mathématique, March 6, 2018, CRM
- [4] *Asymptotics of Painlevé tau functions and a discrete matrix model*, Séminaire Structures Algébriques et Géométriques, Jan. 28, 2016, Université de Sherbrooke
- [5] *Orthogonal Polynomials for a Class of Measures with Discrete Rotational Symmetries in the Complex Plane*, SIAM Conference on Orthogonal Polynomials, Special Functions and Applications 2015, June 3, 2015, NIST, Gaithersburg, MD
- [6] *Finite dimensional tau-functions*, Séminaire Physique Mathématique, April 14, 2015, CRM
- [7] *Conjectured asymptotic expansions for Painlevé tau functions and a discrete matrix model I-II*, Working Seminar on Integrable Systems, March 10 and 17, 2015, Concordia University
- [8] *Orthogonal polynomials for normal matrix models with discrete rotational symmetries*, USF Math Colloquium, Febr. 27, 2015, University of South Florida, Tampa, FL
- [9] *Finite dimensional tau-functions*, Working Seminar on Integrable Systems, Oct. 24, 2014, Concordia University
- [10] *Discrete matrix models for partial sums of conformal blocks associated to Painlevé transcedents*, Séminaire Physique Mathématique Sept. 9, 2014, CRM
- [11] *A discrete matrix model for the conformal blocks associated with the Painlevé transcedents*, Integrable Systems and Mathematical Physics Seminar, March 12, 2014, SISSA
- [12] *Equilibrium measures for a class of potentials with discrete rotational symmetries* (poster presentation with co-author D. Merzi), Advanced School and Workshop on Random Matrices and Growth Models, Sept. 10, 2013, ICTP Trieste
- [13] *Asymptotics of orthogonal polynomials associated to a random normal matrix model I-IV* Integrable Systems Seminar, Jan.-Febr. 2013, SISSA
- [14] *The six-vertex model partition function from a Grassmannian point of view*, Working Seminar on Integrable Systems, Nov. 8, 2012, Concordia University

- [15] *Reduction of planar orthogonality to non-hermitian orthogonality on contours*, Canadian Mathematical Society - Summer Meeting 2012, June 3, 2012, Regina, SK
- [16] *Wronskians of Hermite polynomials*, Working Seminar on Integrable Systems, March 29, 2012, Concordia University
- [17] *Plancherel process on partitions I-II*, Working Seminar on Integrable Systems, Oct. 13 and 21, 2010, Concordia University
- [18] *Reduction of planar orthogonality to non-hermitian orthogonality on contours*, 13<sup>th</sup> International Conference on Approximation Theory, March 7-10, 2010, San Antonio, TX
- [19] *Asymptotics of Bargmann–Fock-type orthogonal polynomials*, Université Laval Mathematical Analysis Seminar, Febr. 27, 2009, Université Laval
- [20] *Random Matrices, Laplacian Growth and Localization for Planar Orthogonal Polynomials*, Center for Nonlinear Studies Seminar, July 10, 2008, CNLS, Los Alamos National Laboratory
- [21] *On the asymptotic zero distribution of some planar orthogonal polynomials*, Conference on Hilbert Spaces of Analytic Functions Dec. 12, 2008, CRM
- [22] *On the asymptotics of some planar orthogonal polynomials*, BIRS Workshop on Random Matrices, Inverse Spectral Methods and Asymptotics, Oct. 5, 2008, Banff International Research Station
- [23] *Localization phenomena for orthogonal polynomials in the plane*, CRM International Workshop on Laplacian Growth and Related Topics, (Thematic Year on Probabilistic Methods in Math. Phys.), Aug. 22, 2008, CRM
- [24] *Equilibrium Measures, Schwarz Functions and Asymptotics of Orthogonal Polynomials*, Séminaire Physique Mathématique, Dec. 11, 2007, CRM
- [25] *Véletlen mátrixok, elektrosztatika és ortogonális polinomok (Random Matrices, Electrostatics and Orthogonal Polynomials)*, Stochastics Seminar of the Bolyai Institute (in Hungarian), Aug. 29, 2007, University of Szeged, Hungary
- [26] *Orthogonal Polynomials for Exponential Type Weights on the Complex Plane and Generalized Quadrature Domains*, BIRS Workshop on Quadrature Domains and Laplacian Growth in Modern Physics, June 15-20, 2007, Banff International Research Station

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## Teaching experience

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### John Abbott College, Ste-Anne-de-Bellevue

- ▲ *Calculus I,II*
- ▲ *Algebra and Functions, Algebra and Trigonometry*
- ▲ *Statistics*
- ▲ *Statistical Methods* (science option course)
- ▲ *Independent Research Project in Science*

**Concordia University, Montréal**

- ▲ *Fundamental Mathematics II*, Winter 2015, Winter 2011, Winter 2009, Fall 2008
- ▲ *Linear Algebra*, Summer 2012
- ▲ *Differential and Integral Calculus II*, Winter 2012, Fall 2011, Winter 2011
- ▲ *Elementary Functions*, Winter 2008
- ▲ *Discrete Mathematics* (practice sessions), Fall 2010
- ▲ *Elementary Numerical Methods* (practice sessions), Winter 2010

**Scuola Internazionale Superiore di Studi Avanzati (SISSA), Trieste, Italy**

- ▲ *KP  $\tau$ -functions and their applications* (graduate course), Spring 2014

**University of Szeged, Hungary**

- ▲ *Time Series Analysis*, Spring 2005
- ▲ *Algebra and Geometry I*, Fall 2003, Fall 2004
- ▲ *Algebra and Geometry II*, Spring 2004, Spring 2005
- ▲ *Calculus II*, Spring 2003
- ▲ *Calculus I for Physicists*, Fall 2001, Fall 2002
- ▲ *Calculus II for Physicists*, Spring 2002

**Teaching-related activities**

<b>Math contest organizer</b> Mathematics Department, John Abbott College	<b>Fall 2022 - present</b>
<b>Math Explorations Club co-organizer</b> Mathematics Department, John Abbott College	<b>Fall 2021 - present</b>
<b>Exam invigilator</b> Canadian Kangaroo Mathematics Contest, Montréal	<b>March 2015</b>
<b>Science fair judge</b> The Study, Montréal	<b>Feb. 2015</b>
<b>Science fair judge</b> Hydro-Québec Montréal Regional Science & Technology Fair	<b>March 2011</b>
<b>Putnam math contest coach</b> Concordia University	<b>2009–2010</b>
<b>Open House representative</b> Department of Mathematics and Statistics, Concordia University	<b>Jan. 2009</b>
<b>Exhibition demonstrator</b> Concordia Expo-Science, Pointe-Claire, mathematics section	<b>Nov. 2007</b>