Citizen Science: Empowering the Public to Help Solve Biomedical Challenges

Andrew Su, Ph.D.
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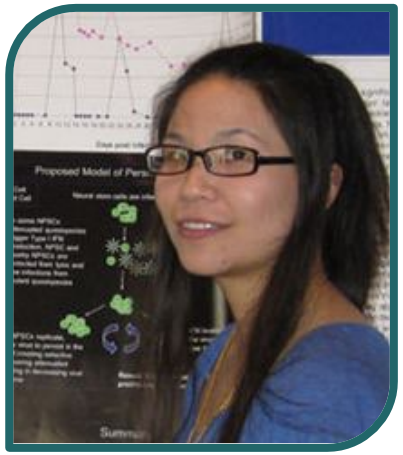
http://sulab.org

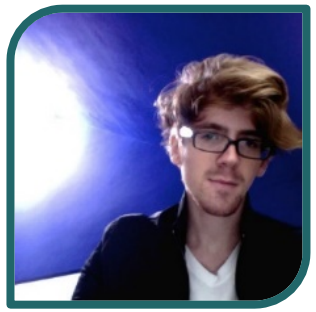
September 10, 2020

Acknowledgements



Ginger Tsueng

Benjamin Good



Max Nanis

Jennifer Fouquier

Ricardo Avila
Marco Cano
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Paul Gaudin
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Mike Mayers
Julia Mullen
Zhongchao Qian
Roger Tu
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Kevin Xin
Colleen Xu
Jerry Zhou

Chunlei Wu

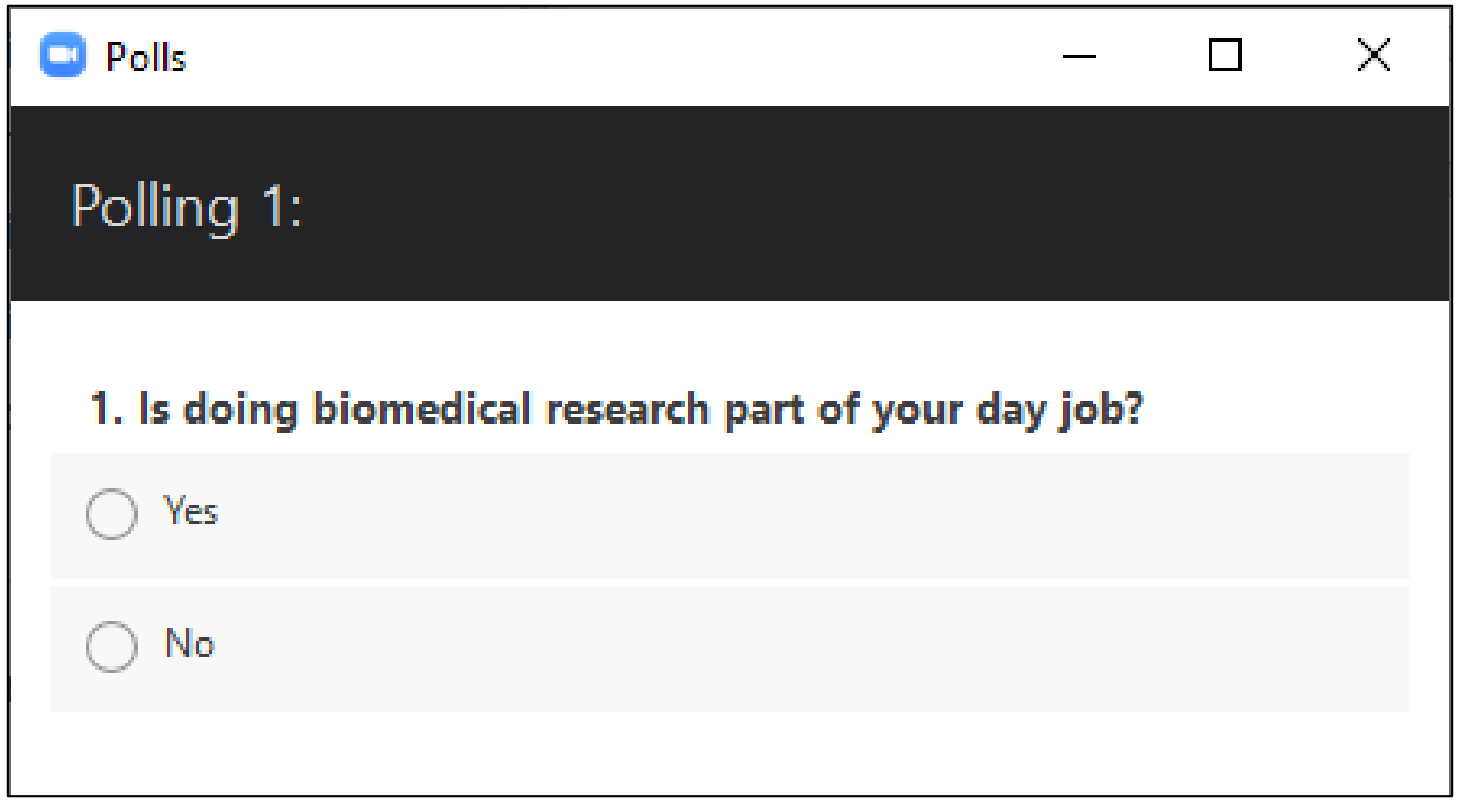
NIH National Institute of General Medical Sciences

NIH National Institute on Aging

NIH National Center for Advancing Translational Sciences

NIH National Institute of Allergy and Infectious Diseases

A quick poll


Polls
Polling 1:
1. Is doing biomedical research part of your day job?
Yes
No

https://www.sdss.org/science/m51/

Galaxy Tutorial

Galaxy Analysis

Galaxy Zoo - Thank You

Show My Galaxies

Galaxy Analysis

Welcome to Galaxy Zoo's view of the Universe. If you're here you should already have seen the Tutorial, but feel free to go and remind yourself. There's no need to agonise for too long over any one image, just make your best guess in each case.

Show Grid Overlay on the next Image

Galaxy Ref:
587729387677679742

Choose the Galaxy Profile by clicking the buttons below

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Hi starstryder | Home | The Science | How to Take Part | Galaxy Analysis | Forum | Press | Blog | FAQ | Links | Contact Us | Logout | Profile

- Galaxy Tutorial
- Galaxy Analysis
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Galaxy Analysis

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"…within **24 hours** of launch we were stunned to be receiving almost **70,000 classifications an hour**. In the end, more than **50 million classifications** were received by the project during its first year, contributed by more than **150,000 people**."

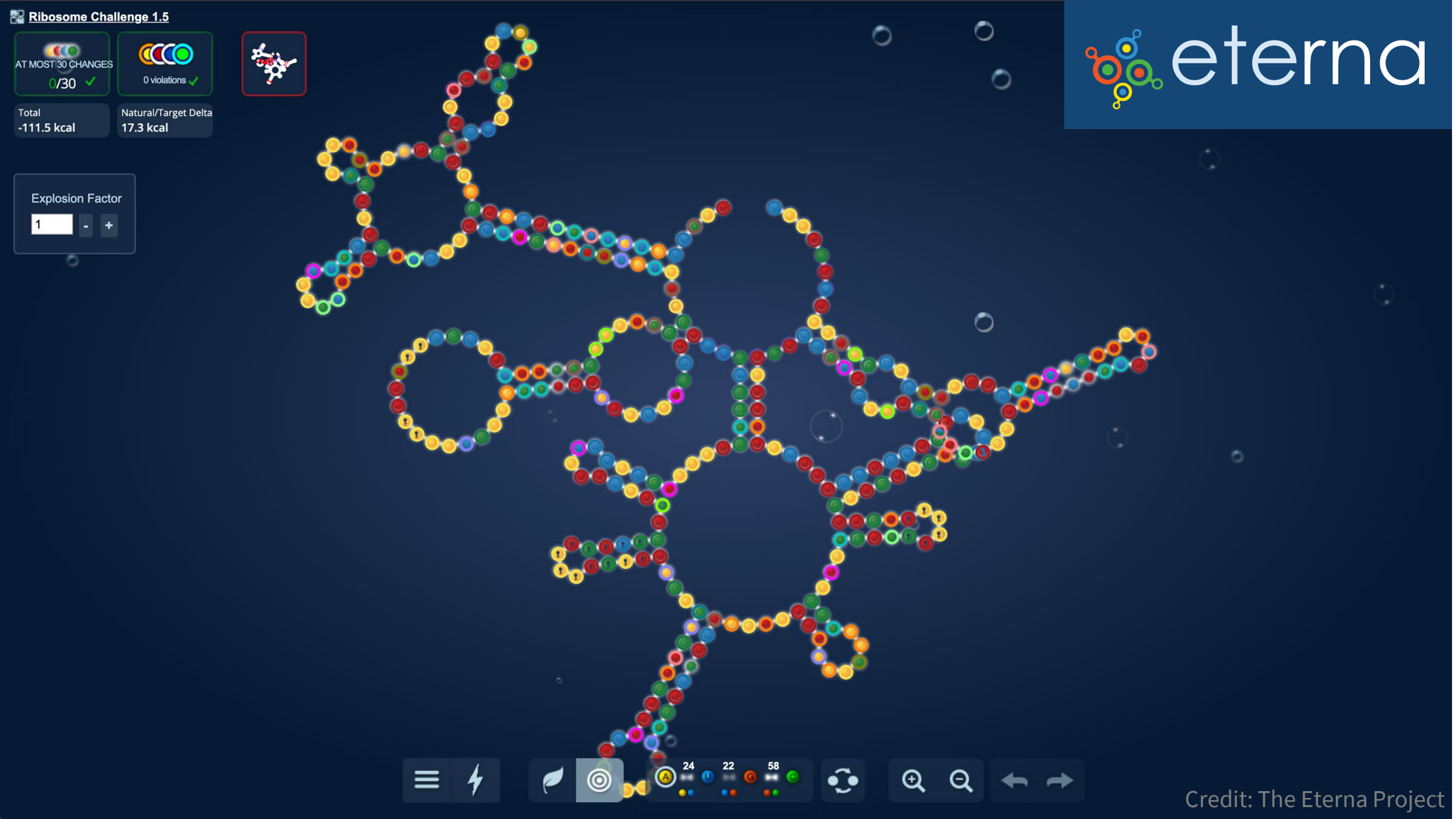
☐ Show Grid Overlay on the next Image

Galaxy Ref:
587729387677679742

Choose the Galaxy Profile by clicking the buttons below

https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/about/results


fold it BETA
Solve Puzzles for Science
Rank: 34
Score: 9455.364
Soloist
223: Core and Tail Design 2
No conditions
Group Competition
Group Name Score
1 Contenders 9628
2 Richard Dawkins Foundation 9627
3 GoFolders 9613
4 Natural Abilities 9611
5 Another Hour Another Point 9596
6 Czech National Team 9590
7 Void Crushers 9584
Soloist Competition
Player Name Current Best
1 BootsMcGraw - 9628
2 vertex - 9627
3 themarquis - 9625
4 Mark- - 9624
5 infjamc - 9613
6 Mr_Jolty - 9611
7 keypad5 - 9604
Cookbook
Chat - Group
auto show
Chat - Puzzle
auto show
shpalmina: and so?
BletchleyPark: and left me with an unanswered question
NatanaelL: what's up?

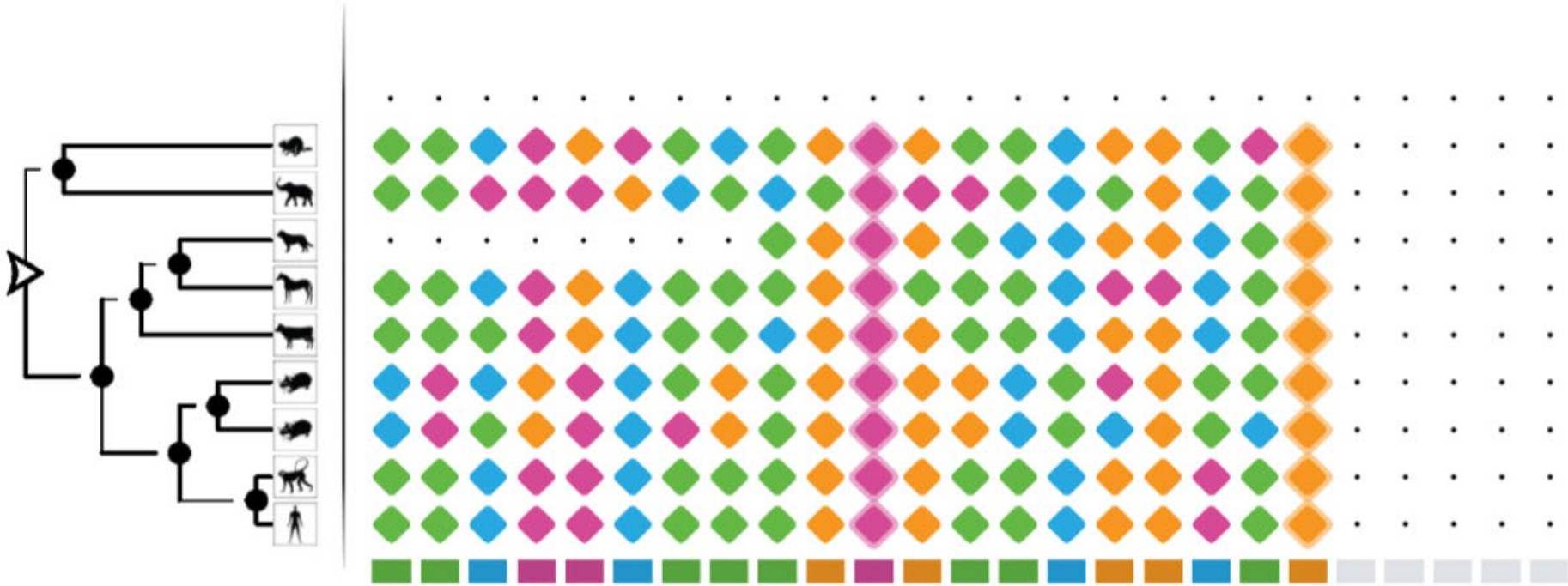

Ribosome Challenge 1.5
AT MOST 30 CHANGES
0/30
0 violations
Total
-111.5 kcal
Natural/Target Delta
17.3 kcal
Explosion Factor
1
-
+
24
22
58
eterna
Credit: The Eterna Project

< CATEGORIES | Digestive and respiratory system diseases | Gaps - 0 | Gap Extends - 0 | Matches - 261 | Mismatches - 51

Goal 202

Score
202

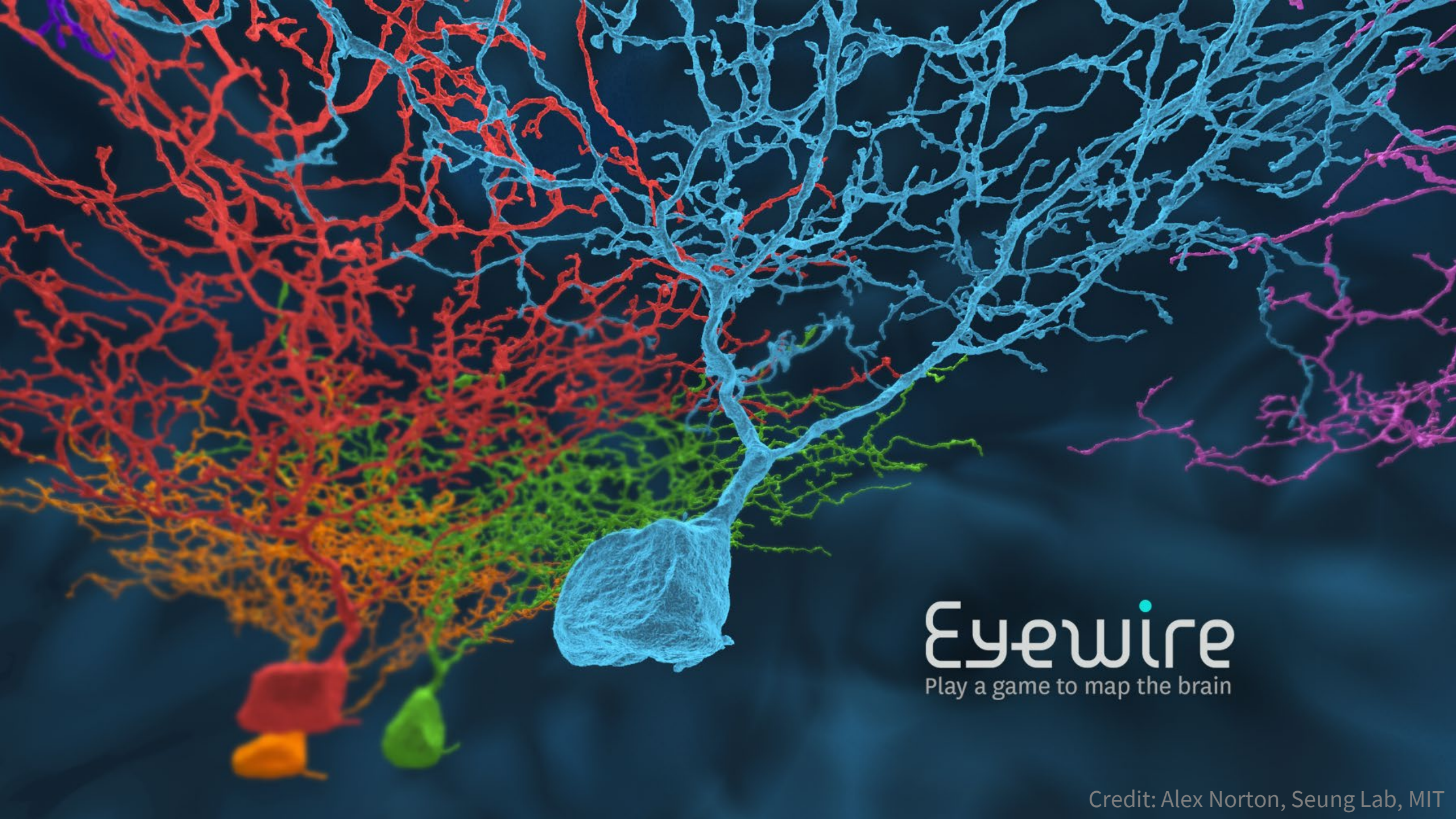
232 Top Score



NEXT STAGE

Home

English | Français



Credit: Alex Norton, Seung Lab, MIT

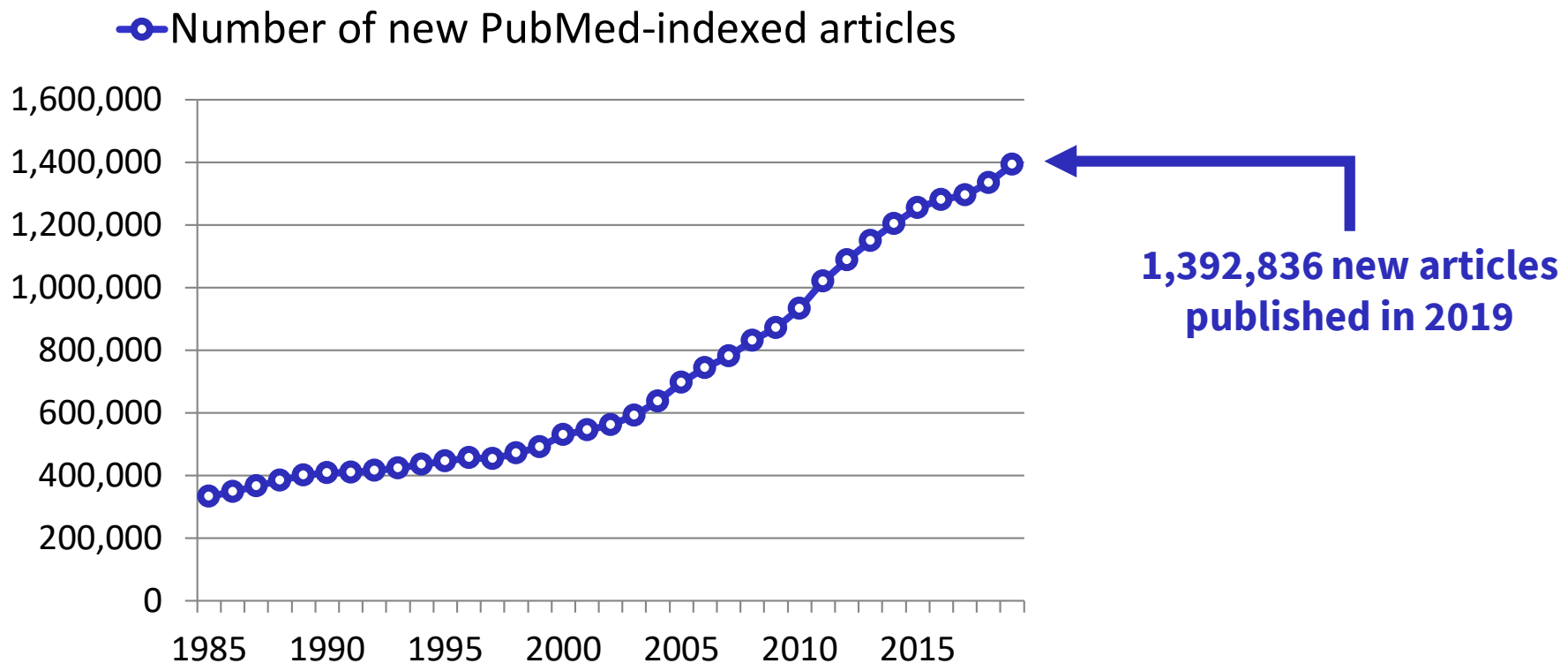
CITIZEN SCIENCE

Source: http://www.flickr.com/photos/bcmphoto/110887045/

Source: http://www.flickr.com/photos/tsoumplekas/7248449256/

Source: http://www.flickr.com/photos/inesnjers/9348711741/

The biomedical literature is massive



Over 30 million articles total in PubMed

Citizen Science Demo

- Participate only if your day job does *NOT* include biomedical research
- We will read a bit of text together, and a zoom poll will ask you a series of questions
- Answer based only on what the text says, not what is “true”
- Don’t worry too much about being sure – make your best guess within the allotted time

Leukemia Research 38 (2014) 1245–1251

Familial systemic mastocytosis with germline KIT K509I mutation is sensitive to treatment with imatinib, dasatinib and PKC412

Paula de Melo Campos[a], João A. Machado-Neto[a], Renata Scopim-Ribeiro[a], Valeria Visconte[b], Ali Tabarroki[b], Adriana S.S. Duarte[a], Flávia F.C. Barra[c], José Vassalo[c], Heesun J. Rogers[d], Irene Lorand-Metze[a], Ramon V. Tiu[b], Fernando F. Costa[a], Sara T. Olalla Saad[a], Fabiola Traina[a,e,*]

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[c] *Laboratory of Investigative and Molecular Pathology, CIPED, School of Medical Sciences, University of Campinas, Campinas, São Paulo, Brazil*
[d] *Department of Clinical Pathology, Cleveland Clinic, Cleveland, OH, USA*
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ARTICLE INFO

Article history:
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Keywords:
Familial mastocytosis
K509I *KIT* mutation
Tyrosine kinase inhibitors
Imatinib
Dasatinib
PKC412

ABSTRACT

Mastocytosis are myeloproliferative neoplasms commonly related to gain-of-function mutations involving the tyrosine kinase domain of *KIT*. We herein report a case of familial systemic mastocytosis with the rare *KIT* K509I germ line mutation affecting two family members: mother and daughter. *In vitro* treatment with imatinib, dasatinib and PKC412 reduced cell viability of primary mast cells harboring *KIT* K509I mutation. However, imatinib was more effective in inducing apoptosis of neoplastic mast cells. Both patients with familial systemic mastocytosis had remarkable hematological and skin improvement after three months of imatinib treatment, suggesting that it may be an effective front line therapy for patients harboring *KIT* K509I mutation.

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Demo #1: Identifying the entities

… We report a case of familial systemic mastocytosis with the rare KIT K509I germ line mutation. In vitro treatment with imatinib, dasatinib and PKC412 reduced cell viability of primary mast cells harboring KIT K509I mutation. Both patients with familial systemic mastocytosis had remarkable hematological and skin improvement after three months of imatinib treatment.

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familial systemic mastocytosis

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familial systemic mastocytosis

KIT

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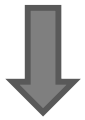
familial systemic mastocytosis

KIT

Imatinib

Demo #1: Instructions

For each of these entities …



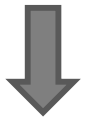
familial systemic mastocytosis

KIT

Imatinib

Demo #1: Instructions

For each of these entities …

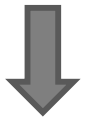


familial systemic mastocytosis

KIT

Imatinib

… select the entity type …



GENE / PROTEIN

DRUG / CHEMICAL

DISEASE

OTHER

Demo #1: Instructions

For each of these entities …

familial systemic mastocytosis

KIT

Imatinib

… select the entity type …

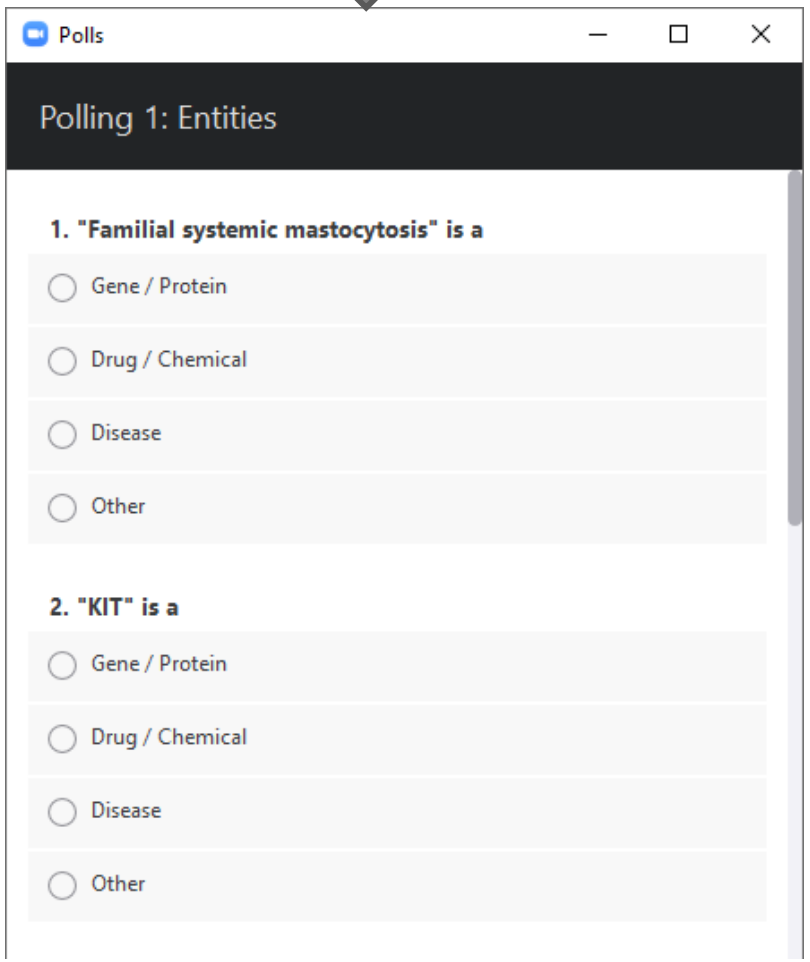
GENE / PROTEIN

DRUG / CHEMICAL

DISEASE

OTHER

… using this poll



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GENE / PROTEIN

DRUG / CHEMICAL

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OTHER

Demo #1: --- 30 seconds, GO! ---

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familial systemic mastocytosis

KIT

Imatinib

GENE / PROTEIN

DRUG / CHEMICAL

DISEASE

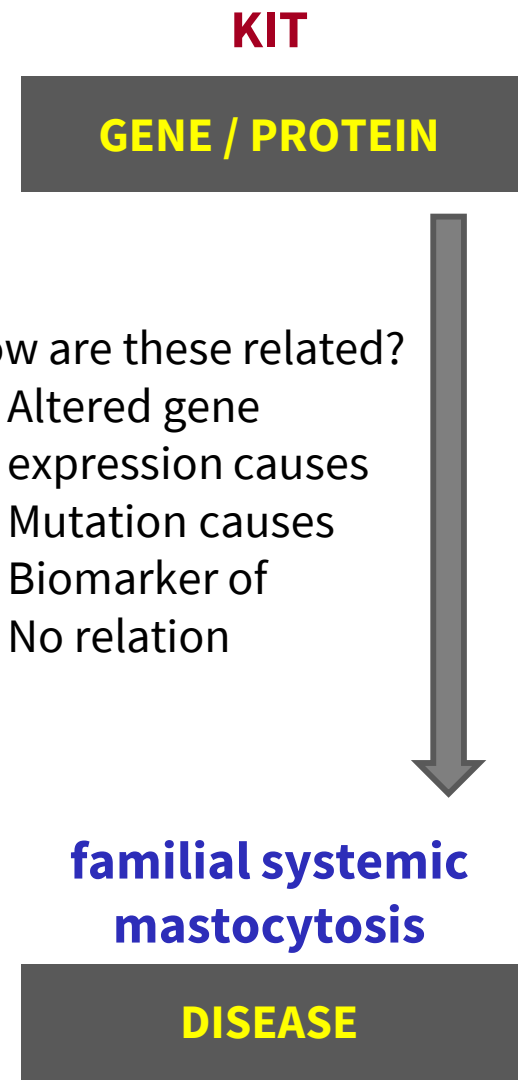
OTHER

Demo #1: Results

familial systemic mastocytosis	is a	**DISEASE**
KIT	is a	**GENE / PROTEIN**
Imatinib	is a	**DRUG / CHEMICAL**

Demo #2: Defining the relationships

… We report a case of familial systemic mastocytosis with the rare KIT K509I germ line mutation. In vitro treatment with imatinib, dasatinib and PKC412 reduced cell viability of primary mast cells harboring KIT K509I mutation. Both patients with familial systemic mastocytosis had remarkable hematological and skin improvement after three months of imatinib treatment.



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KIT

GENE / PROTEIN

How are these related?

- Altered gene expression causes
- Mutation causes
- Biomarker of
- No relation

familial systemic mastocytosis

DISEASE

Imatinib

DRUG / CHEMICAL

How are these related?

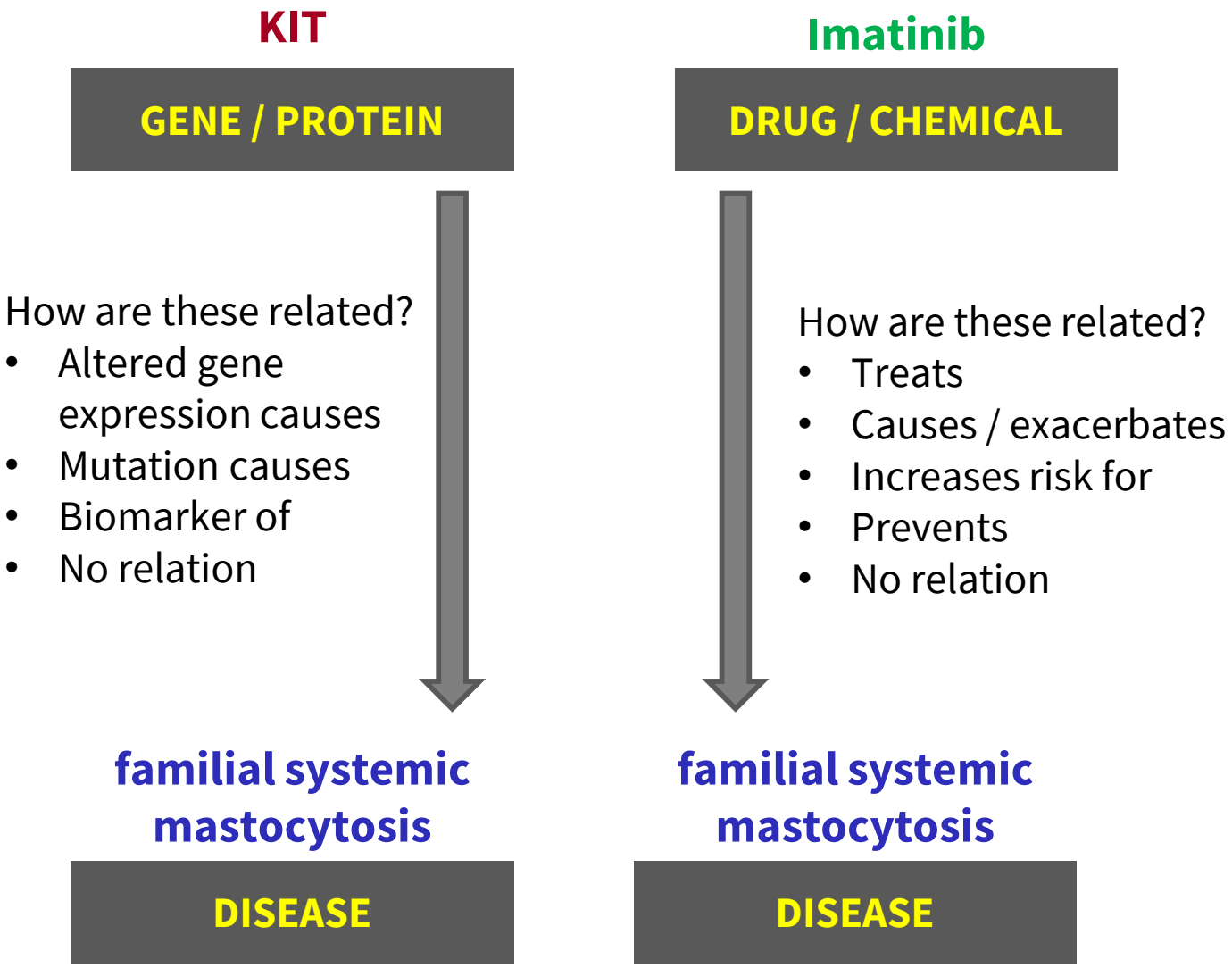
- Treats
- Causes / exacerbates
- Increases risk for
- Prevents
- No relation

familial systemic mastocytosis

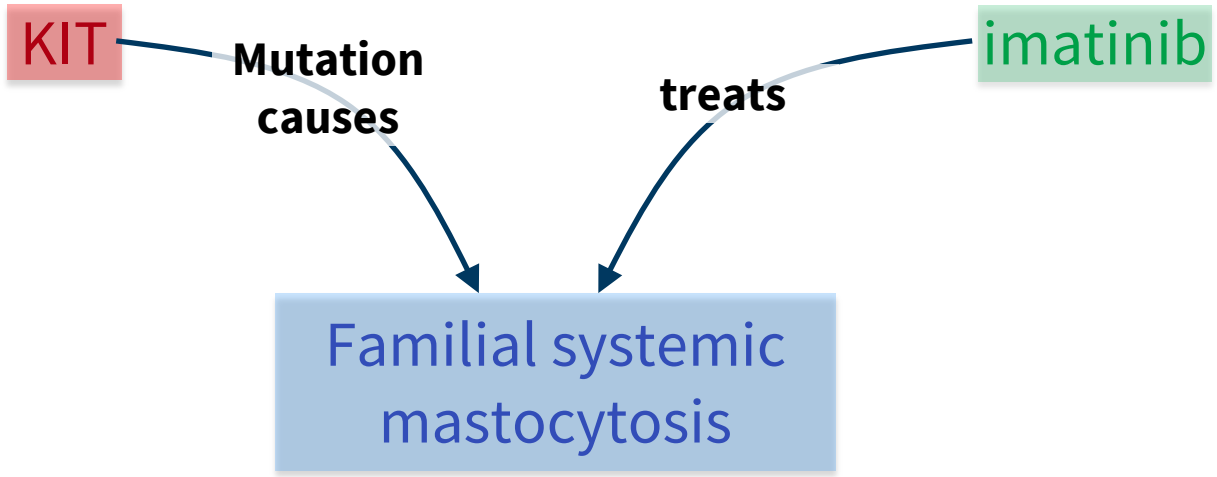
DISEASE

Demo #2: Defining the relationships – 30 s --- GO! ---

… We report a case of familial systemic mastocytosis with the rare KIT K509I germ line mutation. In vitro treatment with imatinib, dasatinib and PKC412 reduced cell viability of primary mast cells harboring KIT K509I mutation. Both patients with familial systemic mastocytosis had remarkable hematological and skin improvement after three months of imatinib treatment.



Demo #2: Results



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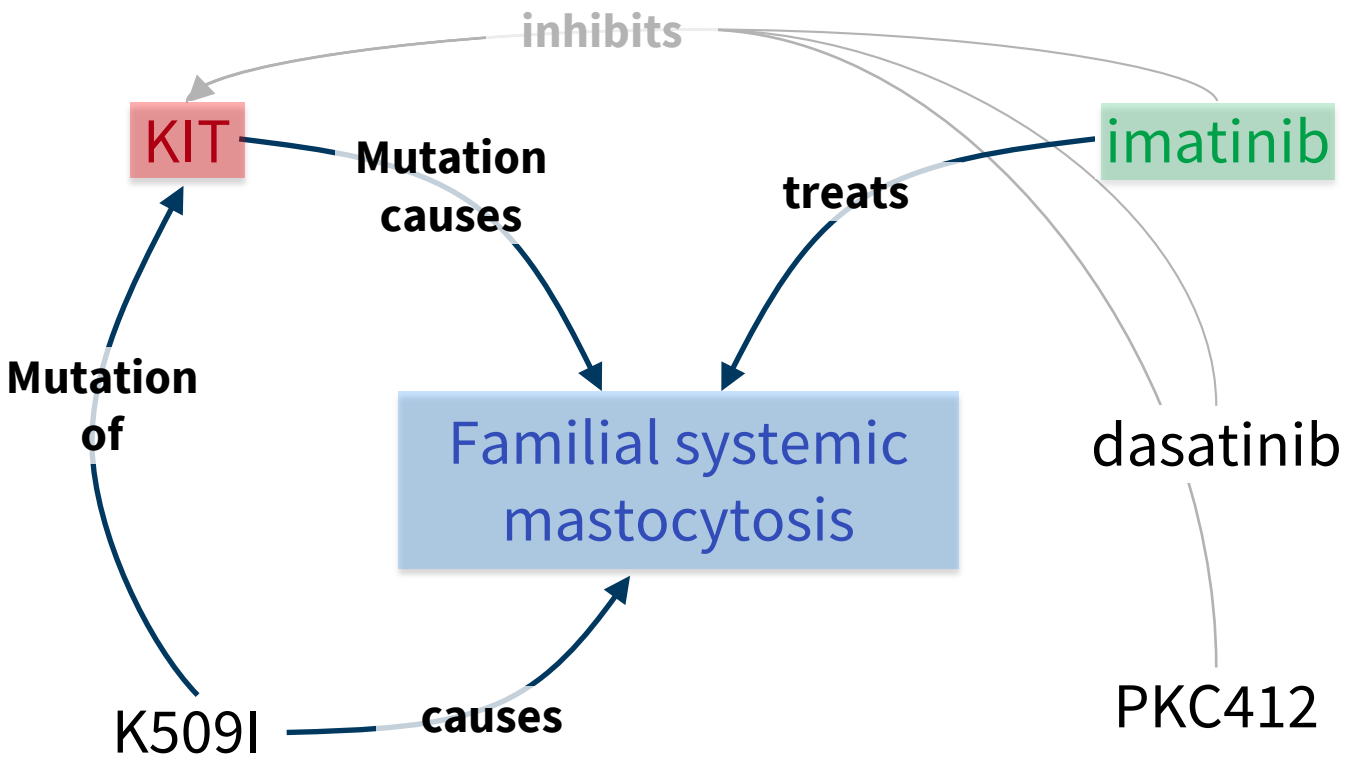


MARK 2 CURE

About FAQ Blog Contact Login

Bertrand was the first case of NGLY1, but he is not alone.

NGLY1 Researchers are racing to find clues in biomedical literature and need your help to uncover hidden links. If you can read, you can help.

About NGLY1 | Get Started | ▶ Watch Video

787,684 annotations have been submitted so far, but we're not done! Your help is still needed… Learn More ›

Current MISSIONS.

sponse and
tures
Docs: 73

Stress Response and glcnac
Total Docs: 75

Galactosemia and Oxidative Stress
Total Docs: 36

http://mark2cure.org

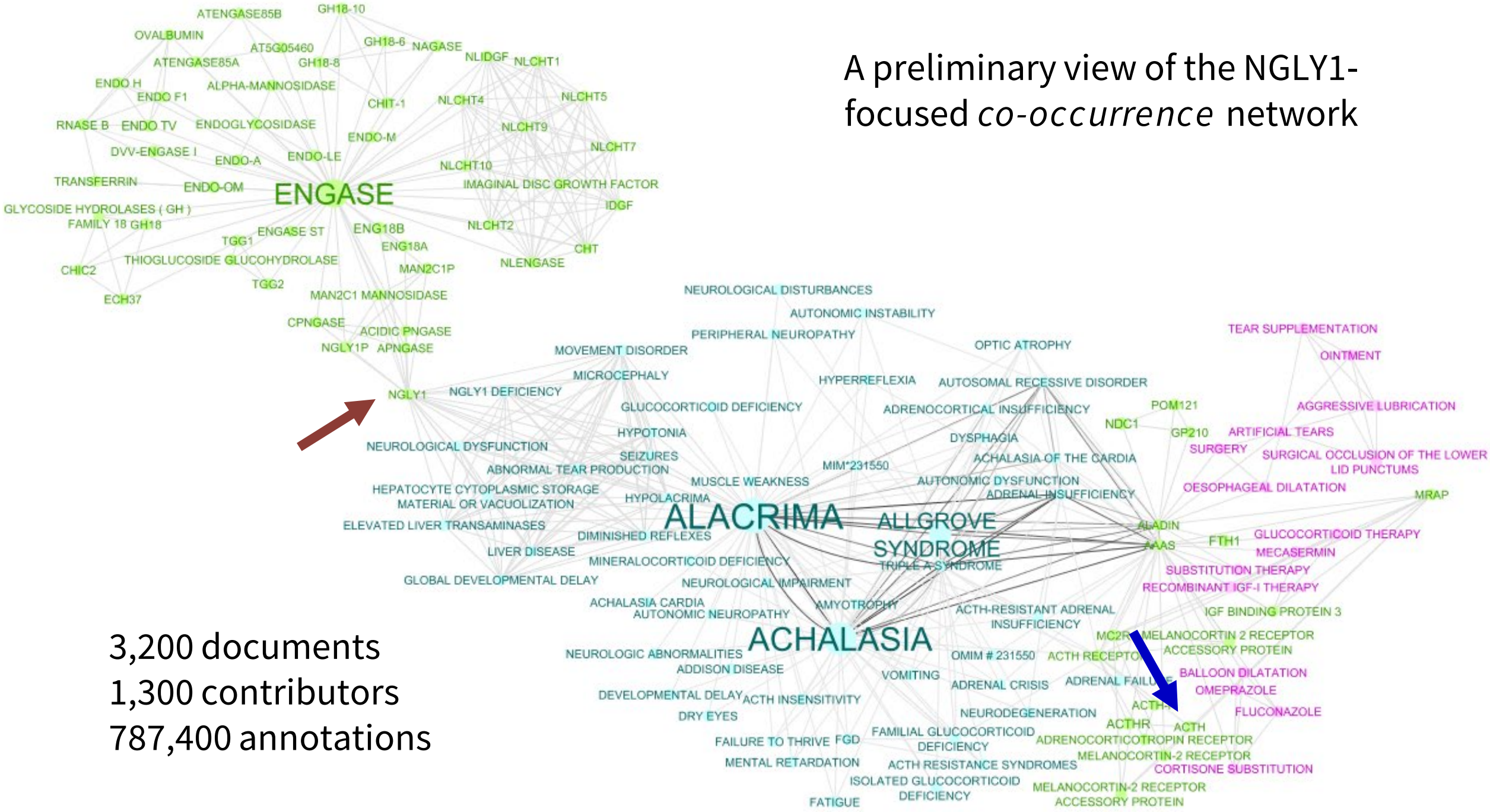
Total Docs: 75

Total Docs: 48

GlcNAc and lipocalin
Total Docs: 68

Oxidative Stress
Total Docs: 444

A preliminary view of the NGLY1-focused *co-occurrence* network



3,200 documents
1,300 contributors
787,400 annotations

“Why do you Mark2Cure?”

In memory of my daughter who had Cystic Fibrosis

I am retired, have a doctorate in medical humanities, and have two children with Gaucher disease. I am just looking for some way to put my education to use.

Studied biology in college and I really miss it!

Give back

My 4 year old daughter Phoebe is living with and battling rare disease.

I Mark2Cure in memory of my son Mike who had type 1 diabetes.

I have Ehlers Danlos Syndrome. I hope to help people learn about this painful and debilitating disorder, so that others like me can receive more effective medical care.


Technical Curiosity ... and a chance to help others
I was/am curious
TO HELP SCIENCE (& STRETCH MY BRAIN)
To give back to the community
TO use my brain to help others
To be a citizen scientist and help save lives
I MISSED SCIENCE I WANTED TO HAVE FUN WHILE HELPING
Find Cures Faster
mark 2 CURE
http://mark2cure

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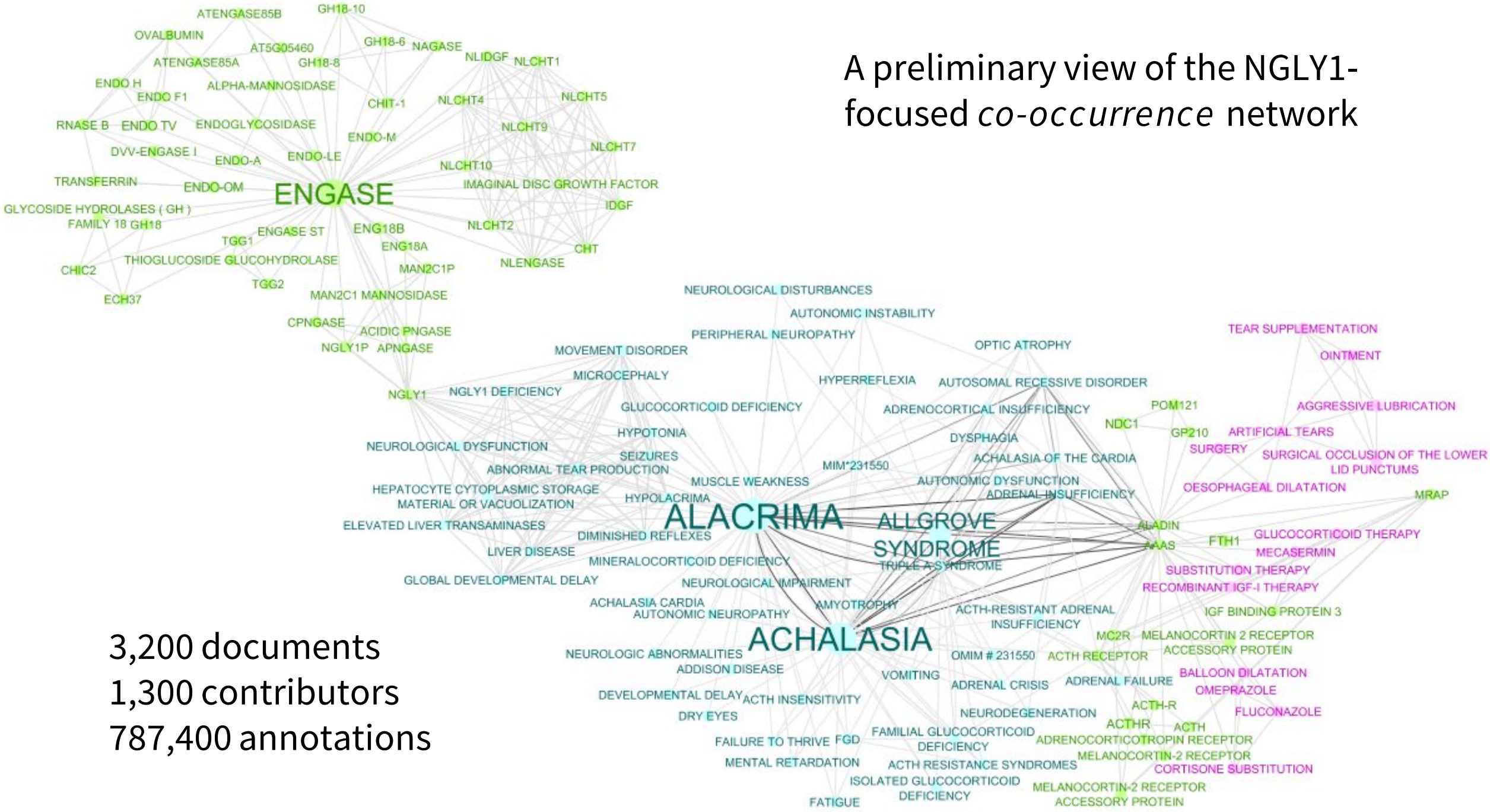

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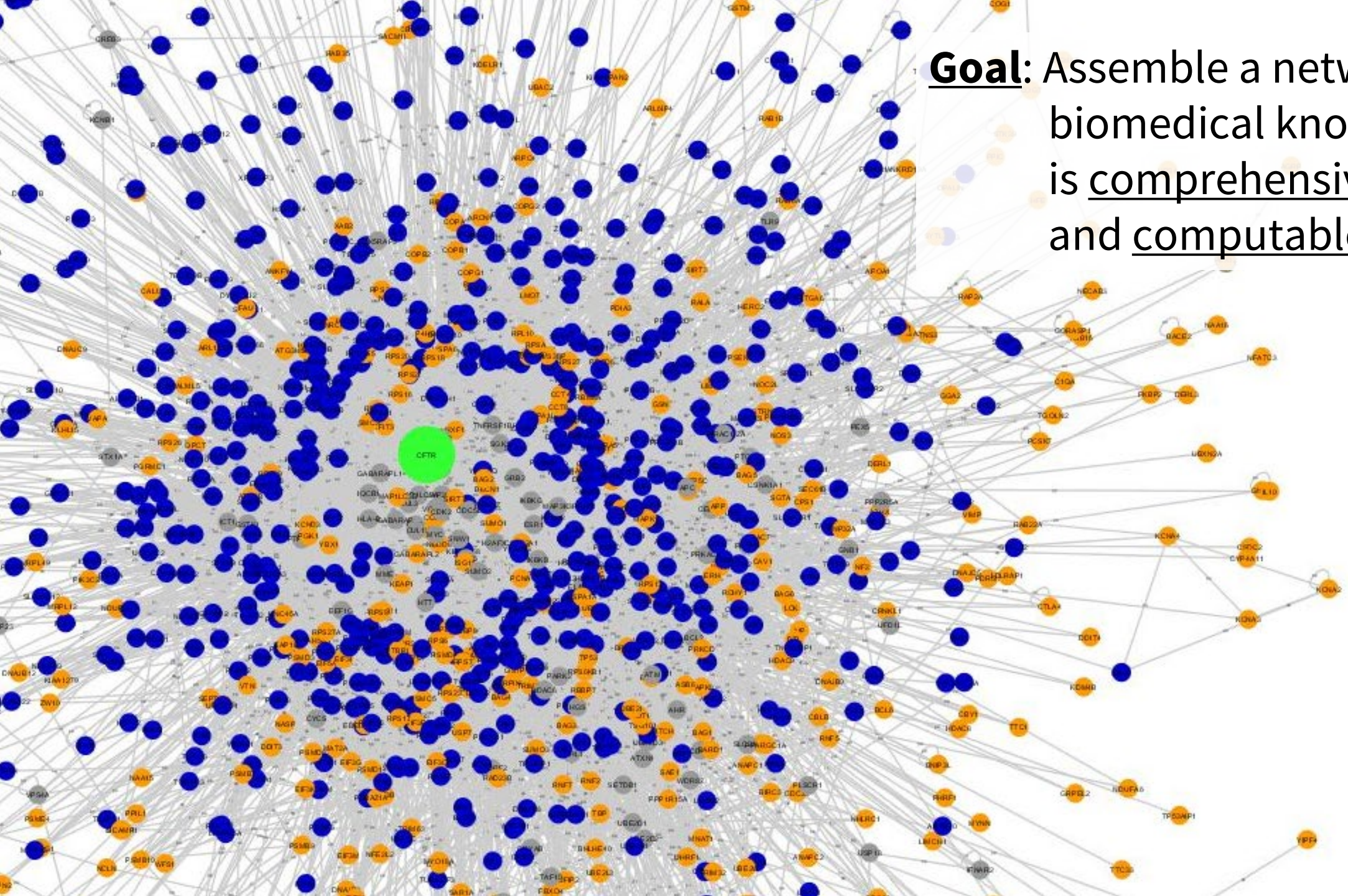


Goal: Assemble a network of biomedical knowledge that is comprehensive, current, and computable.

Drug repurposing

… identifying and developing new uses for existing drugs

Drug repurposing using knowledge graphs

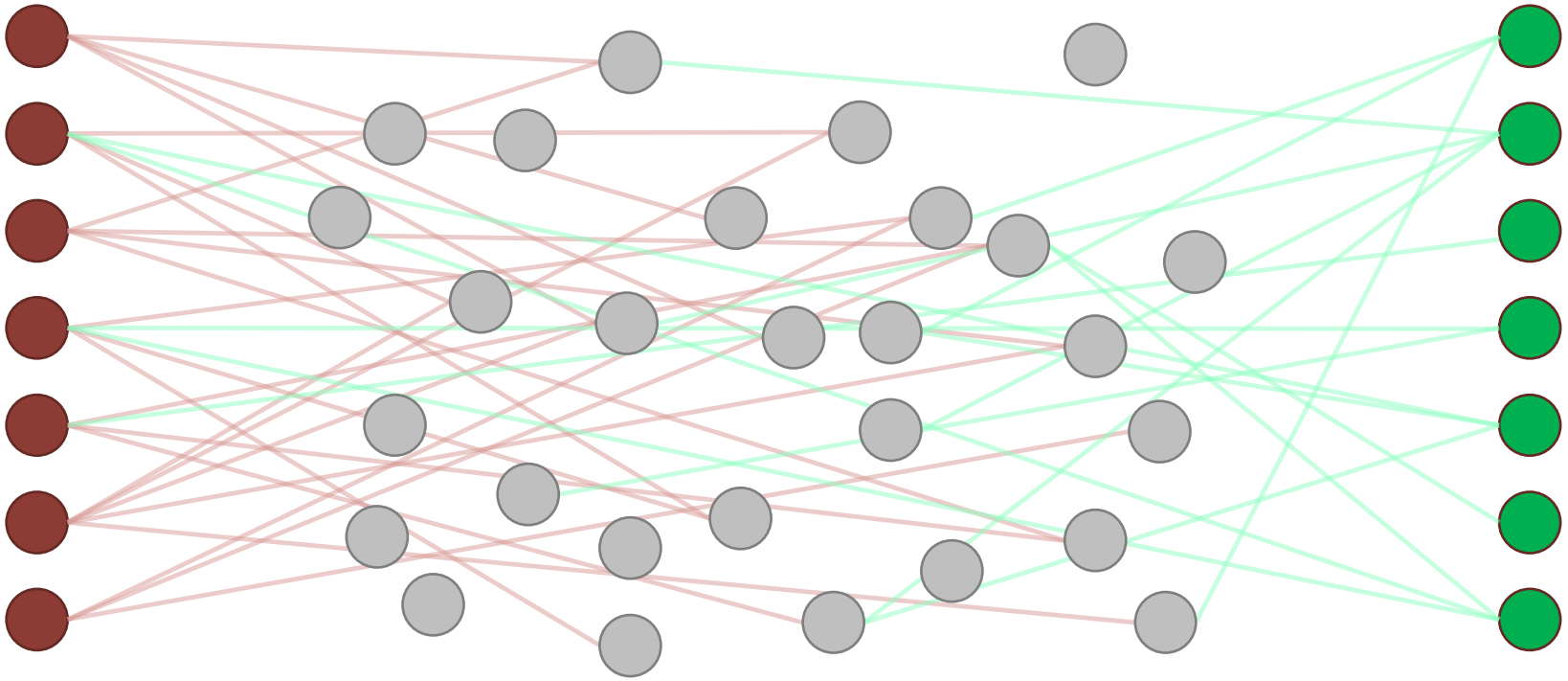
DRUGS

Drug repurposing using knowledge graphs

DRUGS

DISEASES

Drug repurposing using knowledge graphs

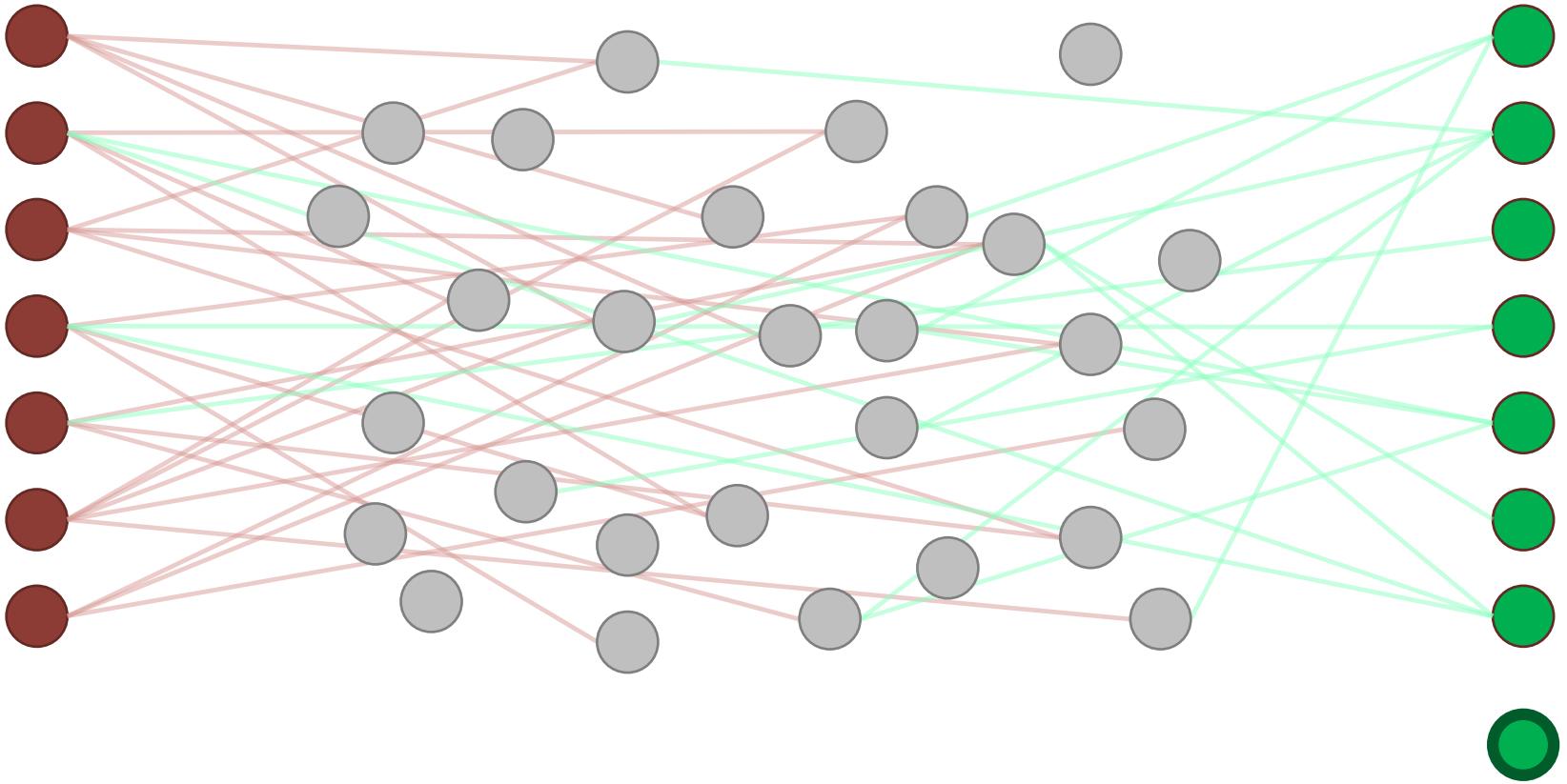


DRUGS

Genes, proteins, pathways, genetic variants, metabolites, …

DISEASES

Drug repurposing using knowledge graphs



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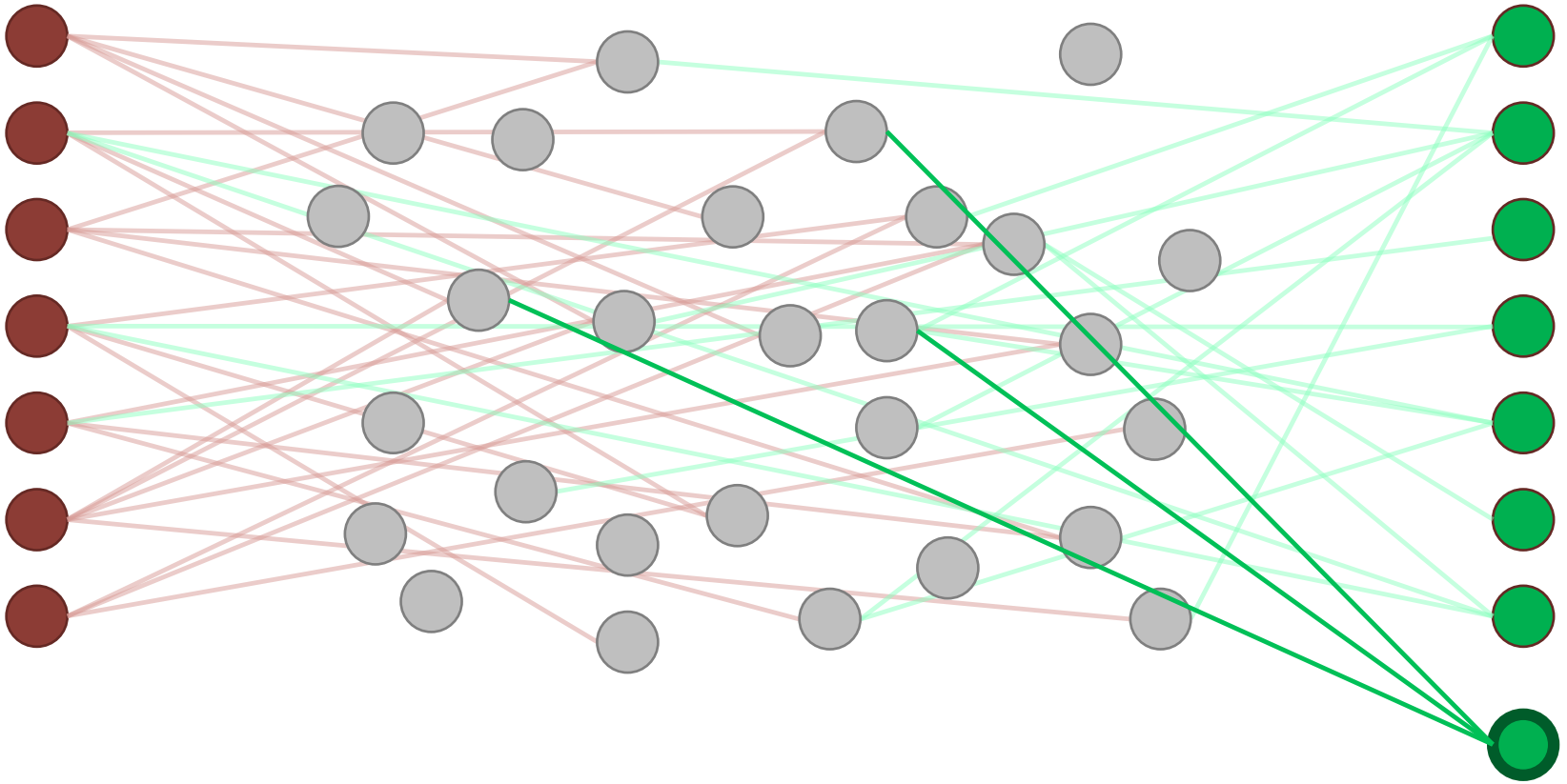
DISEASES

Drug repurposing using knowledge graphs



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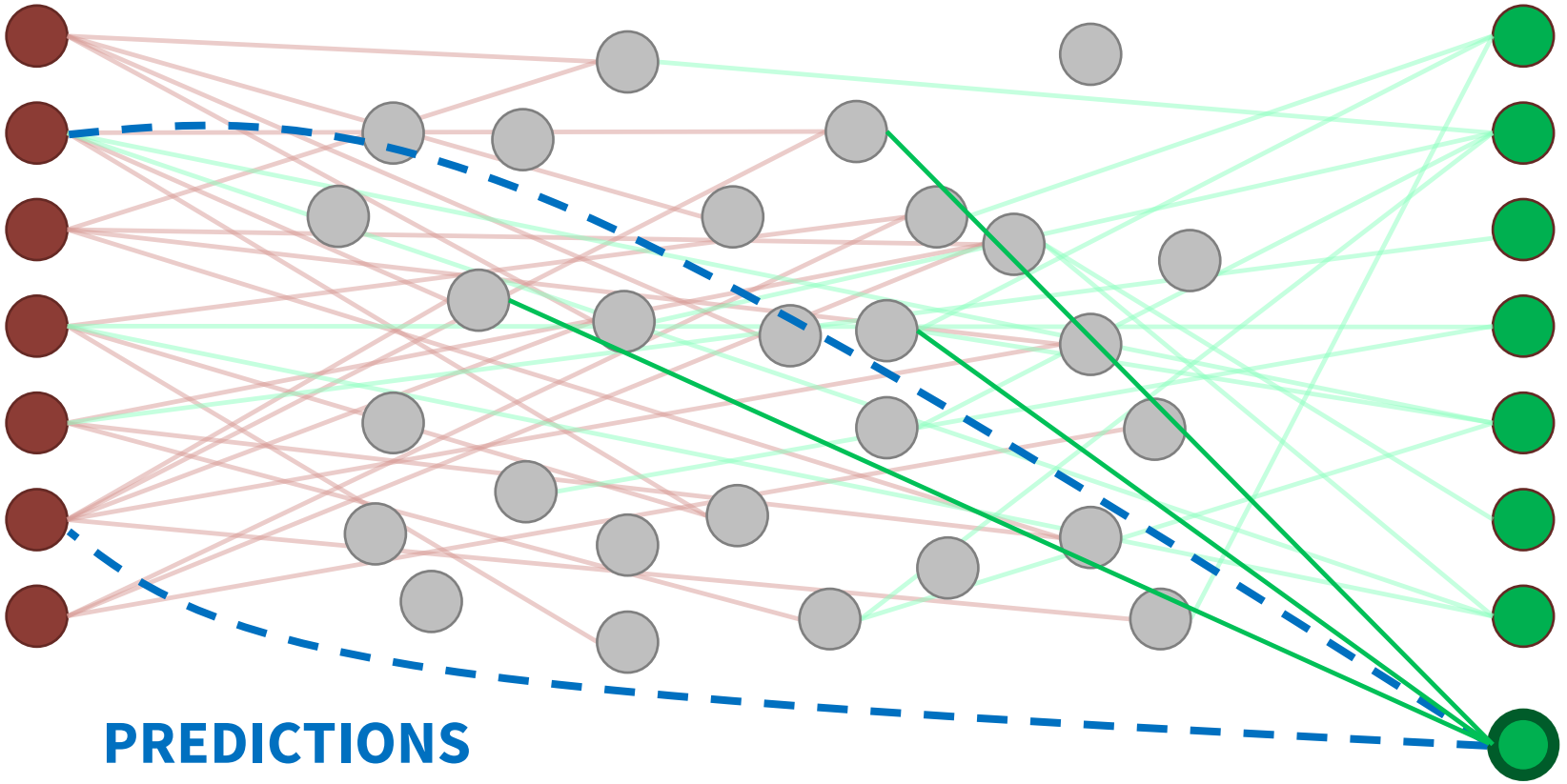

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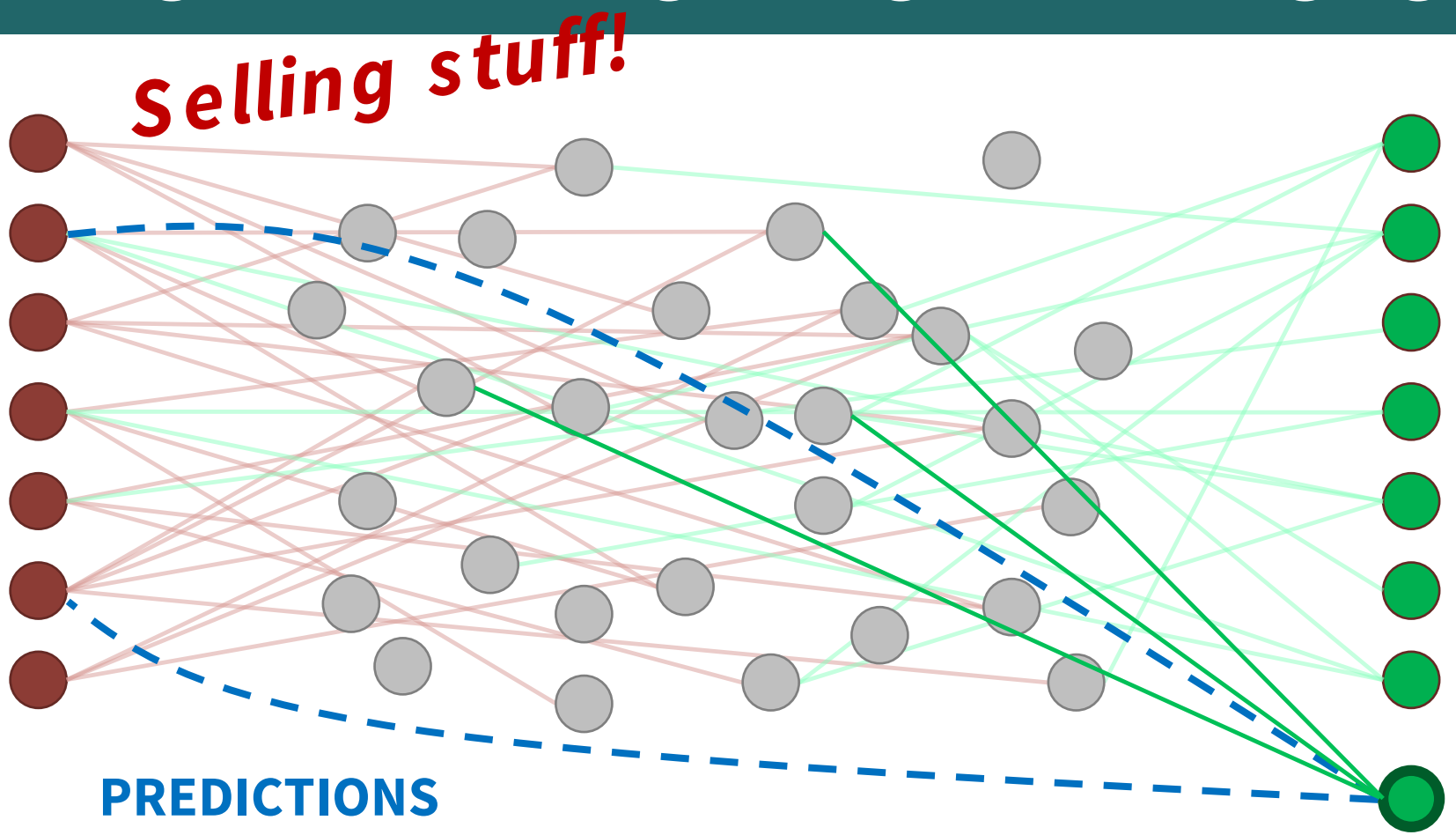
~~Drug repurposing~~ using knowledge graphs



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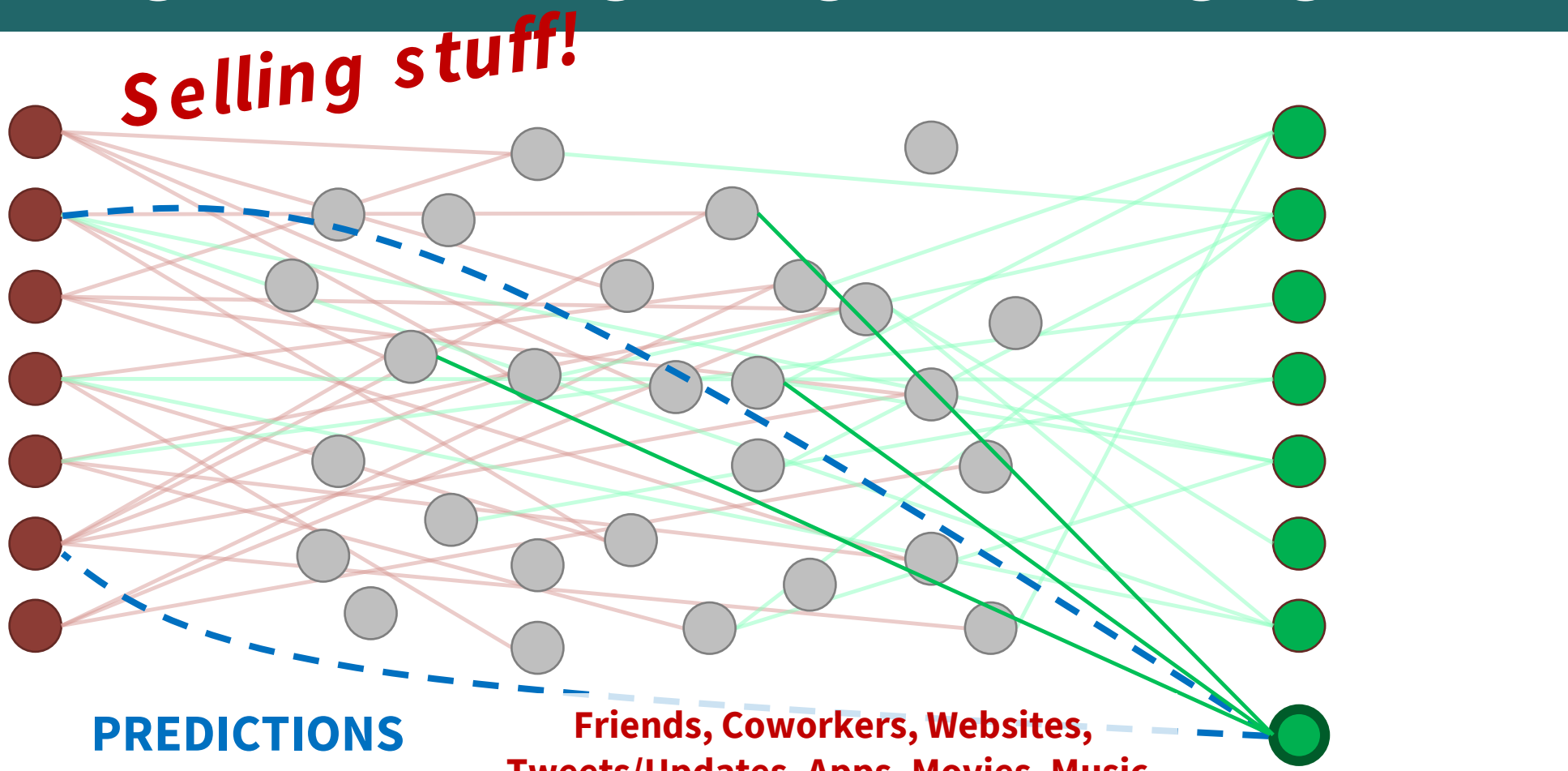

Knowledge graphs in high tech

Model Ensemble for Click Prediction in Bing Search Ads

ABSTRACT

Accurate estimation of the click-through rate (CTR) in sponsored ads significantly impacts the user search experience and businesses' revenue, even 0.1% of accuracy improvement would yield greater earnings in the hundreds of millions of dollars. CTR prediction is generally formulated as a supervised classification problem. In this paper, we share our experience and learning on model ensemble design and our innovation. Specifically, we present 8 ensemble methods and evaluate them on our production data. Boosting neural networks with gradient boosting decision trees turns out to be the best. With larger training data, there is a nearly 0.9% AUC improvement in offline testing and significant click yield gains in online traffic. In addition, we share our experience and learning on improving the quality of training.

WWW 2017, April 3–7, 2017, Perth, Australia.
ACM 978-1-4503-4914-7/17/04.
http://dx.doi.org/10.1145/3041021.3054192

https://www.microsoft.com/en-us/research/publication/model-ensemble-click-prediction-bing-search-ads/

https://www.flickr.com/photos/castellersdevilafranca/3968135872 4

How you can engage in research

Citizen Science Portals

- www.citizenscience.gov
- scistarter.org
- zooniverse.org

Biomedical Citizen Science

- crowd.cochrane.org – organize healthcare evidence
- curate.outbreak.info – COVID-19 resources
- eternagame.org – RNA folding
- eyewire.org – 3D neuronal structure
- foldit.it – protein folding
- phylogame.org – sequence alignment
- stallcatchers.com – Alzheimer's disease

UPCOMING LECTURE

Harnessing Chemical Biology for Cancer Drug Discovery

Speaker:
Michael Erb, PhD
Assistant Professor
Department of Chemistry

WEDNESDAY, OCTOBER 14, 2020

Scripps Research

Register at frontrow.scripps.edu