

# Sebastian Bernasek

Data Scientist | Chemical Engineer

San Francisco Bay Area

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## Skills

### Data Engineering

Relational databases  
Web scraping  
Structured text & NLP  
Feature selection  
Dimensionality reduction

### Analysis

Hypothesis testing  
Bayesian inference  
Unsupervised learning  
Networks & Time series  
Visualization

### Computer Vision

Feature extraction  
Image segmentation  
Feature classification  
Spatial analysis  
Quantitative microscopy

### Modeling

Stochastic processes  
Dynamical systems  
Nonlinear regression  
Classification  
Agent-based models

### Coding

Python & Cython  
Package development  
REST APIs  
Git, LaTeX, HTML/CSS  
Unix shell, OSX/Ubuntu

## Education

### Ph.D. in Chemical and Biological Engineering • 4.0 *Northwestern University*

2014 - 2019

- Co-advised by Luis Amaral and Neda Bagheri.
- Dissertation titled, "Quantitative Analysis of Cell Fate Decisions."

### B.S. in Chemical Engineering • 3.8 • High Honors *University of California, Santa Barbara*

2008 - 2012

- Exchange student at Imperial College London throughout 2010/2011.

## Experience

### Personal Development & Consulting

Present

Took a year off to explore the world, helping out some friends along the way:

- Built a database of 5k+ targeted B2B sales leads using a combination of web-scraping, commercial APIs, and machine learning.
- Demystified a sales pipeline by using unstructured text profiles to predict client outcomes.
- Automated PDF content extraction and parsing routines that will annually save hundreds of hours of tedious labor.

### Researcher at Northwestern University *Evanston, IL*

2014 - 2019

- Combined data science and chemical engineering to study how cells make reliable decisions.
- Published in high profile journals including *Cell* and *PLOS Computational Biology*.
- Developed several computational resources for the broader research community.

Day to day life entailed:

- Exploratory analysis of image and time series data.
- Developing creative strategies to derive insight from noisy experiments.
- Frequent collaboration with wet labs to design more valuable experiments.
- Brainstorming & hackathons for data-driven projects of all flavors.
- Lots of academic reading, writing, presentations, grant writing, and peer review.
- Co-teaching undergraduate chemical engineering courses and data science bootcamps.
- Mentoring graduate, undergraduate, and high school students in formulating their own research.

### Process Engineer at LanzaTech *Chicago, IL*

2012 - 2014

- Invented three processes for converting waste gases to lipid products. One patent granted, two more applications pending.
- Designed and built the company's core process modeling framework.
- Identified promising technology partners, ultimately leading to major investments.
- Modeled refinery-scale processes to predict and optimize economic and life-cycle performance.
- Advised executives and investors with technical analysis.

### Research Assistant at UC Santa Barbara *Santa Barbara, CA*

2011 - 2012

- Conducted first ever dynamic measurement of interaction forces between vesicles. Published in *Soft Matter*

### Summer Intern at UL Air Quality Sciences *Atlanta, GA*

Summer 2011

## Publications

### Ratio-based sensing of two transcription factors regulates the transit to differentiation.

Under Revision

Sebastian Bernasek\*, J.F. Lachance\*, N. Peláez\*, R. Bakker, H. Navarro, L. Amaral, N. Bagheri, I. Rebay, R. Carthew

Expected 2020

## **Fly-QMA: Automated analysis of mosaic imaginal discs in *Drosophila*.**

Sebastian Bernasek, N. Peláez, R. Carthew, N. Bagheri, L. Amaral

*Published in PLOS Comp. Biology*

2020

## **Repressive gene regulation synchronizes neural development with cellular metabolism.**

J. Cassidy\*, Sebastian Bernasek\*, R. Bakker, R. Giri, N. Peláez, B. Eder, A. Bobrowska, N. Bagheri, L. Amaral, R. Carthew

*Published in Cell*

2019

## **Quantitative analysis of cell fate decisions.**

Sebastian Bernasek

*Doctoral Dissertation*

2019

## **Direct measurement of interaction forces between charged multilamellar vesicles.**

J. Frostad, M. Seth, Sebastian Bernasek, L.G. Leal

*Published in Soft Matter*

2014

# **Patents**

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## **US Patent App. 62/872,869, Methods for Optimizing Gas Utilization.**

Sebastian Bernasek & Co-inventors

*LanzaTech*

*Filed 2019*

## **US Patent App. 14/927,950, Fermentation process for the production of lipids.**

Sean Simpson and Sebastian Bernasek

*LanzaTech*

*Filed 2014*

## **US Patent 9,783,835, Method for producing a lipid in a fermentation process.**

Sean Simpson and Sebastian Bernasek

*LanzaTech*

*Granted 2017*

# **Software**

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## **FlyQMA**

*On PyPI*

Python package for automated mosaic analysis of *Drosophila* imaginal discs. Facilitates high-throughput segmentation, bleedthrough correction, and annotation of raw microscope images in order to accelerate experimental pipelines while improving reproducibility.

## **FlyEye Analysis**

*On PyPI*

Python platform for analyzing gene expression dynamics in the developing fly eye. Ascribes quantitative rigor to a popular experimental technique by supporting dynamic analysis, spatial analysis, model fitting, and visualization of the resultant trends.

## **TfBinding**

*On GitHub*

Python package for simulating the statistical mechanics of cooperative binding events between transcription factors and their target promoters. Leverages a novel and highly-parallelizable microstate enumeration algorithm to dramatically outperform the existing state of the art in terms of both memory footprint and simulation scale.

## **GeneSSA**

*On GitHub*

A python framework for exact stochastic simulation of Markov processes, with a particular emphasis on gene regulatory networks. Simulates many classes of large networks faster and more efficiently than all other available software.

# **Mentorship**

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## **Simran Khunger** *High school student*

*Summer 2017*

Project: Designing synthetic benchmarks for 3D segmentation of cell membranes in the larval *Drosophila* eye.

## **Darshan Patel** *Chemical engineering undergraduate*

*Summer 2016*

Project: Probing tradeoffs between efficiency and robustness via in silico evolution of GRN topologies.

# **Teaching**

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## **Chemical Engineering Methods and Analysis**

*Spring 2018*

## **Reaction Engineering and Kinetics**

*Spring 2017*

## **Process Engineering and Design**

*Spring 2016*

