Laurent Hébert-Dufresne

Updated June 25, 2020

PERSONAL
DETAILS

Assistant Professor
Vermont Complex Systems Center & Department of Computer Science
University of Vermont
Burlington, VT, USA

Professeur Associé
Département de Physique, de Génie Physique, et d'Optique
Université Laval
Québec, QC, Canada

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Twitter: @LHDnets
Website: http://laurenthebertdufresne.github.io/ (and my Google Scholar profile)

RESEARCH
INTERESTS

Network Theory and Modelling of Complex Systems in Biology, Epidemiology, Ecology and Sociology

PROFESSIONAL
EXPERIENCE

The University of Vermont, Burlington, Vermont
Assistant Professor, Department of Computer Science, 2018–present
Group leader, Laboratory for Structure & Dynamics, 2018–present
Faculty, The Translational Global Infectious Diseases Research Center, 2018–present
Core Team, Vermont Complex Systems Center, 2017–present

Université Laval, Québec, QC, Canada
Professeur Associé, Département de Physique, de Génie Physique, et d'Optique, 2017–present
Ph.D. in physics, 2011–2014, Advisor: Professor Louis J. Dubé
M.Sc. in physics, 2009–2011, Advisor: Professor Louis J. Dubé
B.Sc. in physics, 2006–2009, concentration in theoretical physics

Network Science Society
Board Member & Conference Oversight Committee, 2018–present

Institute for Disease Modeling, Bellevue, Washington
Postdoctoral Researcher, 2016–2018

Santa Fe Institute (SFI), Santa Fe, New Mexico
James S. McDonnell Foundation Postdoctoral Fellow, 2014–2016
Research Fellow, 2016–2018

FUNDING &
AWARDS

Google Open Source
- Google-Vermont Partnership, PI with James Bagrow on
Open-source Complex Ecosystems And Networks (OCEAN) ($1.0M, 2019)

National Institutes of Health
- National Institute of Allergy and Infectious Diseases: Key Personnel of
"*A Phase II Evaluation of the Safety and Protective Efficacy of the Live Attenuated Tetravalent Dengue Vaccine TetraVax-DV with Challenge by the Recombinant DENV-2 Virus in a Dengue Endemic Population*" ($1.3M, 2019)
- National Institute of General Medical Sciences: Project Leader on
"*Translational research to prevent and control global infectious diseases*" (PI on $1.3M of $12.3M, 2018)

National Science Foundation
- Division of Graduate Education: co-PI of
"*NRT: Quantitative & Evolutionary STEM Training (QuEST)*" ($3M, 2018)
- Division of Mathematical Sciences: PI of
"*Network comparison, a cornerstone of the foundations of network science*" ($125K award, 2016)

Army Research Office
- Network Sciences Division: PI of
  "*Increasing Student Participation at the NetSci Conference*" ($10K award, 2019)

James S. McDonnell Foundation
- Postdoctoral Fellowship Awards in Studying Complex Systems ($200K award, 2013)

Natural Sciences and Engineering Research Council of Canada
- Alexander-Graham-Bell Graduate Scholarship ($105K award, 2011)
- Undergraduate Student Research Awards (2×$4.5K award, 2008 & 2009)

Fonds de recherche du Québec – Nature et technologies
- Doctoral research scholarship (awarded $63K, 2011)
- Masters research scholarship ($15K award, 2010)

Canadian Institutes of Health Research
- Frederick Banting and Charles Best Canada Graduate Scholarship ($17.5K award, 2009)

PUBLICATIONS   Peer-reviewed only, in reverse chronological order:

45. Samuel F. Rosenblatt, Jeffrey A. Smith, G. Robin Gauthier & **Laurent Hébert-Dufresne** (2020)
    Immunization Strategies in Networks with Missing Data.
    PLoS Comput. Biol. (in press)

44. J. Bedson, M.F. Jalloh, D. Pedi, et al., L.A. Skrip, B.M. Althouse, & **L. Hébert-Dufresne**
    Community Engagement during outbreak response: standards, approaches, and lessons from the Ebola outbreak in Sierra Leone.
    BMJ Global Health (in press)

43. **L. Hébert-Dufresne**, S. V. Scarpino & J.-G. Young (2020)
    Macroscopic patterns of interacting contagions are indistinguishable from social reinforcement.
    Nature Physics 16, 426431

42. L.A. Skrip, J. Bedson, S. Abramowitz, et al., **L. Hébert-Dufresne**, and B.M. Althouse (2020)
    Unmet needs and behavior during the Ebola response in Sierra Leone: a retrospective, mixed-methods analysis of community feedback from the Social Mobilization Action Consortium.
    Lancet Planetary Health 4(2): e74-e85

41. J. Ring IV, J.-G Young & **L. Hébert-Dufresne** (2020)
    Connected graphs with a given degree sequence: Efficient sampling, correlations, community detection and robustness.
    Proceedings of NetSci-X 2020, Springer Proceedings in Complexity. Springer, Cham

40. S. Chowdhury, **L. Hébert-Dufresne** & J. Frolik (2020)
    Effective Implementation of Energy Aware Polarization Diversity for IoT Networks Using Eigenvector Centrality.
    Proceedings of NetSci-X 2020, Springer Proceedings in Complexity. Springer, Cham

39. J.-G. Young, G. St-Onge, E. Laurence, C. Murphy, **L. Hébert-Dufresne** & P. Desrosiers (2019)
    Phase transition in the recoverability of network history.
    Phys. Rev. X 9, 041056

38. 72 Hours of Science event (2019)
    Dynamics of beneficial epidemics.
    Scientific Reports, 9, 15093

37. **L. Hébert-Dufresne** & A. Allard (2019)
    Smeared phase transitions in percolation on real complex networks.
    Phys. Rev. Research, 1, 013009

36. E. Libby, **L. Hébert-Dufresne**, S.-R. Hosseini & A. Wagner (2019)
    Syntrophy emerges spontaneously in complex metabolic systems.
    PLOS Comput Biol 15(7): e100716

35. G. St-Onge, J.-G. Young, **L. Hébert-Dufresne** & L. J. Dubé (2019)
    Efficient sampling of spreading processes on complex networks using a composition and rejection algorithm.
    Comput. Phys. Commun. 240: 30-37

34. A. Allard & **L. Hébert-Dufresne** (2019)
    Percolation and the effective structure of complex networks.
    Phys. Rev. X, 9, 011023

33. M. Price, A. C. Legrand, Z. M.F. Brier & **L. Hébert-Dufresne** (2019)
    The Symptoms at the Center: Examining the Comorbidity of Posttraumatic Stress Disorder, Generalized Anxiety Disorder, and Depression with Network Analysis.
    Journal of Psychiatric Research 109: 52-58

32. **L. Hébert-Dufresne**, A. F. A. Pellegrini, U. Bhat, S. Redner, S. W. Pacala & A. Berdahl (2018)
Edge fires drive the shape and stability of tropical forests.
Ecology Letters, 21, 794-803

31. A. Allard, B. M. Althouse, S. V. Scarpino & **L. Hébert-Dufresne** (2017)
Asymmetric percolation drives a double transition in sexual contact networks
Proc. Natl. Acad. Sci. U.S.A., 114(34), p.8969-8973

30. A. Allard, B. M. Althouse, **L. Hébert-Dufresne** & S. V. Scarpino (2017)
The risk of sustained sexual transmission of Zika is underestimated
PLOS Pathogens, 13(9): e1006633

29. **L. Hébert-Dufresne**, A. Allard, P.-A. Noël, J.-G. Young & E. Libby (2017)
Strategic tradeoffs in competitor dynamics on adaptive networks.
Scientific Reports, 7, 7576

28. J.-G. Young, P. Desrosiers, **L. Hébert-Dufresne**, E. Laurence & L. J. Dubé (2017)
Finite-size analysis of the detectability limit of the stochastic block model.
Phys. Rev. E, 95, 062304

27. U. Bhat, M. Shrestha & **L. Hébert-Dufresne** (2017)
Exotic phase transitions of k-cores in clustered networks.
Phys. Rev. E, 95, 012314

26. S. V. Scarpino, A. Allard & **L. Hébert-Dufresne** (2016)
The effect of a prudent adaptive behaviour on disease transmission.
Nature Physics, 12, 1042-1046

25. **L. Hébert-Dufresne**, J. A. Grochow & A. Allard (2016)
Network structure at multiple scales via a new network statistic: the onion decomposition.
Scientific Reports, 6, 31708

24. J.-G. Young, **L. Hébert-Dufresne**, A. Allard & L. J. Dubé (2016)
Growing networks of overlapping communities with internal structure.
Phys. Rev. E, 94, 022317

23. **L. Hébert-Dufresne**, A. Allard, J.-G. Young & L. J. Dubé (2016)
Constrained growth of complex scale-independent systems.
Phys Rev E, 93, 032304

22. **L. Hébert-Dufresne** & B. M. Althouse (2015)
Complex dynamics of synergistic coinfections on realistically clustered networks.
Proc. Natl. Acad. Sci. U.S.A., 112(33), p.10551-10556

21. B. M. Althouse *et al.* (2015)
Enhancing disease surveillance with novel data streams: challenges and opportunities.
EPJ Data Science 4:17

20. A. Allard, **L. Hébert-Dufresne**, J.-G. Young, & L. J. Dubé (2015)
General and exact approach to percolation on random graphs.
Phys Rev E, 92, 062807

19. **L. Hébert-Dufresne**, E. Laurence, A. Allard, J.-G. Young & L. J. Dubé (2015)
Complex networks as an emerging property of hierarchical preferential attachment.
Phys Rev E, 92, 062809

18. J.-G. Young, A. Allard, **L. Hébert-Dufresne** & L. J. Dubé (2015)
A shadowing problem in the detection of overlapping communities.
PLOS ONE, 10(10): e0140133

17. **L. Hébert-Dufresne**, V. Marceau, P.-A. Noël, A. Allard & L. J. Dubé (2014)
The Social Zombie: modelling undead outbreaks on social networks.
Mathematical Modelling of Zombies. Robert Smith?, ed.
University of Ottawa Press.

16. B. M. Althouse & **L. Hébert-Dufresne** (2014)
Epidemic cycles driven by host behavior.
J. R. Soc. Interface, 11, 20140575

15. A. Allard, **L. Hébert-Dufresne**, J.-G. Young & L. J. Dubé (2014)
Coexistence of phases and the observability of random graphs.
Phys. Rev. E, 89, 022801

14. P.-A. Noël, A. Allard, **L. Hébert-Dufresne**, V. Marceau & L. J. Dubé (2014)
Epidemics on contact networks: a general stochastic approach.
J Math Biol, 69(6), p.1627-1660

13. **L. Hébert-Dufresne**, A. Allard, J.-G. Young & L. J. Dubé (2013)
Percolation on random networks with arbitrary k-core structure.
Phys Rev E, 88, 062820

12. **L. Hébert-Dufresne**, A. Allard, J.-G. Young & L. J. Dubé (2013)
Global efficiency of local immunization on complex networks.
Scientific Reports, 3, 2171

11. **L. Hébert-Dufresne**, O. Patterson-Lomba, G. M. Goerg & B. M. Althouse (2013)
Pathogen mutation modeled by competition between site and bond percolation.
Phys Rev Lett, 110, 108103

10. B. M. Althouse, O. Patterson-Lomba, G. M. Goerg & **L. Hébert-Dufresne** (2013)
Targeting and timing of treatment influences the emergence of influenza resistance in structured populations.
PLOS Comput Biol, 9(2), e1002912

9. O. Patterson-Lomba, B. M. Althouse, G. M. Goerg & **L. Hébert-Dufresne** (2013)
Optimizing treatment regimes to hinder antiviral resistance in influenza across time scales.
PLOS ONE 8(3): e59529

8. **L. Hébert-Dufresne**, A. Allard, V. Marceau, P.-A. Noël & L. J. Dubé (2012)
Stochastic process for the growth of scale-free, modular and self-similar systems.
Phys Rev E, 85, 026108

7. A. Allard, **L. Hébert-Dufresne**, P.-A. Noël, V. Marceau & L. J. Dubé (2012)
Bond percolation on a class of correlated and clustered random graphs.
J. Phys. A: Math. Theor. 45, 405005

6. A. Allard, **L. Hébert-Dufresne**, P.-A. Noël, V. Marceau & L. J. Dubé (2012)
Exact solution of bond percolation on small arbitrary graphs.
EPL, 98, 16001

5. P.-A. Noël, A. Allard, **L. Hébert-Dufresne**, V. Marceau & L. J. Dubé (2012)
Propagation on networks: an exact alternative perspective
Phys Rev E, 85, 031118

4. **L. Hébert-Dufresne**, A. Allard, V. Marceau, P.-A. Noël & L. J. Dubé (2011)
Structural preferential attachment: Network organization beyond the link.
Phys Rev Lett, 107, 158702

3. V. Marceau, P.-A. Noël, **L. Hébert-Dufresne**, A. Allard & L. J. Dubé (2011)
Modeling the dynamical interaction between epidemics on overlay networks.
Phys Rev E, 84, 026105

2. V. Marceau, P.-A. Noël, **L. Hébert-Dufresne**, A. Allard & L. J. Dubé (2010)
Adaptive networks: coevolution of disease and topology.
Phys Rev E, 82, 036116

1. **L. Hébert-Dufresne**, P.-A. Noël, V. Marceau, A. Allard & L. J. Dubé (2010)
Propagation dynamics on networks featuring complex topologies.
Phys Rev E, 82, 036115

Other writings

- **L Hébert-Dufresne** & V. Chuqiao Yang (2020)
Misinformation about an outbreak like COVID-19 is important public health data.
STAT, April 7 2020

- G. St-Onge, V. Thibeault, A. Allard, L. J. Dubé & **L. Hébert-Dufresne** (2020)
COVID-19: Cancel your next large event, and tell your friends to cancel theirs.
Medium, March 14 2020

OTHER
SCIENTIFIC
ACTIVITIES

Publishing and funding agencies

- Editor for PLOS Complexity Channel (2018–present)
- Review panels for National Science Foundation.
- Guest editor for Science Advances
- Reviewer for: PNAS, Nature Communications, Science Advances, Physical Review X, Physical Review E, Physical Review Letters, Journal of the Royal Society Interface, PLOS Computational Biology, PLOS ONE, Scientific Reports, Journal of Complex Networks, Chaos, Entropy, IEEE Transactions on Neural Networks and Learning Systems, Wiley textbooks, DEDS, Journal of Physics A, Physics Letters A

Conferences

- Director of the "Complex Networks Winter Workshop" in Melbourne, Australia (Jul. 2021)
- Organizer of "*Dynamics of Interacting Contagions*", SFI (Nov. 2020).
- Director of the "Complex Networks Winter Workshop" in Québec City (Dec. 2018, 2019, 2020)
- Co-organizer of "ALife 2020" in Montréal, Québec, Canada (July 2020)
- Chair of "NetSci 2019" in Burlington VT (May 2019)
- Co-organizer of "Symposium on the Science of Stories" in Burlington VT (Oct. 2018)
- Co-organizer of "Symposium on Health & Wellness Behavior" in Burlington VT (Sep. 2018)
- Organizer of "Contagion on Networks 2018", Paris (Jun. 2018).
- Organizer of "Contagion on Networks 2017", Indianapolis (Jun. 2017).
- Organizer of "*Strategies in Adaptive Systems*", SFI (Jan. 2017).
- Organizer of "*Studying the Interplay of Hard Modularity and Dynamics*", SFI (Jan. 2016).
- Organizer of "*From Co-Infection to Cultural Dissonance*", SFI (Sep. 2013).

Program committees

- "2020 Spring Simulations Conference", Fairfax VA (May 2020).
- "The 8th International Workshop on Complex Networks", Lisbon, Portugal (Dec. 2019).
- "NERCCS2019", Binghamton NY (Apr. 2019).
- "COMPLENET'19", Tarragona, Spain (Mar. 2019).
- "Conference on Complex Systems 2018", Thessaloniki, Greece (Sep. 2018).
- "International Conference on Complex Systems 2018", Cambridge MA (July 2018).
- "The 7th International Workshop on Complex Networks", Campbridge UK (Dec. 2018).
- "IC2S2 2018", Evanston IL (Jul. 2018).
- "SIAM Workshop on Network Science", Portland OR (Jul. 2018).
- "NetSci 2018", Paris, France (Jun. 2018).
- "The 6th International Workshop on Complex Networks", Lyon, France (Dec. 2017).
- "9th International Conference on Social Informatics", Oxford, UK (Sep. 2017).
- "Conference on Complex Systems 2017", Cancun, Mexico (Sep. 2017).
- "NetSci 2017", Indianapolis IN (Jun. 2017).
- "The 5th International Workshop on Complex Networks", Milan, Italy (Dec. 2016).

OTHER
EXPERIENCES

Teaching

- (2020–present) CS/CSYS 395: Data Lab
- (2018–present) CS/CSYS 302: Modeling Complex Systems
- (2018–present) CS/CSYS 295: Algorithms for Complex Networks
- (2017–present) Co-PI and Leadership team of NRT: Quantitative & Evolutionary STEM Training.
- (2015–2016) Tutorial series on Graphs and C++, Santa Fe Institute's REU program
- (2015) Statistical Physics and Networks, Complex Systems Winter School, IISER Mohali, India

Academic mentorship

- (2020–present) John Meluso, OCEAN postdoctoral fellow
- (2020–present) Andrea Allen, complex systems and data science M.Sc
- (2020–present) Nicholas Roberts, complex systems Ph.D. student
- (2020–present) Milo Trujillo, complex systems Ph.D. student
- (2019–present) Connor Klopfer, complex systems and data science M.Sc
- (2019–present) Mariah Boudreau, mathematics Ph.D. student
- (2019–present) Blake Williams, complex systems and data science M.Sc
- (2018–present) Alexander Daniels, complex systems Ph.D. student
- (2018–present) Brendan Case, computer science Ph.D. student
- (2018–present) Samuel F. Rosenblatt, computer science Ph.D. student
- (2018–present) Guillaume St-Onge, physics & computer science Ph.D. student
- (2018–2019) Blake Williams, mathematics undergraduate honor thesis, thesis: *Analysis and modeling of the genotype network of Influenza.*
- (2016–2017) Andrea Allen, mathematics undergraduate student, project: *Quantifying chronology in temporal networks with an epidemic diffusion approach to network comparison.*
- (2015–2017) Maurice Bokanga, computer science undergraduate student, project: *Using mobility data to redefine cities and their structure.*
- (2014–2015) Christopher LeSueur, high-school student, project: *Graph structure of trades between sports teams reflects a collective assessment of performance.*

Volunteering

- (2018–present) Lecture series organizer, Research Jams, at the Vermont Complex Systems Center
- (2014–2016) Lecture series organizer, Reckless Ideas, at the Santa Fe Institute.
- (2014–2015) Research mentorship for high-school students via inspire Santa Fe.
- (2014–2015) Science fair judge, via The Santa Fe Alliance for Science.
- (2011–present) Online mentorship for high-school students via Academos Cybermentorat.

Talks and invited lectures

- Introduction & Tutorial to Network Epidemiology.
  net-COVID, Online Workshop (invited 2020).
- Quantifying human behavior in network epidemiology.
  Université de Sherbrooke, Sherbrooke QC (invited 2019)
  Institute for Disease Modeling, Bellevue WA (invited 2019)
  Harvard T.H. Chan School of Public Health, Boston MA (invited 2019)
  University of Michigan, Center for the Study of Complex Systems, Ann Arbor MI (invited 2019)
  Santa Fe Institute, Santa Fe NM (invited 2018).
- Sequential phase transitions in percolation on complex networks.
  NetSci 2018 International conference, Paris, France. (talk)
- Interacting simple contagions are complex contagions.
  Networks in Disease Ecology, Paris, France. (invited 2018)
- Spread of Viruses and Ideas in the Age of Echo Chambers.
  Reckless Idea Lecture Series, Burlington VT. (invited 2018)
- Asymmetric percolation drives a double transition in sexual contact networks.
  NetSci 2017 International conference, Indianapolis, Indiana. (talk)
- Symposium on Systems and Design Thinking, Royal Military College Saint-Jean. (invited panelist)
- Network Comparison.
  University of Vermont's Complex Systems Center, Burlington VT. (invited 2017)
  University of Colorado Boulder, Boulder CO. (invited 2017)
- Unexpected consequences of human behavior in network epidemiology.
  BioFrontiers Institute, Boulder CO. (invited 2017)
  Institute for Systems Biology, Seattle WA. (invited 2017)
- Multi-scale network analysis and reconstruction via a new statistic: The onion decomposition.
  NetSci 2016 International conference, Seoul, Korea. (talk)
- Strategic tradeoffs in competitor dynamics on adaptive networks.
  NetSci 2016 International conference, Seoul, Korea. (talk)
  Women Corporate Directors Foundation. (invited 2016)
- Disease dynamics in 2016 (invited series with Daniel B. Larremore).
  SFI's President Circle.
  Los Alamos Rotary Club.
  Christus St. Vincent Medical Center.
- Complex dynamics of synergistic coinfections on realistically clustered networks.
  Conference on Complex Systems 2015, Tempe AZ. (talk)
  Departament de Física Fonamental, Universitat de Barcelona, Barcelona, Spain. (invited 2015)
  Institute for Scientific Interchange, Turin, Italy. (invited 2015)
  NetSci 2015 International conference, Zaragoza, Spain. (talk)
- Epidemic cycles driven by host behaviour.
  Dynamics of and on networks, Santa Fe NM (invited 2014)
- Complex networks are an emerging property of hierarchical preferential attachment.
  Santa Fe Institute, Santa Fe NM (invited 2014)
  NetSci 2014 International conference, Berkeley CA. (outstanding poster)
- Hard-core random networks.
  NetSci 2013 International conference, Copenhagen, Denmark. (talk)
- On the constrained growth of complex systems.
  COMPLEX 2012, Santa Fe NM. (talk)
- Global efficiency of local immunization.
  NetSci 2012 International conference, Chicago IL. (poster)
- Structural preferential attachment.
  NetSci 2011 International conference, Budapest, Hungary. (talk)
- Propagation dynamics on complex topologies.
  NetSci 2010 International conference, Boston MA. (poster)

VARIA

Society membership

- Network Science Society
- Complex Systems Society

A few examples of media coverage (on me or my work or my research groups)

- L'épidémie s'essouffle, l'espoir revient. *Le Figaro*, 2020
- Des chercheurs revoient le seuil d'immunité collective à la baisse. *Mediapart*, 2020
- How memes and social media shape the spread of coronavirus. *cnet*, 2020
- State ramps up contact tracing teams to contain Covid-19. *VTDigger*, 2020
- How large a gathering is too large during the coronavirus pandemic? *Science News*, 2020
- Get the Message. *Santa Fe Reporter*, 2020
- No, a Border Wall Won't Stop Coronavirus. *Wired*, 2020
- What viral internet memes may tell us about Covid-19's spread. *New Zealand Herald*, 2020
- To prevent collapse of tropical forests, protect their shape. *Yahoo! News*, 2018.
- Warmer weather could bring fresh Zika misery. *New Scientist*, 2017.
- Going Home Sick? Your Substitute Could Spread Disease More Widely. *Smithsonian*, 2016.
- Send your sick colleague home — but dont hire a replacement. *Nature Microbiology*, 2016.
- Sending Sick Workers Home Makes More Workers Sick. *gizmodo*, 2016.
- Substitute teachers, nurses may further spread illness, study suggests. *Fox News*, 2016.
- How Staying Home From Work Can Spread Disease. *Pacific Standard*, 2016.
- Disease outbreaks partially fueled by replacement employees. *Physics Today*, 2016.
- Las sustituciones de bajas por gripe podran acelerar la transmisin de la enfermedad. *El Mundo*, 2016 (Spanish).
- Using substitute workers for sick staff spreads disease, study finds. *The Irish Times*, 2016.
- Why Beneficial Epidemics Spread More Quickly than Harmful Ones. *MIT Technology Review*, 2016.
- APS editor's suggestion for: Constrained growth of complex scale-independent systems. *PRE Highlights*, March 2016.
- When Things Go Viral and Everybody Wins. *gizmodo*, 2016.
- 1+1=3. *brand eins*, 2015 (German).
- Using patients' trail of digital crumbs for public health surveillance. *Phys.org*, 2015.
- Can social isolation fuel epidemics? *MedicalXpress*, 2015.
- Un physicien bien réseauté. *Le Soleil*, 2013 (French).
- Poverty Escape Plan Revealed by Computer Model of Economic Vicious Cycles, *The Physics arXiv*, 2013.
- De Facebook aux Misérables. *Au fil des évènements*, 2011 (French).

Other interests

- Biking, hiking, snow-shoeing, music, cooking, whiskey, coffee and French pastries!