

Contreras Castillo, Carlos

CONTACT INFORMATION

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in carloscontrerasc

EDUCATION

University of Alberta, Edmonton, AB, Canada

PhD, Applied Mathematics, September 2013 – March 2020

- Thesis title: Mathematical modelling of the effect of low-dose radiation on the G2/M transition and survival fraction via the ATM-Chk2 pathway
 - Supervisor: Dr. Gerda de Vries, gerda.devries@ualberta.ca
 - Co-supervisor: Dr. Gustavo Carrero, gustavoc@athabascau.ca

MSc, Master in Mathematics, February 2012

- Academic major: Mathematical Modelling
- With honour awards
- Thesis Topic: *Cellular Systems Biology*
 - Supervisor: Dr. Minaya Villasana, mvillasa@usb.ve
 - Co-supervisor: Dr. Gustavo Carrero, gustavoc@athabascau.ca

BSc, Mathematics (Applied to Statistics and Computational Mathematics), September 2009

- Thesis Topic: *Numerical Analysis and Inverse Problems*
- Supervisor: Dr. René Escalante, rescalante@usb.ve
- Exchange student at Universidad de Zaragoza (Sept. 2007 – Sept. 2008)

EXPERIENCE

University of Alberta, Edmonton, Canada

Postdoctoral Fellow - Researcher

August 2020 to present

- COVID-19 research focused on the immune response of the body to coronavirus.
- Development of a classification tool of COVID-19 patients by risk of morbidity based on worldwide data.
- Development and numerical implementation of a standard virus load function.
- Modelling of the dynamics of SARS-Cov-2 and its interaction with the lungs, heart, kidneys and other organs to predict mortality risk in severe COVID-19 infections.
- Modelling of the effect of low-dose radiation of the cell cycle and the cell survival.
- Development of a novel concept in Dynamical Systems: the persistence of a bifurcation after transforming a parameter into a variable.
- Supervise an undergraduate student on their term research project. Research topic: Machine Learning to predict morbidity risk in COVID-19 patients in Canada.
- Supervisors: Dr. Thomas Hillen, Dr. Jay Newby, Dr. Gerda de Vries, and Dr. Gustavo Carrero.

Assistant Lecturer

January 2019 to August 2020

- MATH 134 Calculus I for Life Sciences. Lectures, preparation of support material including lectures notes, detailed solution problems, and topic summaries.
- MATH 201 Differential Equations. Second year course for engineering students. Lectures, preparation of support material including lectures notes, detailed solution problems, and topic summaries.
- MATH 300 Advanced Boundary Value Problems I. Third year course for engineering students. Lectures, preparation of support material including lectures notes and videos. Design of commulative and formative assessments.

Teaching Assistant

September 2013 to present

- MATH 201 Second year differential equations course for engineering students. Preparation of support material including detailed solution problems, class notes, and topic summaries.
- MATH 100, MATH 101 First year calculus courses for engineering students.
- STAT 235 Second year statistics Laboratory for engineering students.

Syndemedic, Edmonton, AB, Canada

Researcher and software developer

December 2016 to December 2017

- Implementation of mathematical techniques and creation of output movies using Python, PyMol, and MongoDB.

Universidad Simón Bolívar, DACE, Caracas, Venezuela

Data Analyst and Software Developer

September 2011 to July 2012

- Data collection, descriptive data analysis, prediction of student performance, and automation of output reports for admission test results at the Universidad Simón Bolívar. Implementation in Matlab and L^AT_EX.

Universidad Simón Bolívar, Caracas, Venezuela

Assistant professor

January 2013 to July 2013

- Lecturer for CO2111: *Cómputo Científico I* (introductory programming course).
- Laboratory instructor for CO5211: *Cálculo Numérico* (numerical methods).

Teaching assistant

September 2009 to December 2012

Instructor for second year introductory programming, third year numerical methods and statistics courses for engineering and mathematics students.

AWARDS

- 2019 Graduate Student Teaching Award, University of Alberta, April 2018.
- 2015 Graduate Student Teaching Award, University of Alberta, March 2015.
- 1st place at the PIMS International Graduate Training Center Program, Poster Competition. Summit 2013, Naramata–Canada, October 2012.

SCHOLARSHIPS

- Completion of the PIMS Industrial Workshop “Math to the power industry” 2020, August 2020. Industrial partner: Aerium Analytics.
- PIMS Student Training Acceleration Award, University of Alberta, June 2018. Amount: \$ 4,000.
- Pundit RD Sharma Memorial Graduate Award in Mathematical Sciences, Spetember 2013. Amount: \$ 1,500.
- University of Alberta Doctoral Recruitment Scholarship, September 2013. Amount: \$ 5,000.
- [Emerging Leader of las Americas Program \(ELAP\)](#), August 2012. Amount: \$ 10,000.
- Fellowship in the PIMS International Graduate Training Centre (IGTC) in Mathematical Biology, March 2012. *Declined*.
- Completion of the [7th Mathematical Biology Summer Workshop](#), University of Alberta. May 2010. Travelling expenses covered.

PUBLICATIONS

- Contreras C., Carrero G., and de Vries, G. (2021). *Carryover of a saddle-node bifurcation after transforming a parameter into a variable*. Preprint.
- Contreras, C., Newby, J.M., Hillen, T. (2021). *Personalized Virus Load Curves for Acute Viral Infections*. *Viruses*, 13(9), 1815.
- Contreras, C., Carrero, G., and de Vries, G. (2019). *A Mathematical Model for the Effect of Low-Dose Radiation on the G2/M Transition*. *Bulletin of Mathematical Biology*.

- Contreras, C., Villasana, M., Hendzel, M. J., and Carrero, G. (2018). *Using a model comparison approach to describe the assembly pathway for histone H1*. PLOS ONE, 13(1), e0191562.
- Carrero, G., Contreras, C., and Hendzel, M. J. (2011). *Visualizing the distribution of proteins and estimating their kinetic parameters using Virtual Photoactivated Fluorescence (VPAF)*. GSTF Journal of BioSciences, 1(1), 27–35.

IMPORTANT COURSES TAKEN

- MATH 524 Ordinary Differential Equations. University of Alberta.
- MATH 527 Intermediate Partial Differential Equations. University of Alberta.
- MATH 536 Numerical Solutions of Partial Differential Equations. University of Alberta.
- MATH 538 Techniques of Applied Mathematics. University of Alberta.
- CMPUT 551 Topics in Artificial Intelligence: Machine Learning. University of Alberta.
- STAT 441/505 Applied Statistical Methods for Data Mining. University of Alberta.
- STAT 566 Methods in Statistical Inference. University of Alberta.

RESEARCH INTERESTS

Mathematical Biology, Cell Biology, Machine Learning, Statistical Analysis, Programming, Optimization, Numerical Methods.

TECHNICAL SKILLS

Preferred programming and mathematical software: Julia, Python, R Project, C, Fortran, Matlab, Sage, Maple, L^AT_EX, SQL, MongoDB, Vim. Unix operation systems.

INVITED PRESENTATIONS

Contreras, C., Carrero, G., and G. de Vries. A mathematical model for the effect of low-dose radiation on the G2 checkpoint. *CAIMS Annual Meeting 2018*. Ryerson University, Toronto, ON, Canada. June 3-7, 2018.

PRESENTATIONS AND POSTERS

- Contreras, C., Newby, J.M., and Hillen, T. Personalized Virus Load Curves of SARS-CoV-2 Infection. *Society of Mathematical Biology 2021*. Online due to COVID. Minisymposium.
- Contreras, C. and Carrero, G., and de Vries, G. Modelling the effect of low-dose radiation on the G2/M transition. *Athabasca University Graduate Students Conference 2018*. Edmonton, AB, Canada 2021. Short talk.
- Contreras, C. and Carrero, G., and de Vries, G. Understanding the cell survival fraction of irradiated cells through cell cycle modelling. *PIMS Graduate Summit in Mathematical Biology and Applied PDE*. Jasper, AB, Canada. May 25-28, 2017. Poster.
- Contreras, C. and Carrero, G., and de Vries, G.. Understanding the cell survival fraction of irradiated cells through cell cycle modelling. *Séminaire de Mathématiques Supérieures 2016: Biological Dynamics*. University of Alberta, Edmonton, AB, Canada. May 30-June 10, 2016. Poster.
- Contreras, C. and Carrero, G.. A Three Population Model for Quantifying Changes in Linker Histone Dynamics: Its Application After Acetylation and Its Simplification. *International Symposium on Biomathematics and Ecology Education and Research 2015*. Illinois State University, Normal, IL, USA. October 2015. Short Talk.
- Contreras, C. and Carrero, G.. An asymptotic analysis on Histone H1 rapid interactions in living cells. *11th PIMS Young Researchers Conference 2014*. University of British Columbia, Vancouver, BC, Canada. June 2-4, 2014. Short talk.

- Contreras, C., Villasana, M., Hendzel, M., and Carrero, G.. Understanding the binding pathway of histone H1 using model comparison and FRAP experiments. *2013 PIMS Intenational Graduate Training Center Summit*. Banff, AB, Canada. November 8-10, 2013. Poster (*best poster award*).
- Contreras, C., Carrero, G., Villasana, M., and Hendzel, M. Comparación de modelos para describir el mecanismo de asociación de la histona H1. *IX Jornadas de Aplicaciones Matemáticas*. Valencia, Venezuela. May 18-20, 2011. Short talk.
- Contreras, C., Carrero, G., Villasana M., and Hendzel, M. Describing the binding mechanism of histone H1 using a system of reaction-diffusion equations and FRAP experiment. *International Conference on Applied Mathematics and Informatics ICAMI 2010*. San Andres, Colombia. November 29-December 3, 2010. Short talk.
- Contreras, C. and Escalante, R. Método de Landweber versus Métodos de Proyecciones Alternas en Recuperación de Señales. *VII Jornadas de Aplicaciones Matemáticas*. Valencia, Venezuela. October 2009. Short talk.

VOLUNTEERING
EXPERIENCE

Postdoctoral Fellows Association, Edmonton, AB, Canada

Member-at-large

November 2020 to present

- Support the executive with counseling and organization of meetings and tasks.
- Social media curator.

Strathcona Housing Co-op, Edmonton, AB, Canada

VP Maintenance

June 2018 to June 2020

- Responsible for the administration, repair, and improvement of interior and exterior facilities.
- Maintenance committee leader and Board Director member.
- Developpe annual maintenance budget.
- Report to general membership during quarterly General Meetings.

Member-at-large

June 2017 to June 2018

- Counsel and support to Board of Directors.
- Organize and chair meetings as needed.

Edmonton Bicycle Commuters Society, Edmonton, AB, Canada

Mechanic and host

May 2016 to present

- Assist clients with the repair of their bicycles and purchase of bicycles at the store.
- Repair and general maintenance of bicycles.