

# Leonardo Collado-Torres

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## Education

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**Johns Hopkins Bloomberg School of Public Health**

*PhD in Biostatistics*

**Baltimore, US**

*2011-present*

**National Autonomous University of Mexico (UNAM)**

*Bachelor in Genomic Sciences (LCG), Grade 9.71/10*

**Cuernavaca, MX**

*2005-2009*

**ITESM Campus Cuernavaca**

*High school, Grade 97.8/100*

**Cuernavaca, MX**

*2002-2005*

## PhD thesis

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**Title:** *Annotation-Agnostic Differential Expression and Binding Analyses.*

**Advisors:** **Jeffrey T. Leek** and **Andrew E. Jaffe.**

**Description:** The goal is to develop statistical methods and software that enable researchers to differentiate the sources of variation observed in RNA-seq while minimizing the dependence on known annotation. This will allow researchers to correct for technological variation and study the biological variation driving their phenotype of interest. Then apply these methods to further our understanding of neuropsychiatric disorders using the Lieber Institute for Brain Development human brains collection (> 1000 samples).

## Honors and awards

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**2011:** Awarded CONACyT Mexico scholarship for PhD studies outside Mexico.

**2009:** *Summa Cum Laude* for bachelor in Genomic Sciences studies at LCG-UNAM.

**2005:** Best high school average (~ 200 students): awarded ITESM system 90% scholarship for college studies, declined to join LCG-UNAM.

## Experience

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Industry.....

### Winter Genomics

Cuernavaca, MX

*Scientific executive*

2009–2011

Responsible for recruiting and hiring new personnel, overseeing and supervising bioinformaticians, training new employees, writing research reports and presenting them to colleagues, and organizing all scientific projects.

- First scientific staff member at Winter Genomics;
- Projects completed:
  - de novo genome assembly simulations,
  - assembly and annotation of the *phiVC8* bacteriophage genome,
  - integrated analysis of more than 20 RNA-seq samples for determination of transcription initiation in *Escherichia coli* reported in Gama-Castro et al., PMID 21051347,
  - de novo assembly of four *Escherichia coli* strains and lead to Aguilar et al., PMID 22884033;
- Designed training material for new employees.

Research.....

### Enrique Morett lab

IBT-UNAM, Cuernavaca, MX

*Bioinformatician*

2009–2011

Identified transcriptions start sites and transcription units in *Escherichia coli* and *Geobacter sulfurreducens* with RNA-seq data. Developed the *BacterialTranscription* R package.

### Guillermo Dávila lab

CCG-UNAM, Cuernavaca, MX

*Undergraduate research assistant*

2007–2009

Determined bacteriophage ecological groups by developing a method based on codon distribution of all phage sequenced genomes. Joint work with Sur Herrera Paredes.

### Roberto Kolter lab

Harvard, Boston, US

*Undergraduate research assistant*

2007

Supervisor: Elizabeth Shank. Carried out screenings to identify bacteria that activate the production of exopolysaccharide through the activation of the gene *tasA* in *Bacillus subtilis*.

## Publications

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Peer-reviewed.....

1. **Collado-Torres L**, Jaffe AE and Leek JT. regionReport: Interactive reports for region-based analyses. *F1000Research* 2015, 4:105. doi: 10.12688/f1000research.6379.1.
2. Jaffe AE, Shin J, **Collado-Torres L**, Leek JT, et al. Developmental regulation of human cortex transcription and its clinical relevance at single base resolution. *Nat. Neurosci.* 2015. doi: 10.1038/nn.3898.
3. Shank EA, Klepac-Ceraj V, **Collado-Torres L**, Powers GE, Losick R, Kolter R. Interspecies interactions that result in *Bacillus subtilis* forming biofilms are mediated mainly by members of its own genus. *Proc. Natl. Acad. Sci. U.S.A.* 2011 Nov;108(48):E1236–1243. doi: 10.1073/pnas.1103630108.
4. Gama-Castro S, Salgado H, Peralta-Gil M, Santos-Zavaleta A, Muñoz-Rascado L, Solano-Lira H, Jimenez-Jacinto V, Weiss V, García-Sotelo JS, López-Fuentes A, Porrón-Sotelo L, Alquicira-Hernández S, Medina-Rivera A, Martínez-Flores I, Alquicira-Hernández K, Martínez-Adame R, Bonavides-Martínez C, Miranda-Ríos J, Huerta AM, Mendoza-Vargas A, **Collado-Torres L**, Taboada B, Vega-Alvarado L, Olvera M, Olvera L, Grande R, Morett E, Collado-Vides J. RegulonDB

version 7.0: transcriptional regulation of Escherichia coli K-12 integrated within genetic sensory response units (Gensor Units). *Nucleic Acids Res.* 2011 Jan;39(Database issue):D98–105. doi: 10.1093/nar/gkq1110.

Pre-prints.....

1. Nellore A, Jaffe AE, Fortin JP, Alquicira-Hernández J, **Collado-Torres L**, Wang S, Phillips RA, Karbhari N, Hansen KD, Langmead B, Leek JT. Human splicing diversity across the Sequence Read Archive. *bioRxiv* 038224 (2016). doi: 10.1101/038224.
2. Nellore A, **Collado-Torres L**, Jaffe AE, Morton J, Pritt J, Alquicira-Hernández J, Leek JT, Langmead B. Rail-RNA: Scalable analysis of RNA-seq splicing and coverage. *bioRxiv* 019067 (2015). doi: 10.1101/019067.
3. **Collado-Torres L**, Jaffe AE, Leek JT. regionReport: Interactive reports for region-based analyses. *bioRxiv* 016659 (2015). doi: 10.1101/016659.
4. **Collado-Torres L**, Frazee AC, Love MI, Irizarry RA, Jaffe AE, Leek JT. derfinder: Software for annotation-agnostic RNA-seq differential expression analysis. *bioRxiv* 015370 (2015). doi: 10.1101/015370.

Books.....

1. Frazee AC, **Collado-Torres L**, Jaffe AE, Langmead B, Leek JT. Measurement, Summary, and Methodological Variation in RNA-sequencing in Statistical Analysis of Next Generation Sequencing Data, *Springer*, 2014, 115-128.

## Public profiles

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**Google Scholar:** h57-MykAAAAJ

**ORCID:** 0000-0003-2140-308X

**Impactstory:** 0000-0003-2140-308X

**GitHub:** lcolladotor

**Twitter:** fellgernon

**SlideShare:** lcolladotor

**LinkedIn:** lcollado

**Epernicus:** lc40

## Professional service

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Develop and maintain open-source biostatistical software.

Peer review.....

**Bioinformatics:** Since 2015

**Biostatistics:** Since 2013

## Professional memberships

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**2015-2016:** American Statistical Association

**2014-2016:** ENAR student member

2014: American Public Health Association

## Presentations

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Talks at conferences.....

**2016: Collado-Torres L**, et al. Annotation-agnostic differential expression analysis, *ENAR*, Austin – US. (slides)

**2015: Collado-Torres L**, Frazee AC, Love MI, Irizarry RA, Jaffe AE, Leek JT. Annotation-agnostic differential expression analysis, *Genomics and Bioinformatics Symposium*, Center for Computational Genomics, Hopkins, Baltimore – US.

**2015: Jaffe AE**, Shin J, **Collado-Torres L**, Leek JT, et al. Dissecting human brain development at high resolution using RNA-seq, *ENAR*, Miami – US. (slides)

**2014: Jaffe AE**, Shin J, **Collado-Torres L**, Leek JT, et al. Developmental regulation of human cortex transcription at base-pair resolution, *is3b: 1st International Summer Symposium on Systems Biology*, INMEGEN, Mexico City – MX.

**2014: Collado-Torres L**, Frazee AC, Love MI, Irizarry RA, Jaffe AE, Leek JT. Fast differential expression analysis annotation-agnostic across groups with biological replicates, LCG 10 year anniversary, LCG-UNAM, Cuernavaca – MX.

**2013: Collado-Torres L**, Frazee AC, Irizarry RA, Jaffe AE, Leek JT. Differential expression analysis of RNA-seq data at base-pair resolution in multiple biological replicates, *useR2013*, Albacete – Spain.

**2010: Collado-Torres L**, Reyes-Quiroz A, Cuéllar-Partida G, Moreno-Mayar V, Vargas-Chávez C, Collado-Vides J. BacterialTranscription: a R package to identify Transcription Start Sites and Transcription Units, *Bioconductor Developer Meeting*, EMBL, Heidelberg – Germany.

Posters.....

**2015: Collado-Torres L**, Frazee AC, Love MI, Irizarry RA, Jaffe AE, Leek JT. Annotation-agnostic RNA-seq differential expression analysis software, *ASHG2015* and *IDIES2015*, Baltimore – US.

**2014: Collado-Torres L**, Frazee AC, Love MI, Irizarry RA, Jaffe AE, Leek JT. Fast annotation-agnostic differential expression analysis, *ENAR* and *Delta Omega Poster Competition (JHBSPH)*, Baltimore – US.

**2013: Collado-Torres L**, Jaffe AE, Leek JT. Fast annotation-agnostic differential expression analysis, *Genomics and Bioinformatics Symposium*, Center for Computational Genomics, Hopkins, Baltimore – US.

**2010: Collado-Torres L**, Reyes-Quiroz A, Cuéllar-Partida A, Moreno-Mayar V, Taboada B, Vega-Alvarado L, Jiménez-Jacinto V, Mendoza-Vargas A, Grande R, Olvera L, Olvera M, Vargas-Chávez C, Juárez K, Collado-Vides J, Morett E. Global Analysis of Transcription Start Sites and Transcription Units in Bacterial Genomes, *From Functional Genomics to Systems Biology*, EMBL, Heidelberg – Germany.

**2010: Collado-Torres L**, Reyes-Quiroz A, Cuéllar-Partida A, Moreno-Mayar V, Taboada B, Vega-Alvarado L, Jiménez-Jacinto V, Mendoza-Vargas A, Grande R, Olvera L, Olvera M, Vargas-Chávez C, Juárez K, Collado-Vides J, Morett E. Global Analysis of Transcription Start Sites and Transcription Units in Bacterial Genomes, *BioC2010*, FHCRC, Seattle – US.

Other talks.....

**2015:** dbFinder, *Joint Genomic Meeting*, JHBSPH, Baltimore – US.

**2015:** Easy parallel computing with BiocParallel and HTML reports with knitrBootstrap, *Biostatistics Computing Club*, JHBSPH, Baltimore – US.

**2015:** Does mapping simulated RNA-seq reads provide information?, *Joint Genomic Meeting*, JHBSPH, Baltimore – US.

**2014:** Git for research, *Biostatistics Computing Club*, JHBSPH, Baltimore – US.

**2013:** Introduction to ggbio, *Genomics for Students*, JHBSPH, Baltimore – US.

**2013:** Introduction to knitr, *Biostatistics Computing Club*, JHBSPH, Baltimore – US.

**2013:** Introduction to High-Throughput Sequencing and RNA-seq, *Genomics for Students*, JHBSPH, Baltimore – US.

**2012:** DEXSeq paper discussion, *Genomics for Students*, JHBSPH, Baltimore – US.

**2012:** Introduction to R and Biostatistics, LCG-UNAM via Skype.

**2012:** Introducing Git while making your academic webpage, *Biostatistics Computing Club*, JHBSPH, Baltimore – US.

**2011:** Introducing Biostatistics to first year LCG students, LCG-UNAM via Skype.

**2010:** Introduction to using Bioconductor for High Throughput Sequencing Analysis, *National Bioinformatics Week*, CCG-UNAM, Cuernavaca – MX.

**2009:** Bacteriophages: analyzing their diversity, *LCG third generation symposium*, CCG-UNAM, Cuernavaca – MX.

## Courses and Meetings Attendance\_\_\_\_\_

**2015:** ENAR, Miami – US.

**2014:** *is3b*, INMEGEN, Mexico City – MX.

**2014:** *BioC2014*, Harvard, Boston – US.

**2014:** *IDIES2014*, Johns Hopkins University, Baltimore – US.

**2014:** ENAR, Baltimore – US.

**2014:** *Delta Omega Poster Competition*, Johns Hopkins University, Baltimore – US.

**2014:** LCG 10 year anniversary, LCG-UNAM, Cuernavaca – MX.

**2013:** *Genomics and Bioinformatics Symposium*, Johns Hopkins University, Baltimore – US.

**2013:** *useR2013*, Albacete – Spain.

**2011:** *BioC2011*, FHCRC, Seattle – US.

**2010:** *From Functional Genomics to Systems Biology*, EMBL, Heidelberg – Germany.

**2010:** *BioC2010*, FHCRC, Seattle – US.

**2009:** *BioC2009*, FHCRC, Seattle – US.

**2009:** Course on Oral Communication taught by the master Rafael Popoca, CCG-UNAM, Cuernavaca – MX.

**2008:** *BioC2008*, FHCRC, Seattle – US.

**2008:** *A Short R/Bioconductor Course* by James Bullard from UC Berkeley, LCG-UNAM, Cuernavaca – MX.

**2007:** *Boston Bacterial Meeting*, Boston – US.

**2007:** *Retreat of the Department of Microbiology and Molecular Genetics - Harvard*, Boston – US.

**2006:** *Winter School in Genomics*, CCG-UNAM, Cuernavaca – MX.

**2005:** *HUGO 2005*, Kyoto – Japan.

## Software

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Bioconductor – main author.....

**2014:** *derfinder*: Annotation-agnostic differential expression analysis of RNA-seq data at base-pair resolution via the DER Finder approach – 3024 downloads in last 12 months.

**2014:** *derfinderPlot*: plotting functions for *derfinder* results – 2366 downloads in past 12 months.

**2014:** *regionReport*: Generate HTML or PDF reports for a set of genomic regions or DESeq2/edgeR results – 2246 downloads in last 12 months.

**2014:** *derfinderHelper*: helper functions for *derfinder* package – 2671 downloads in last 12 months.

**2014:** *derfinderData*: data for *derfinder* examples – 658 downloads in past 12 months.

Bioconductor – contributor role.....

**2015:** *bumphunter*

**2014:** *ballgown*

Other R packages.....

**2014:** *enrichedRanges*: identify enrichment between two sets of genomic ranges.

**2014:** *dots*: simplify function calls.

**2013:** *fitbitR*: visualize your FitBit data.

**2011:** *BacterialTranscription*: identify TSSs and TUs from RNA-seq data.

shiny applications.....

**2014–2016:** MPH capstone TA office hours sign up

**2014:** Simple mortgage calculator

Miscellaneous.....

**2016:** Updated the JHU thesis template available at [GitHubgithub.com/lcolladotor/jhu-thesis-template](https://github.com/lcolladotor/jhu-thesis-template) and Overleaf[www.overleaf.com/latex/templates/johns-hopkins-university-unofficial-thesis-template/tqdzgmrxbtg](https://www.overleaf.com/latex/templates/johns-hopkins-university-unofficial-thesis-template/tqdzgmrxbtg)

## Computer skills

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**all-purpose:** R *Ranked 152/5661 in the US and 418/53325 worldwide by GitHub Awards as of January 28, 2016. Does not take into account contributions at leekgroup organization.*

**statistics:** Stata

**scripting:** bash, Perl

**markup:** LaTeX, markdown

OS: Linux

cluster queue: Sun Grid Engine

## Teaching Experience

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Instructor.....

- o PDCB-UNAM, Cuernavaca, MX  
**2011:** Invited instructor for the course *Introduction to R and Biostatistics* (website) ~ 10 enrollment.  
**2010:** *Analysis of High-Throughput Sequencing data with Bioconductor* for Biomedical Sciences PhD Program students (website) ~ 10 enrollment.
- o CCG-UNAM, Cuernavaca, MX  
**2010:** *Introduction to Using Bioconductor for High-Throughput Sequencing Analysis* practice lab at the *National Bioinformatics Week* ~ 40 enrollment.
- o IBT-UNAM, Cuernavaca, MX  
**2010:** *Introduction to R and plotting with R* course for Morett's lab ~ 10 enrollment.  
**2010:** Organized and gave a lecture for the course on *Statistical Methods and Analysis of Genomic Data* (website) ~ 20 enrollment.  
**2009:** Organized the course *Introduction to Bioinformatics* for Morett's lab and served as instructor for the *Introduction to R and plotting with R* module (website) ~ 10 enrollment.
- o LCG-UNAM, Cuernavaca, MX  
**2009:** *Seminar III: R/Bioconductor*. In-depth Bioconductor course (website) ~ 30 enrollment.

Guest lecturer.....

- o JHBSPH, Baltimore, US  
**2015:** *Introduction to R for Public Health Researchers: Reproducible research module* ~ 20 enrollment.
- o LCG-UNAM, Cuernavaca, MX  
**2012:** *Introduction to R and Biostatistics* lecture for *Seminar 1: Introduction to Bioinformatics* course ~ 30 enrollment.  
**2011:** *Introduction to R and Biostatistics* lecture for *Seminar 1: Introduction to Bioinformatics* course ~ 30 enrollment.

Lead teaching assistant.....

- o JHBSPH, Baltimore, US  
**2015–2016:** *Statistical Methods in Public Health II* ~ 550 enrollment.  
**2014–2015:** *Statistical Methods in Public Health I and II* ~ 550 enrollment.

Teaching assistant.....

- o JHBSPH, Baltimore, US  
**2014–2016:** *MPH capstone project*: 30 min one-on-one consulting sessions (biostatistics, Stata coding) ~ 500 enrollment. Develop and maintain the MPHcapstoneTA shiny application.  
**2015–2016:** *Statistical Methods in Public Health I* ~ 550 enrollment.  
**2015:** *Introduction to R for Public Health Researchers* ~ 20 enrollment.

**2013–2014:** *Statistical Methods in Public Health I and II* ~ 550 enrollment.

**2012–2013:** *Statistical Methods in Public Health I, II, III, and IV* ~ 550 enrollment.

o LCG-UNAM, Cuernavaca, MX

**2009:** *Principles of Statistics*. Basic R (website) ~ 30 enrollment.

**2008:** *Bioinformatics and Statistics I*. R and Bioconductor overview (website) ~ 40 enrollment.

## Mentoring

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**2015:** Mentored Alquicira-Hernández J, LCG-UNAM student visiting Jeff Leek's group.

**2009–2011:** Advised and trained 13 LCG-UNAM students and alumni while working at *Winter Genomics*: Riveros-McKay F, Vargas-Chávez C, Dulanto-Acevedo V, Romero-Martínez S, Samaniego-Castruita J, Zepeda-Mendoza L, Vargas-Velázquez A, Noé-González M, Soto Jiménez LM, López Moyado I, Medina-Abarca H., Izquierdo-Rangel E, and Berrocal-Quezada NA.

**2009:** Trained 3 LCG-UNAM students to take over the R/Bioconductor course: Reyes-Quiroz A, Moreno-Mayar V, and Reyes-López J.

## Other

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**2016:** Student representative for the Centennial celebration of the Department of Biostatistics.

**2012–2016:** Organized *Cultural Mixer* events for the Department of Biostatistics with Amanda Mejia for raising cultural awareness.

**2012–2014:** Organized the *Genomics for Students* group (website)

**2009–2011:** Organized a Genomics Journal Club at IBT-UNAM.

**2008–2009:** Elected class representative for the LCG Academic Committee.

**2008–2009:** Class representative for Administration Unit for Technology Information committee.

**2008:** Helped start the National Node of Bioinformatics online forum.

## Languages

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**Native:** Spanish

**Bilingual:** English

**Basic:** French