Data integration and multi-omics

Thomas Stoeger
thomas.stoeger@northwestern.edu

November 24th, 2020

How this lecture will work:

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Q/A on handout

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mini-presentation

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mini-presentation

group coding exercise

How this lecture will work:

Q/A on handout

get overview
know where to find details

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solidify main points

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Handout (7min to read)

https://github.com/tstoeger/course_multi_omics/blob/main/multi-omics.pdf

Q/A on handout

get overview
know where to find details

Handout (7min to read)

https://github.com/tstoeger/course_multi_omics/blob/main/multi-omics.pdf

Questions (~5min)

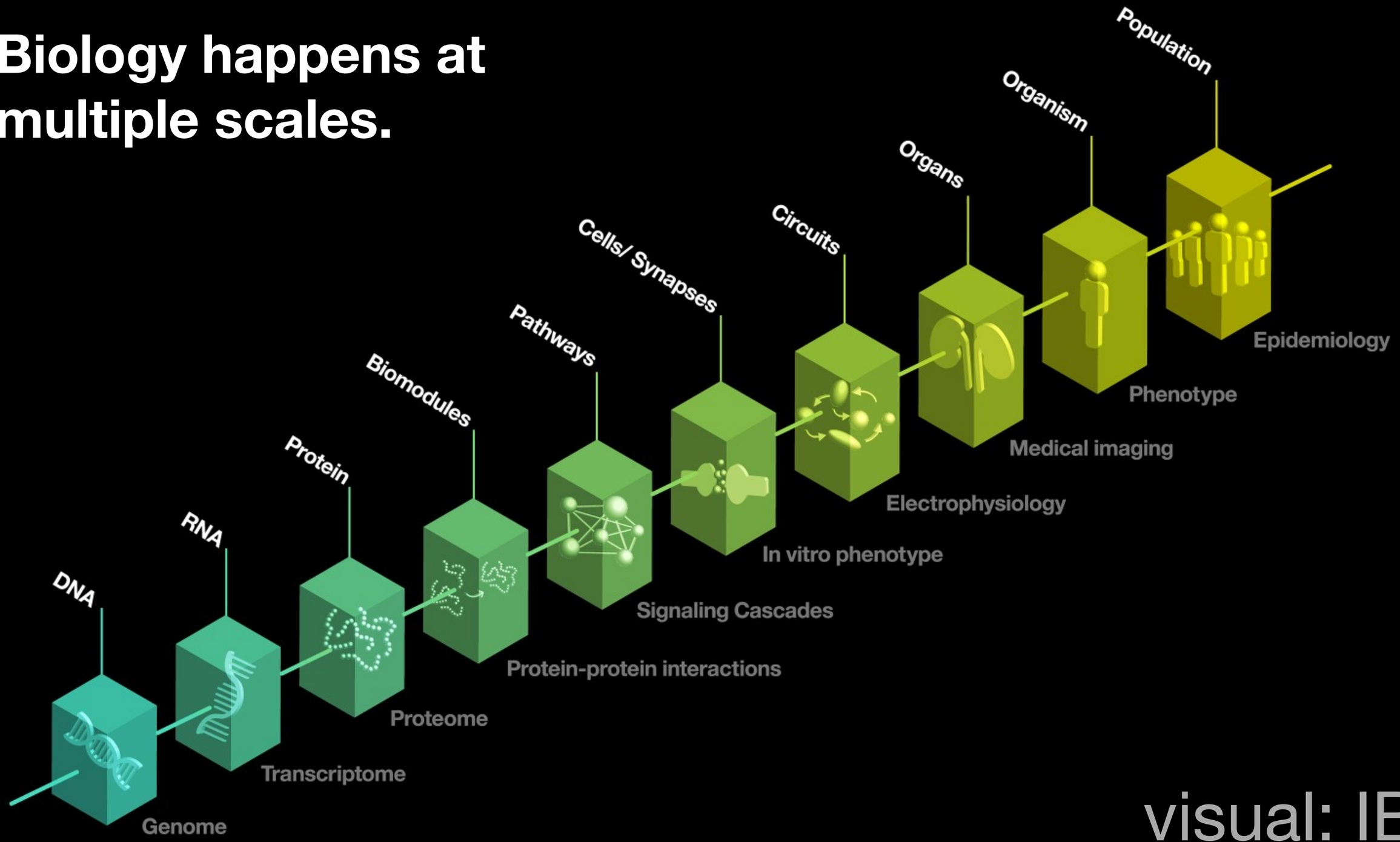
Ask in person.

Ask anonymously on:
https://padlet.com/thomasstoeger/a4mtvpym671dwgnl

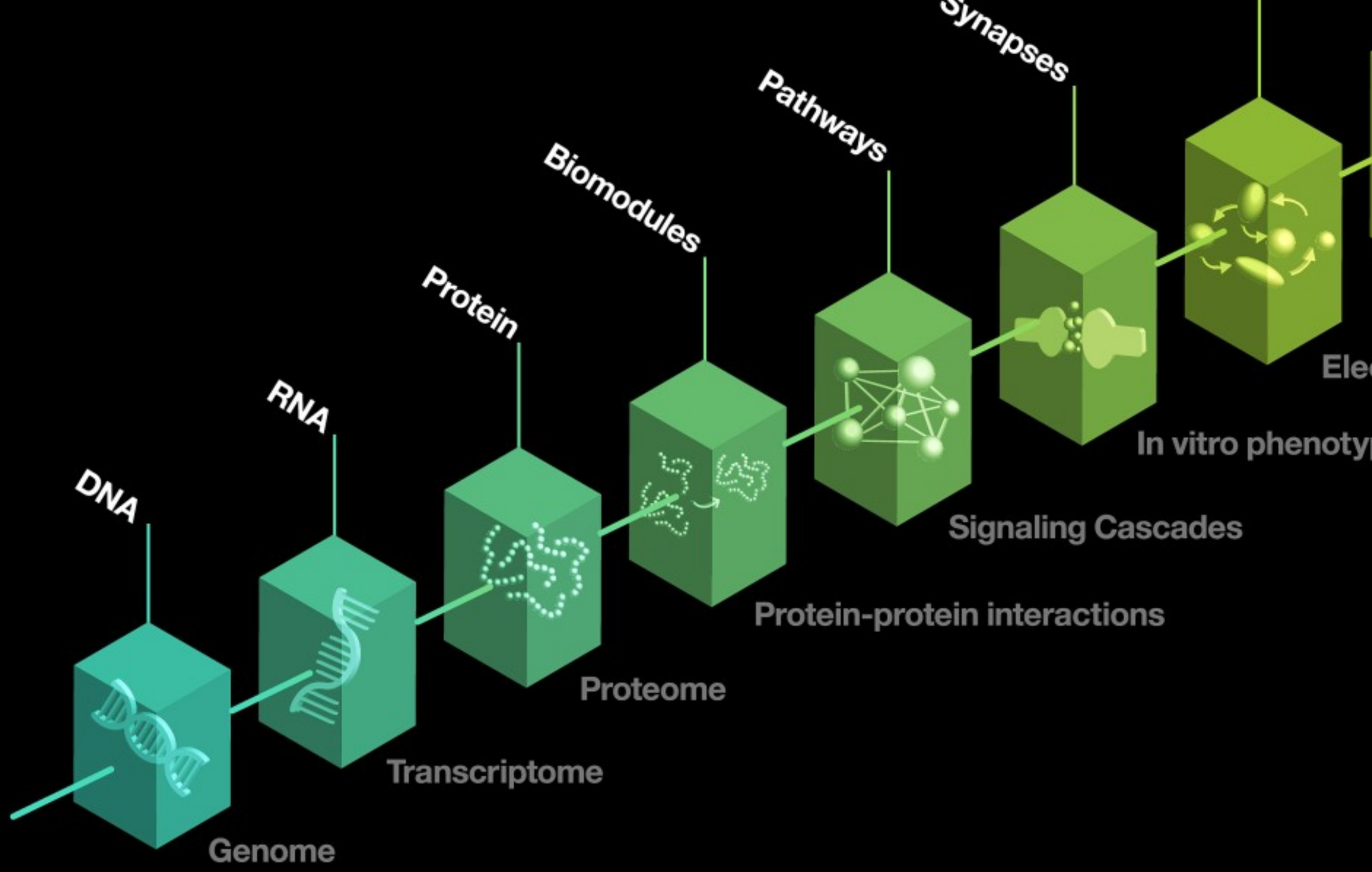
mini-presentation

solidify main points

Biology happens at multiple scales.



visual: IBM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Synapses
Genome
Transcriptome
Proteome
Protein-protein interactions
Signaling Cascades
In vitro phenoty
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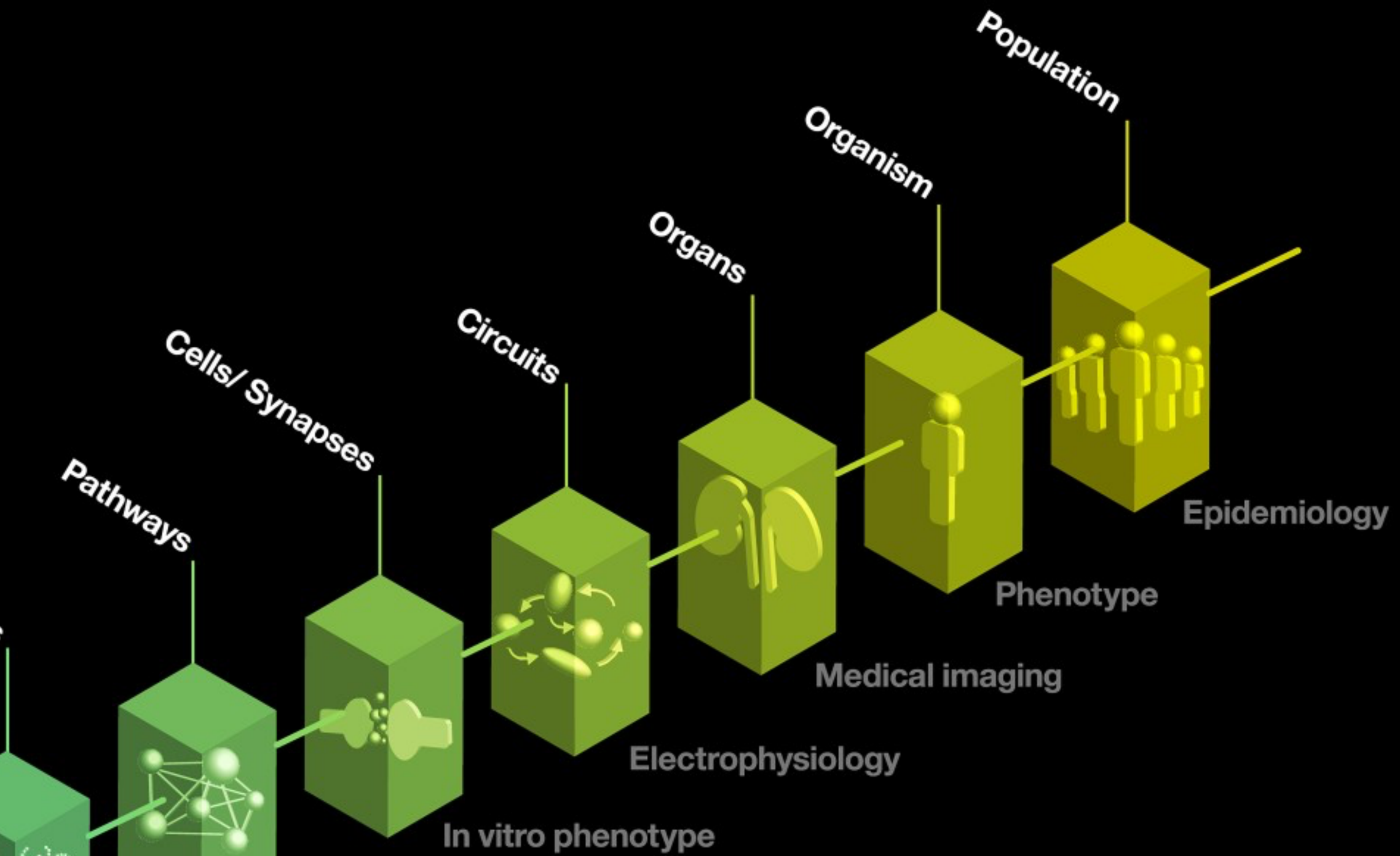
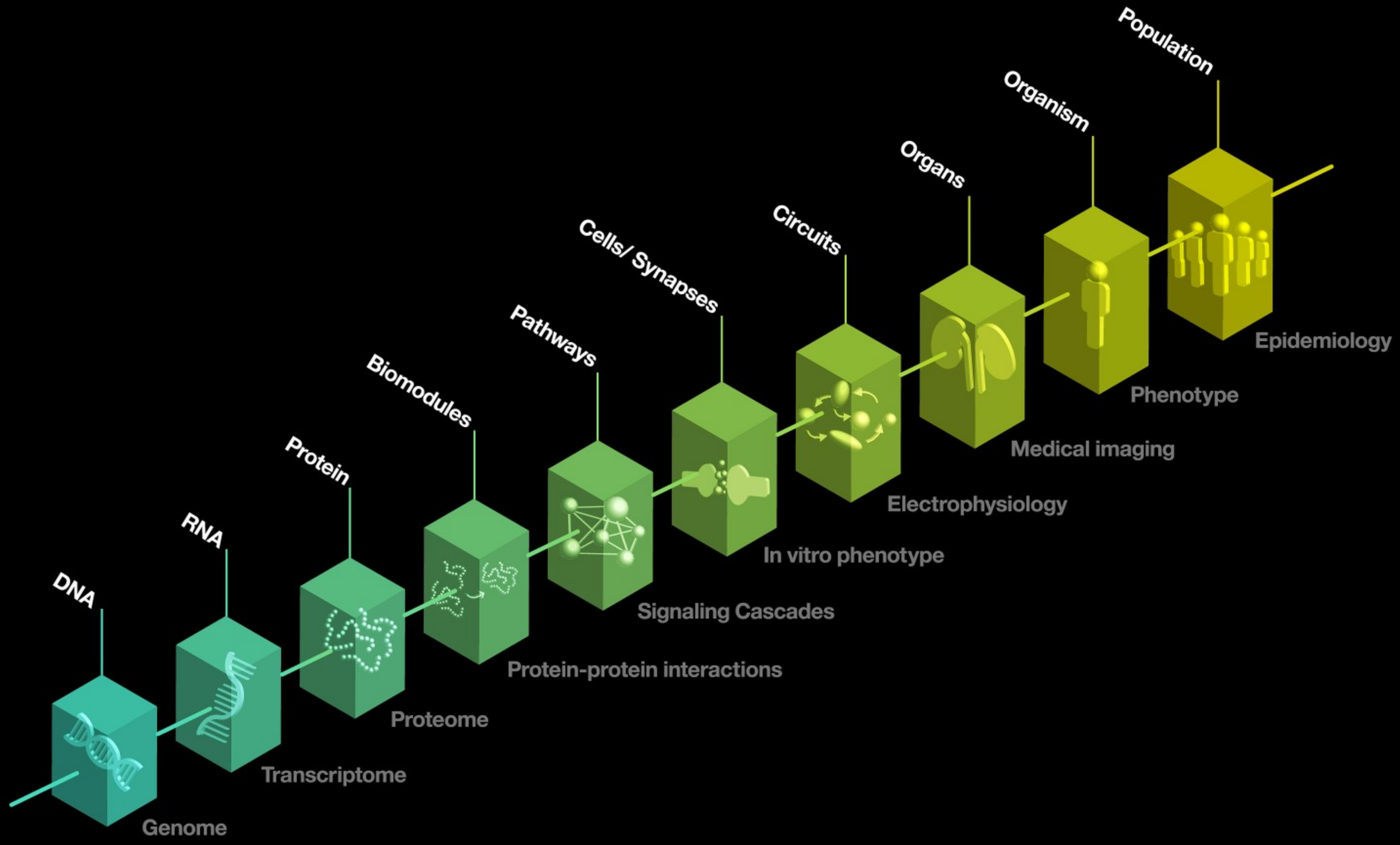

Population
Organism
Organs
Circuits
Cells/ Synapses
Pathways
Epidemiology
Phenotype
Medical imaging
Electrophysiology
In vitro phenotype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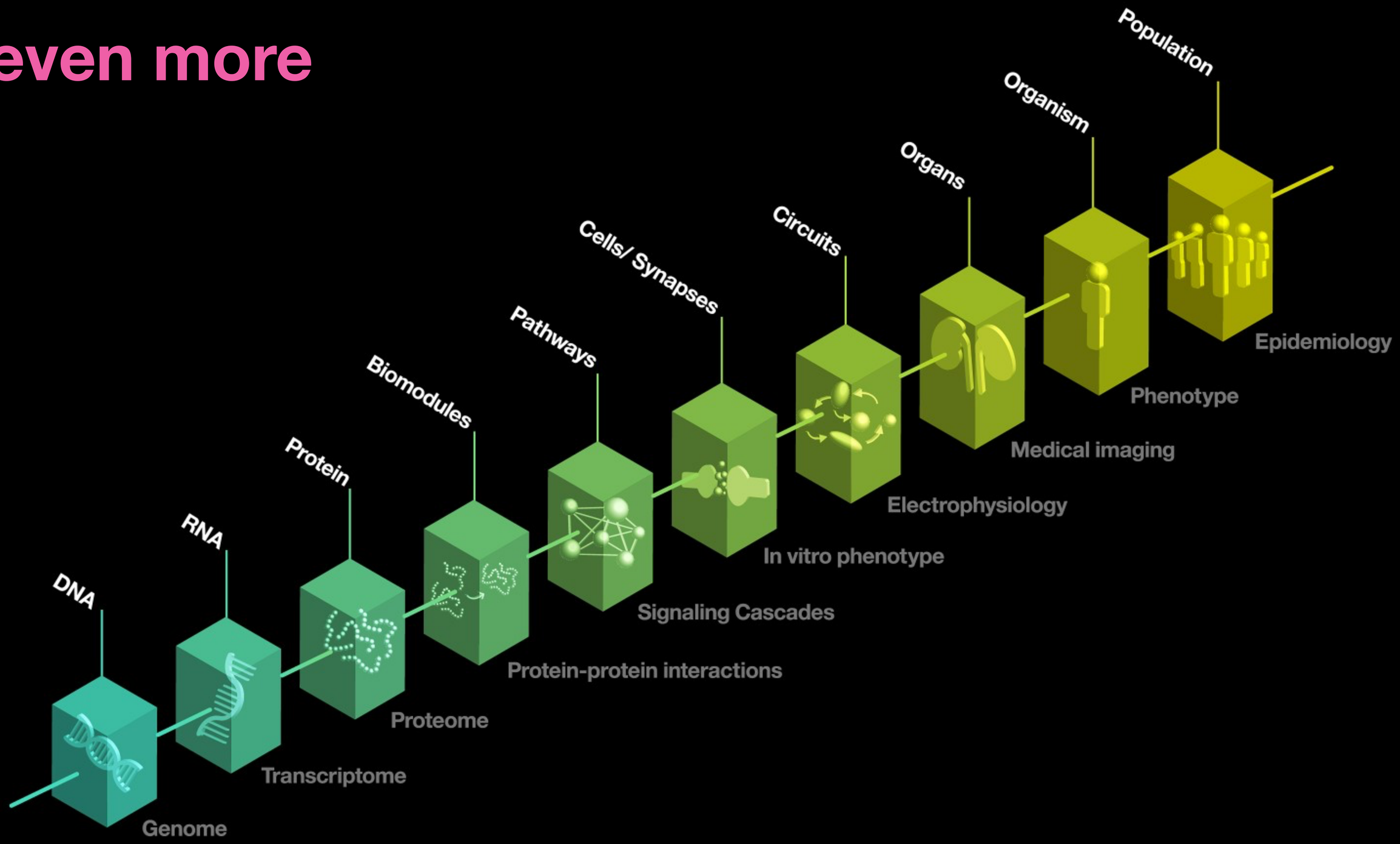
even more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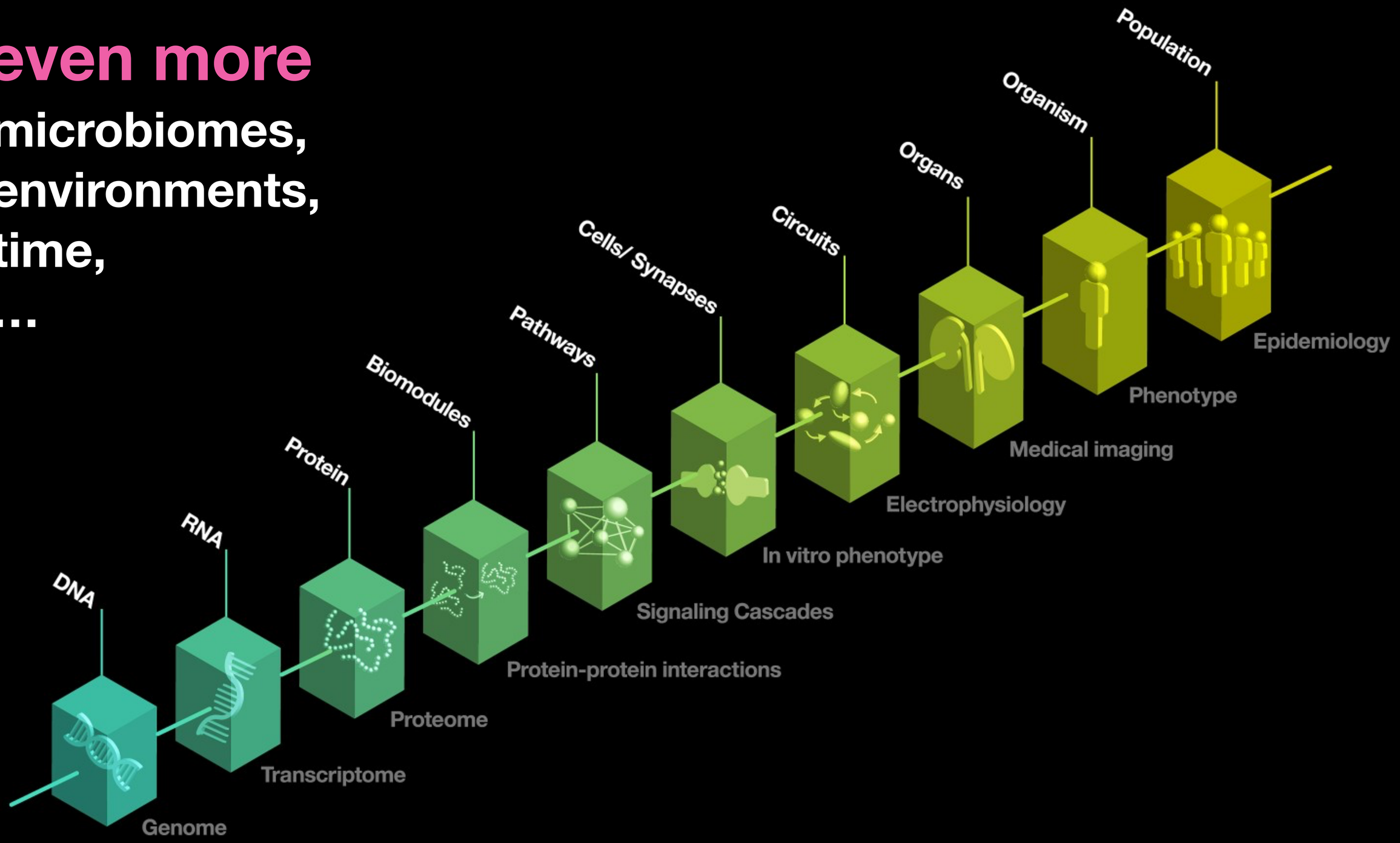
even more

microbiomes,
environments,
time,
...



even more

microbiomes,
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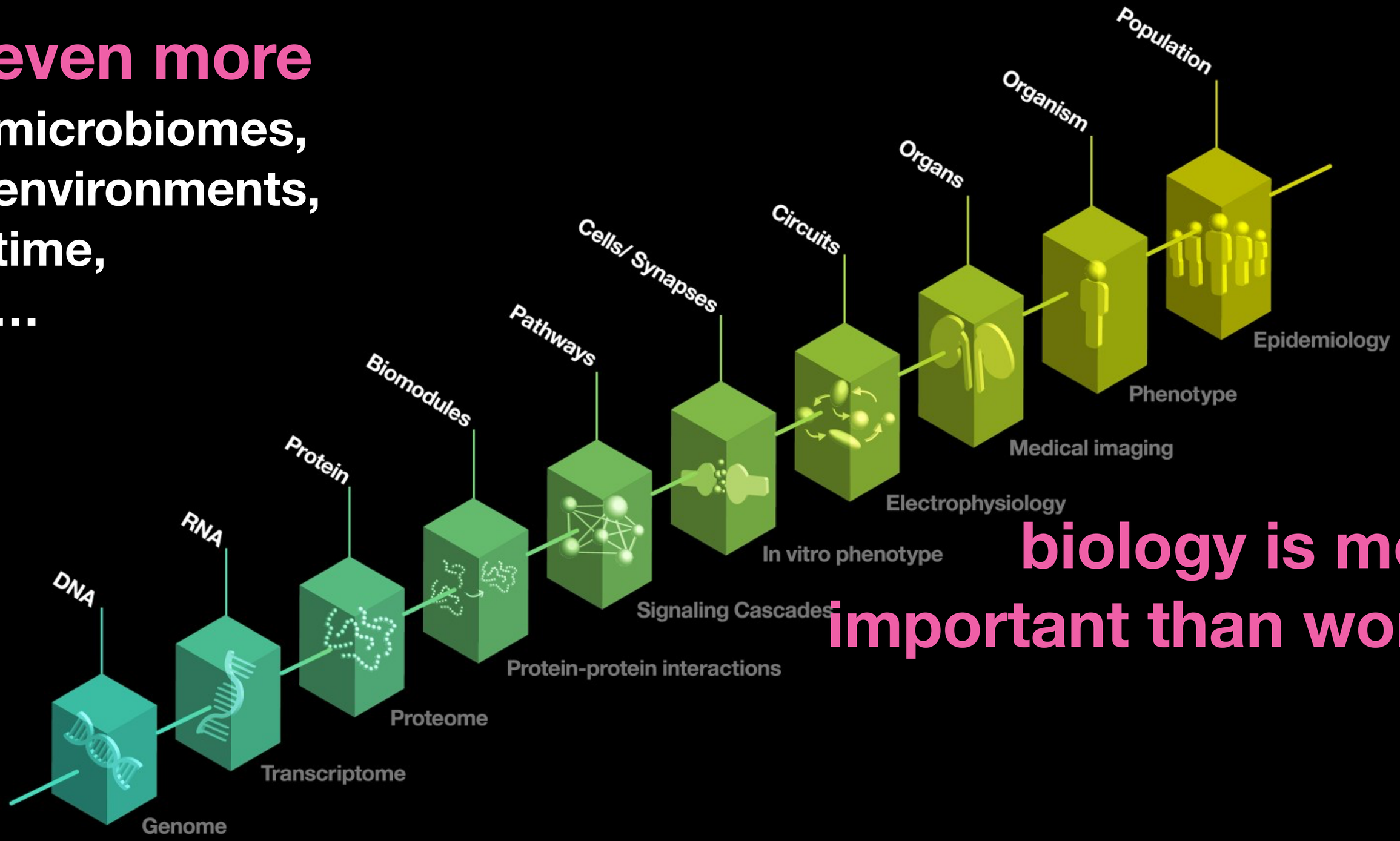
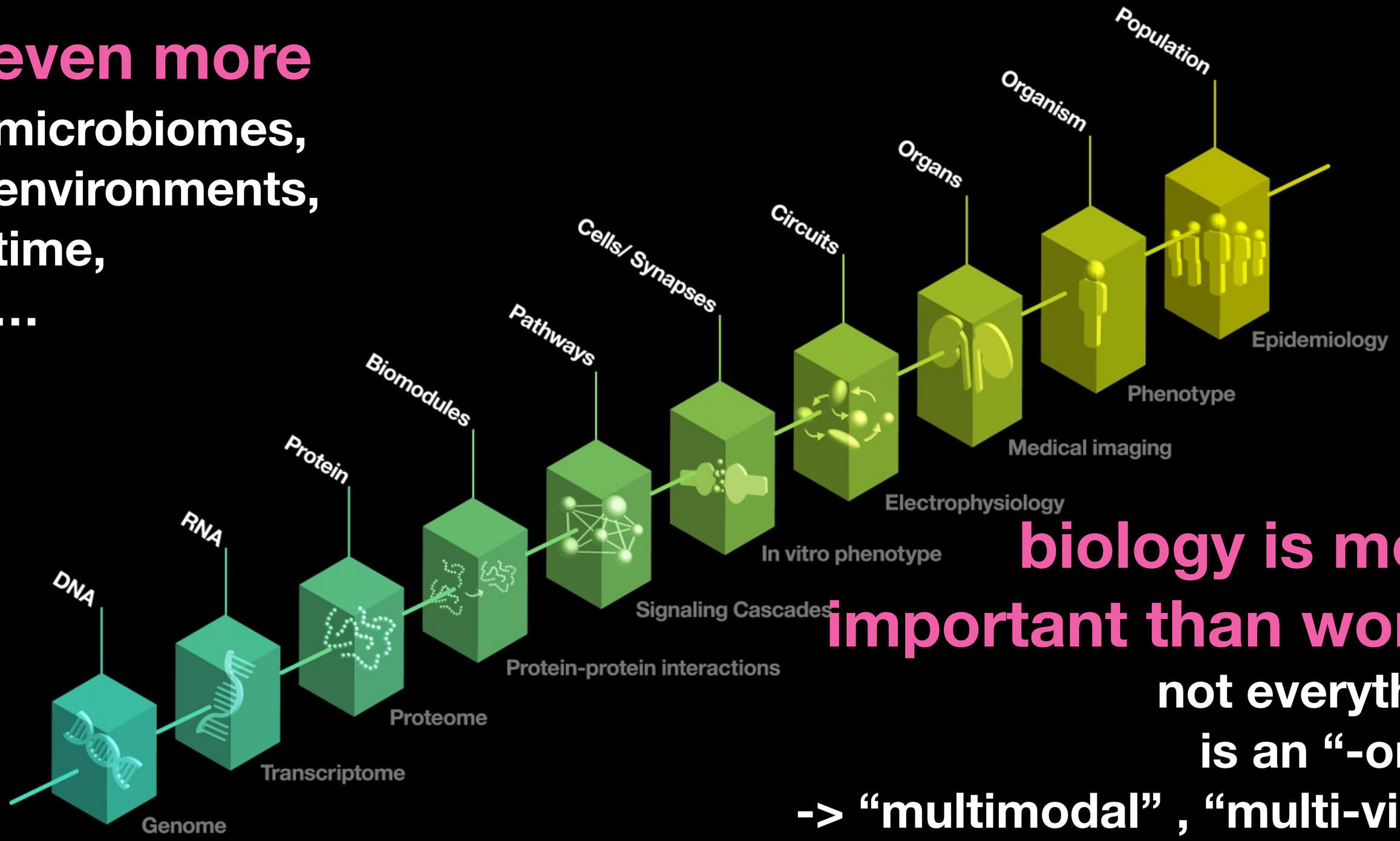


biology is more important than words

even more

microbiomes,
environments,
time,
...

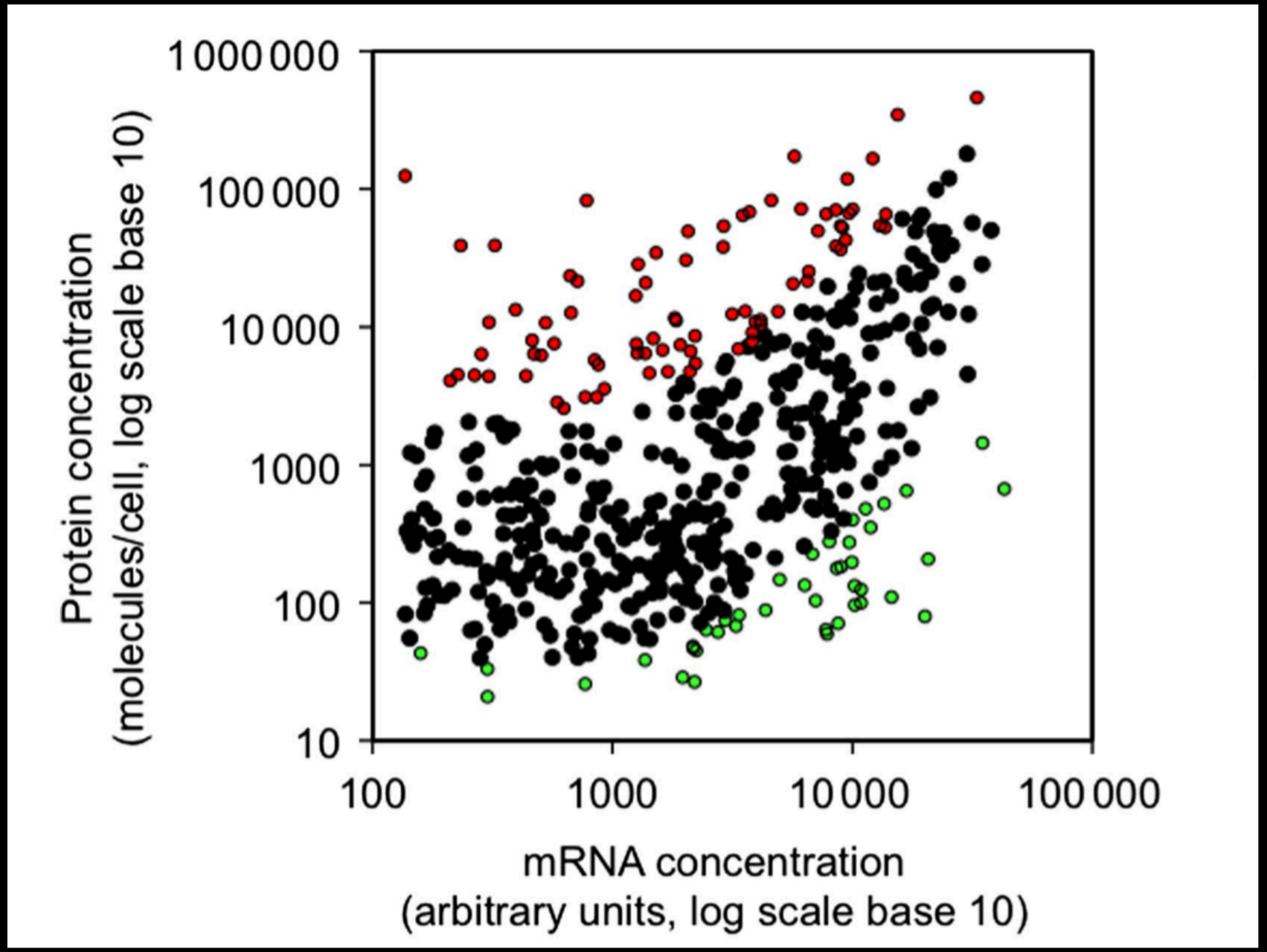


biology is more important than words

not everything
is an “-ome”
-> “multimodal” , “multi-view”

many combinations

Be careful!


1 000 000
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(molecules/cell, log scale base 10)
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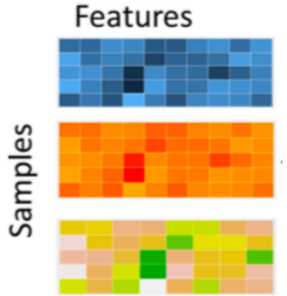
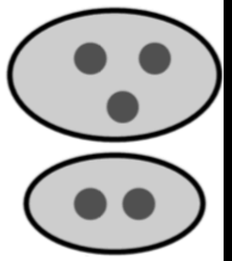
There are many different strategies.





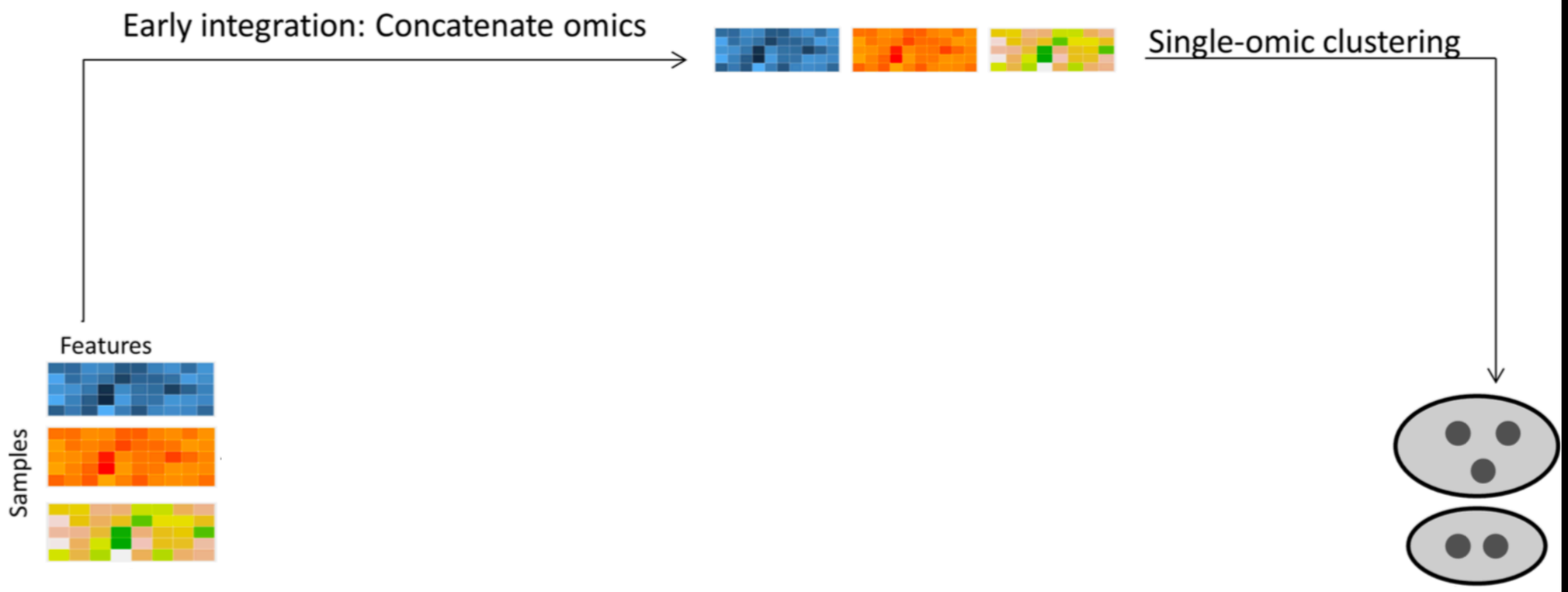
Pavlidis et al., 2001

Rappoport and Shamir, 2018

Stuart and Satija, 2019

Figure 1. Overview of multi-omics clustering approaches.

There are many different strategies.



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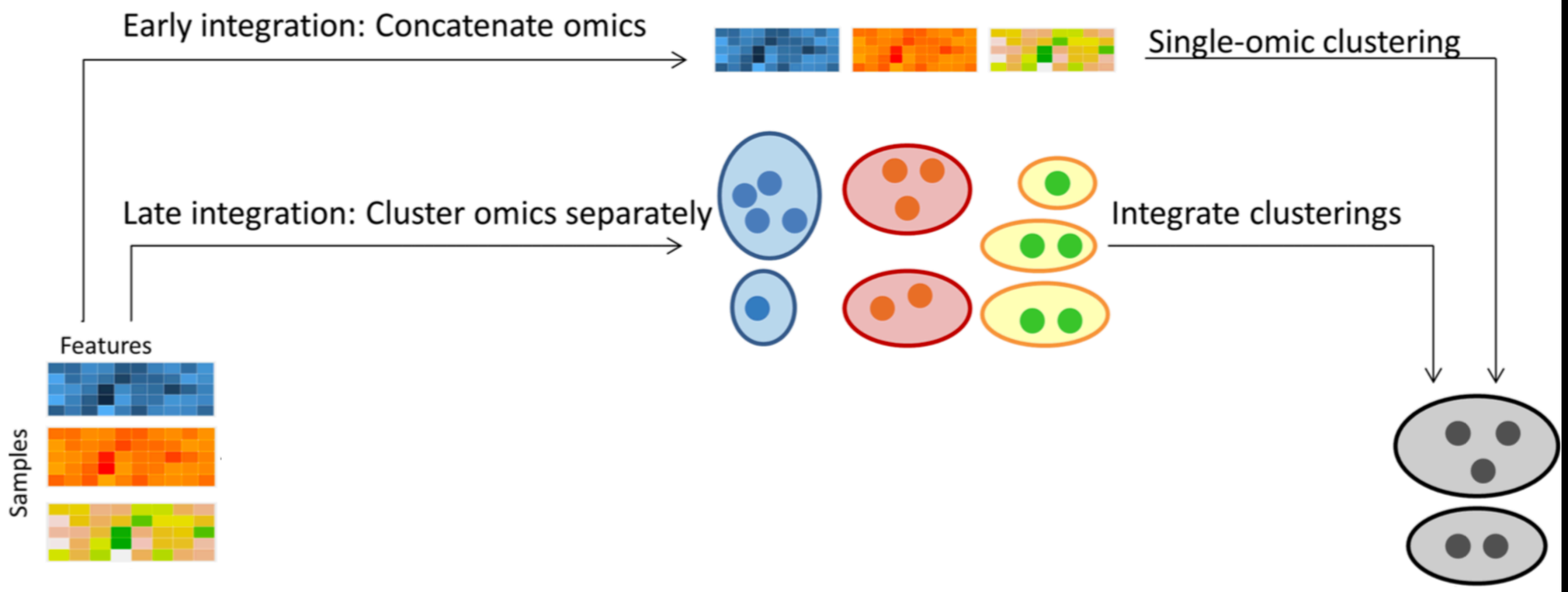

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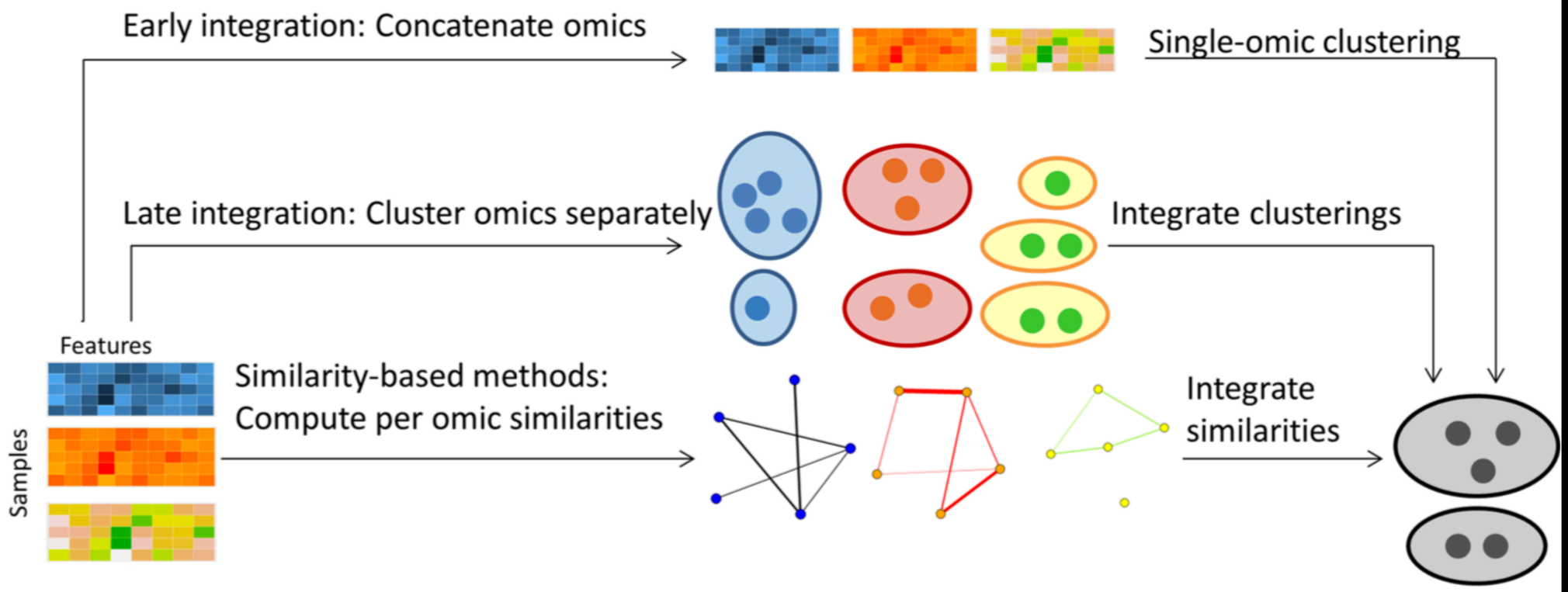

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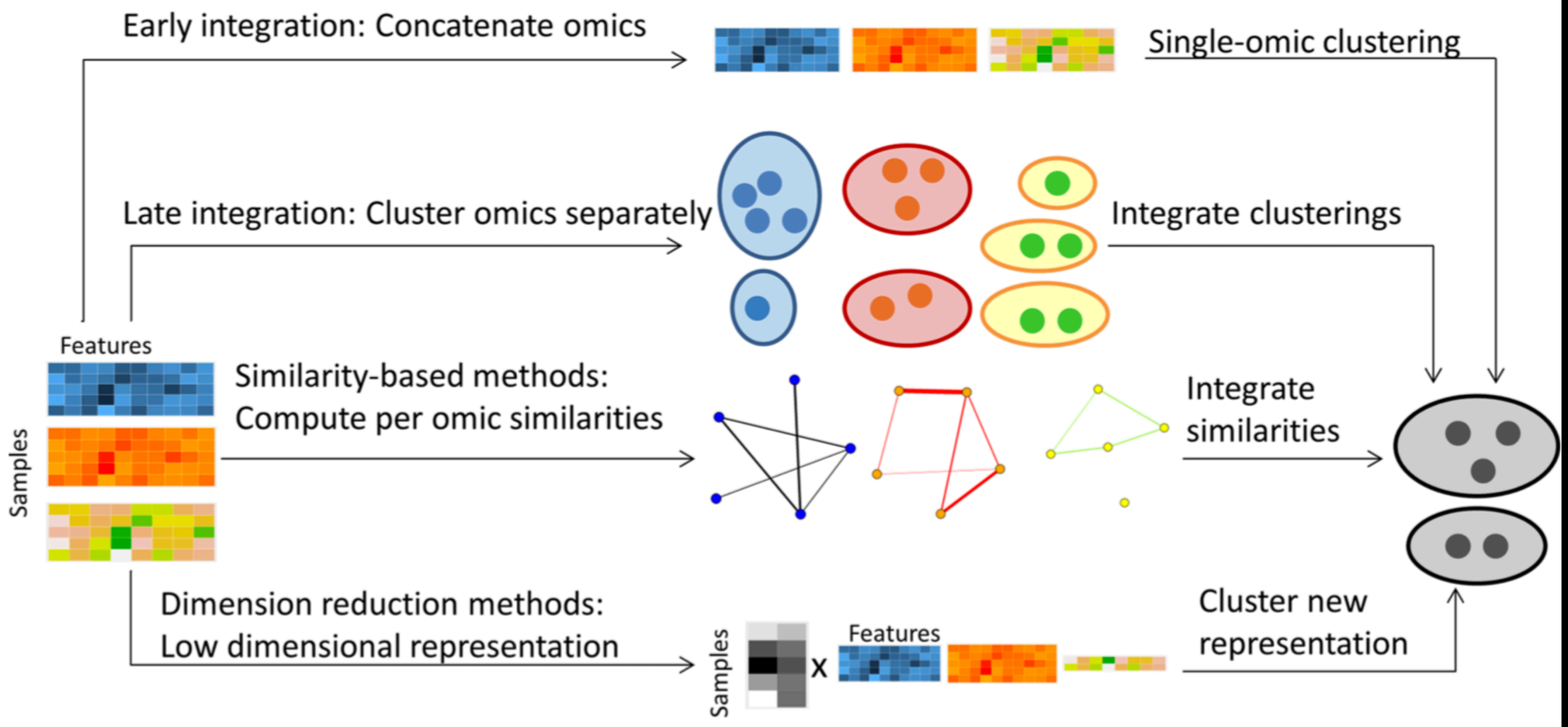

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Organize data by adhering to good practices.

THE AMERICAN STATISTICIAN
2018, VOL. 72, NO. 1, 2–10
https://doi.org/10.1080/00031305.2017.1375989

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OPEN ACCESS Check for updates

Data Organization in Spreadsheets

Karl W. Broman[a] and Kara H. Woo[b]

[a]Department of Biostatistics & Medical Informatics, University of Wisconsin-Madison, Madison, WI; [b]Information School, University of Washington, Seattle, WA

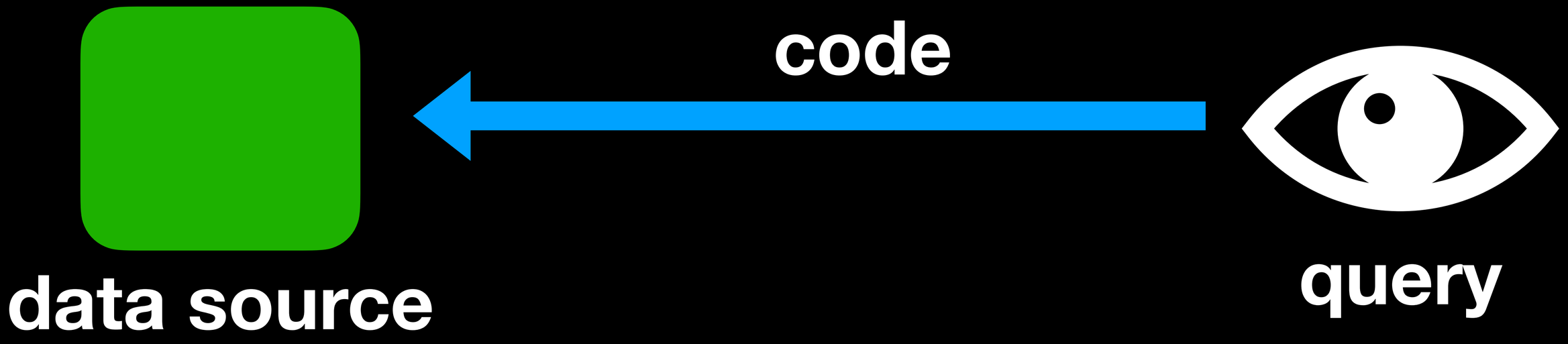
ABSTRACT

Spreadsheets are widely used software tools for data entry, storage, analysis, and visualization. Focusing on the data entry and storage aspects, this article offers practical recommendations for organizing spreadsheet data to reduce errors and ease later analyses. The basic principles are: be consistent, write dates like YYYY-MM-DD, do not leave any cells empty, put just one thing in a cell, organize the data as a single rectangle (with subjects as rows and variables as columns, and with a single header row), create a data dictionary, do not include calculations in the raw data files, do not use font color or highlighting as data, choose good names for things, make backups, use data validation to avoid data entry errors, and save the data in plain text files.

ARTICLE HISTORY
Received June 2017
Revised August 2017

KEYWORDS
Data management; Data organization; Microsoft Excel; Spreadsheets

Wrappers, something very useful to learn for everyone working with data.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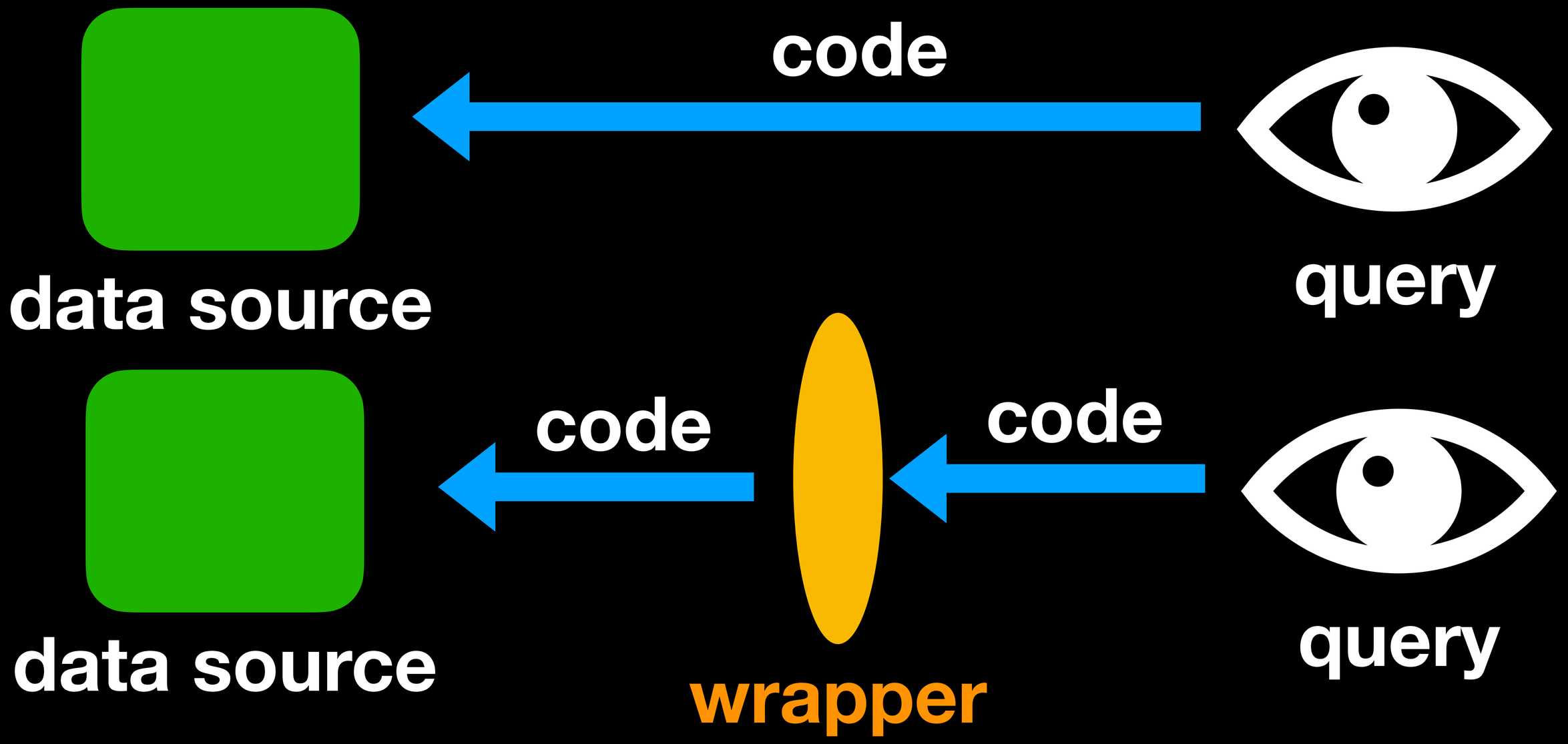
query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data source
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code
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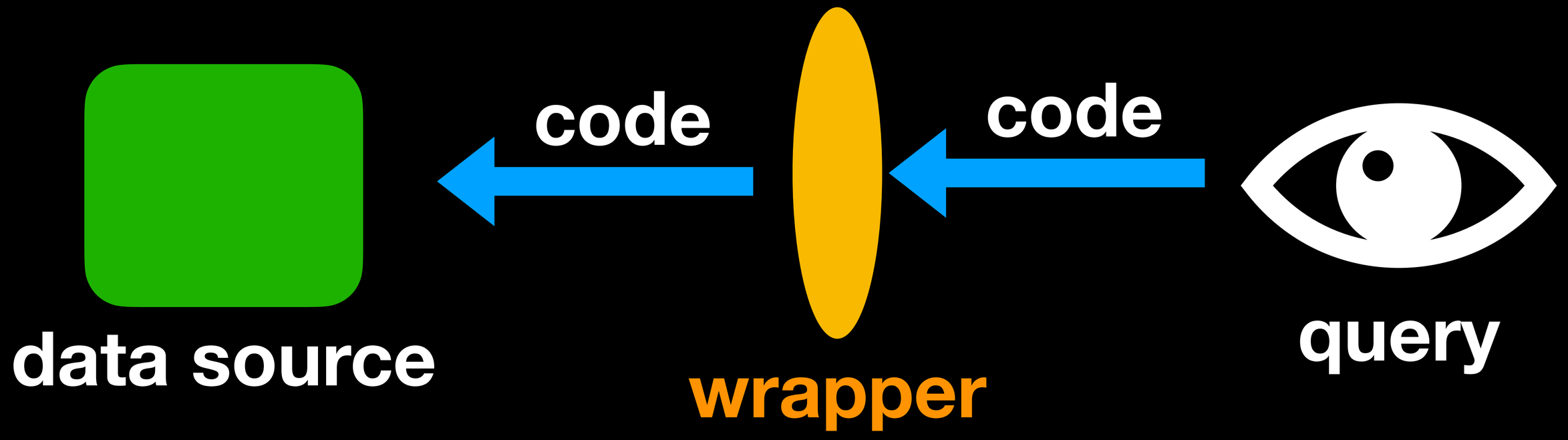
wrapper
query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other / new
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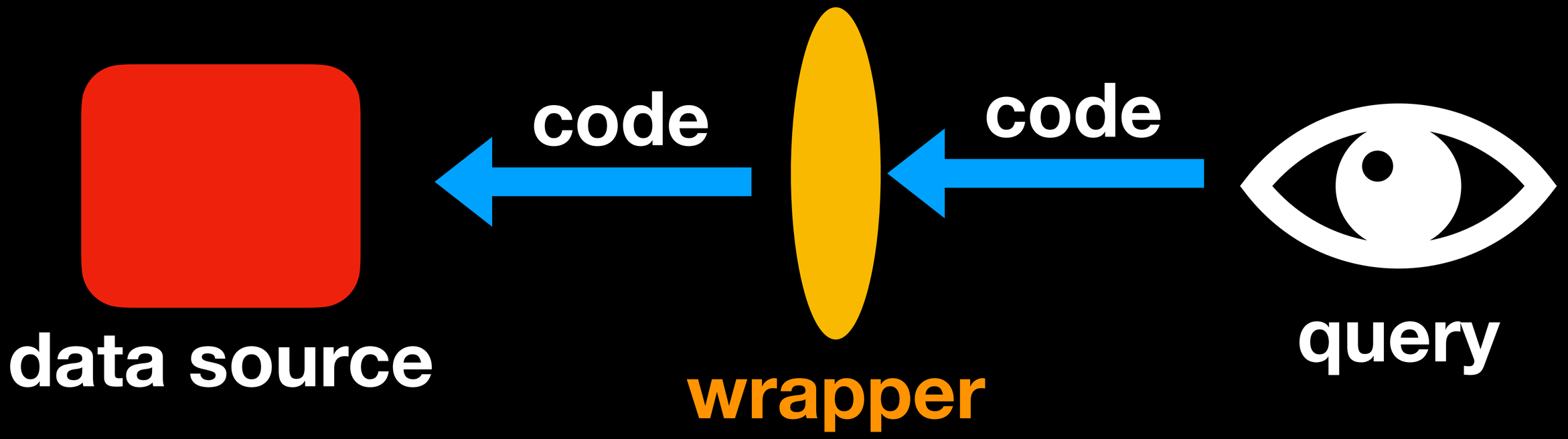

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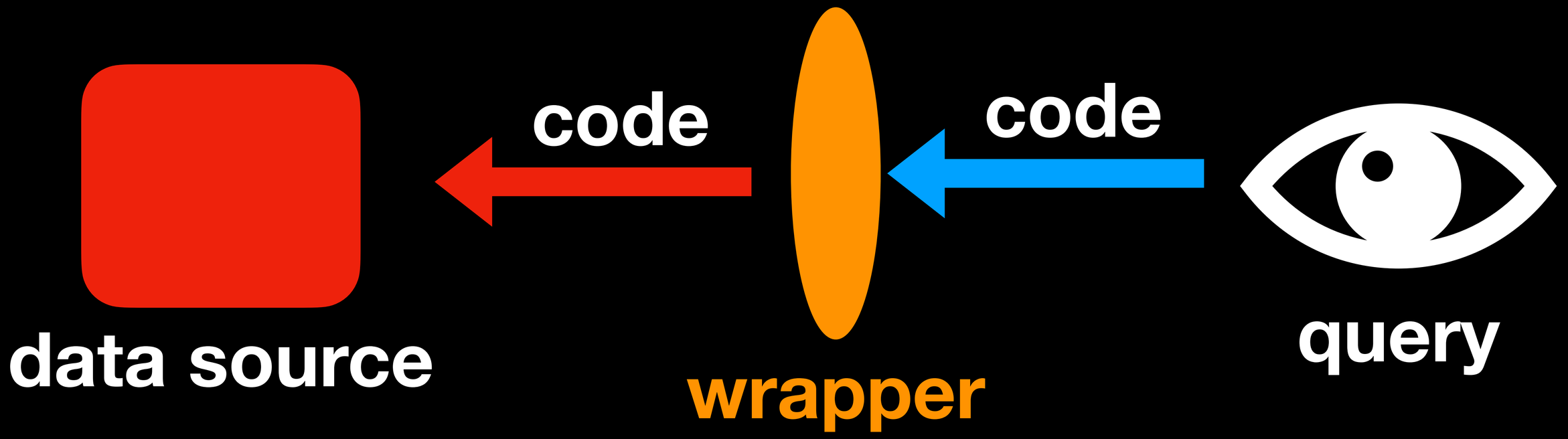

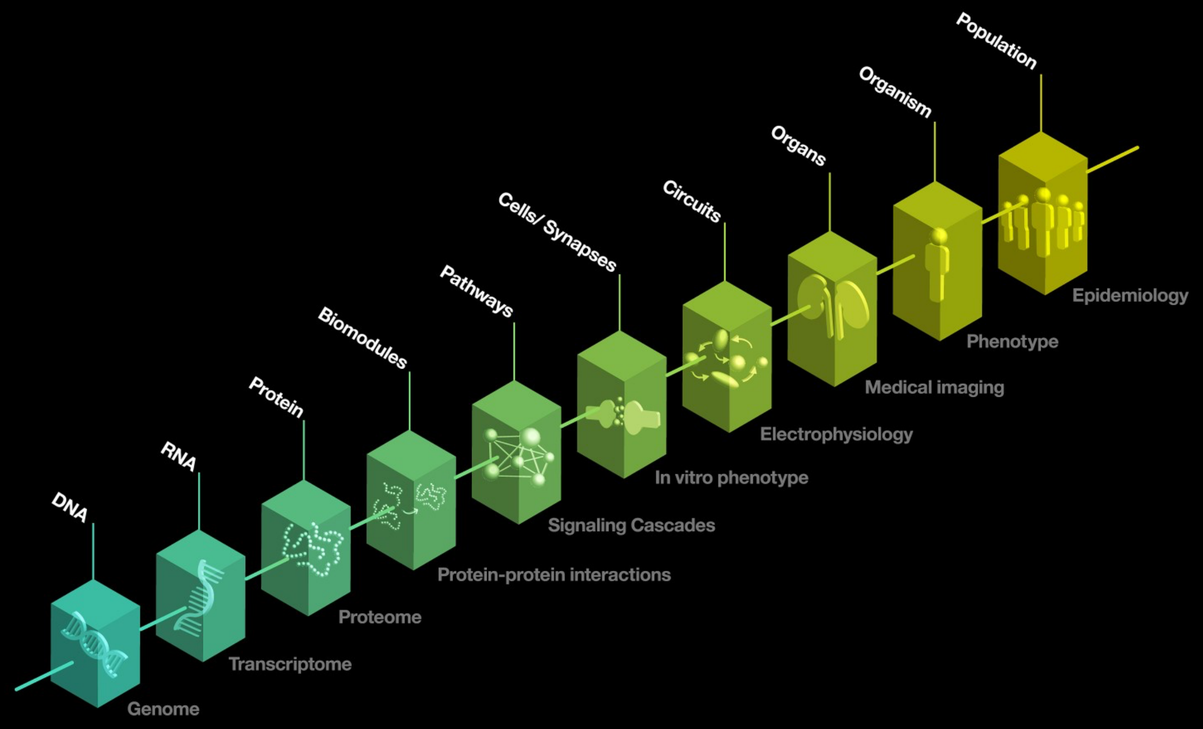
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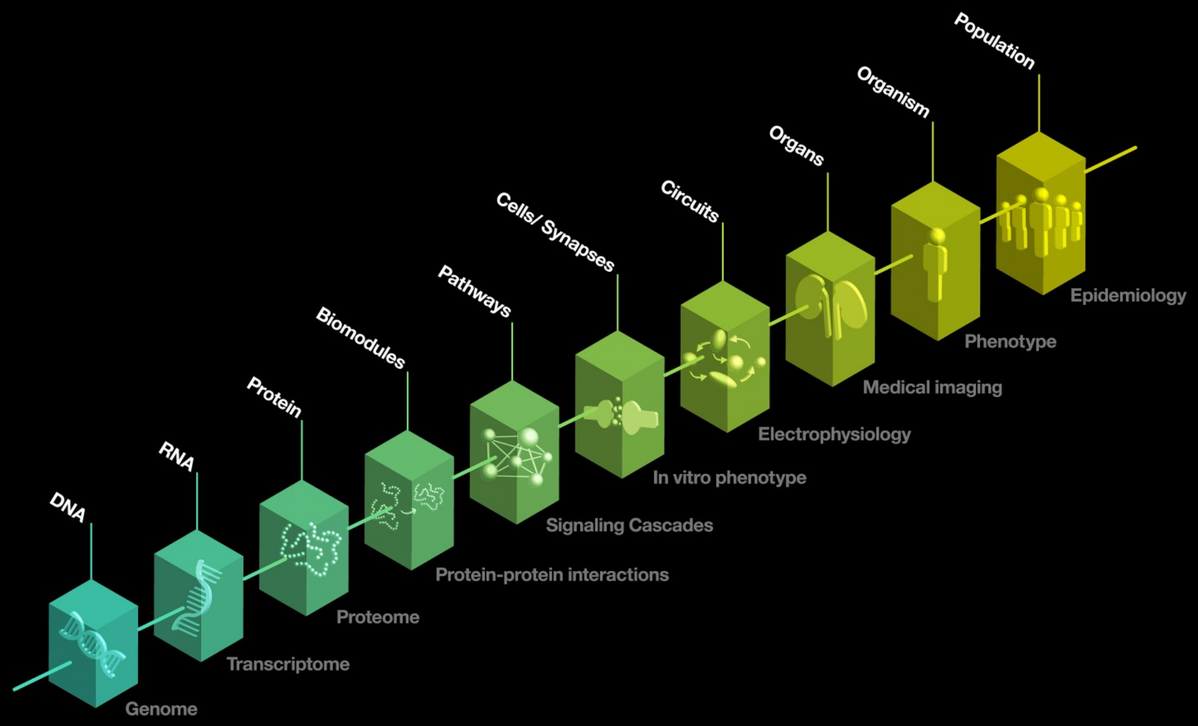
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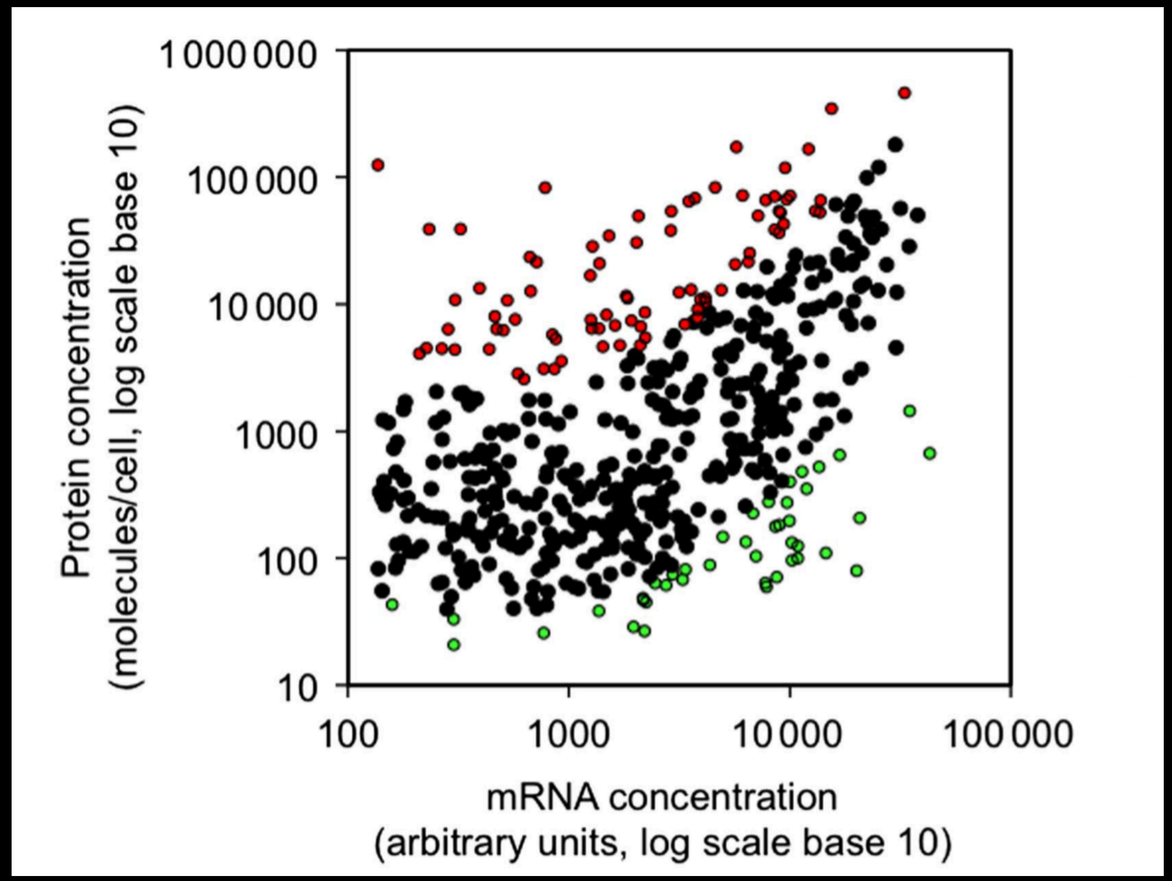
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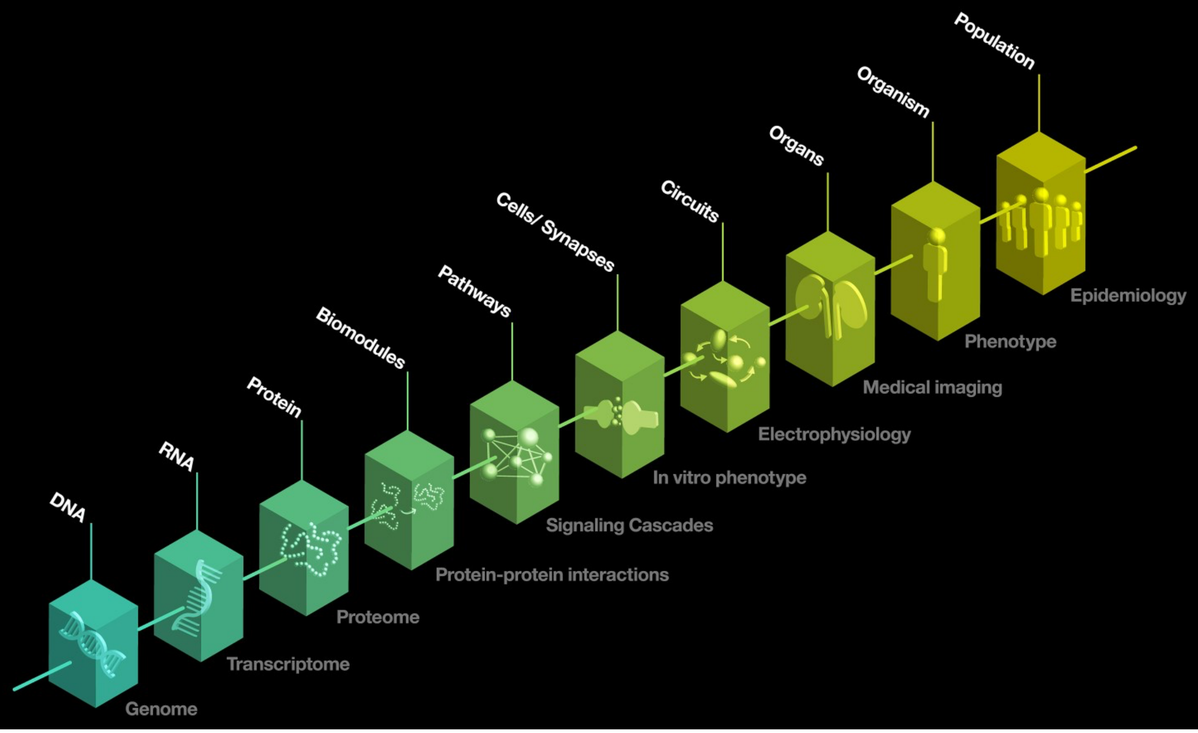

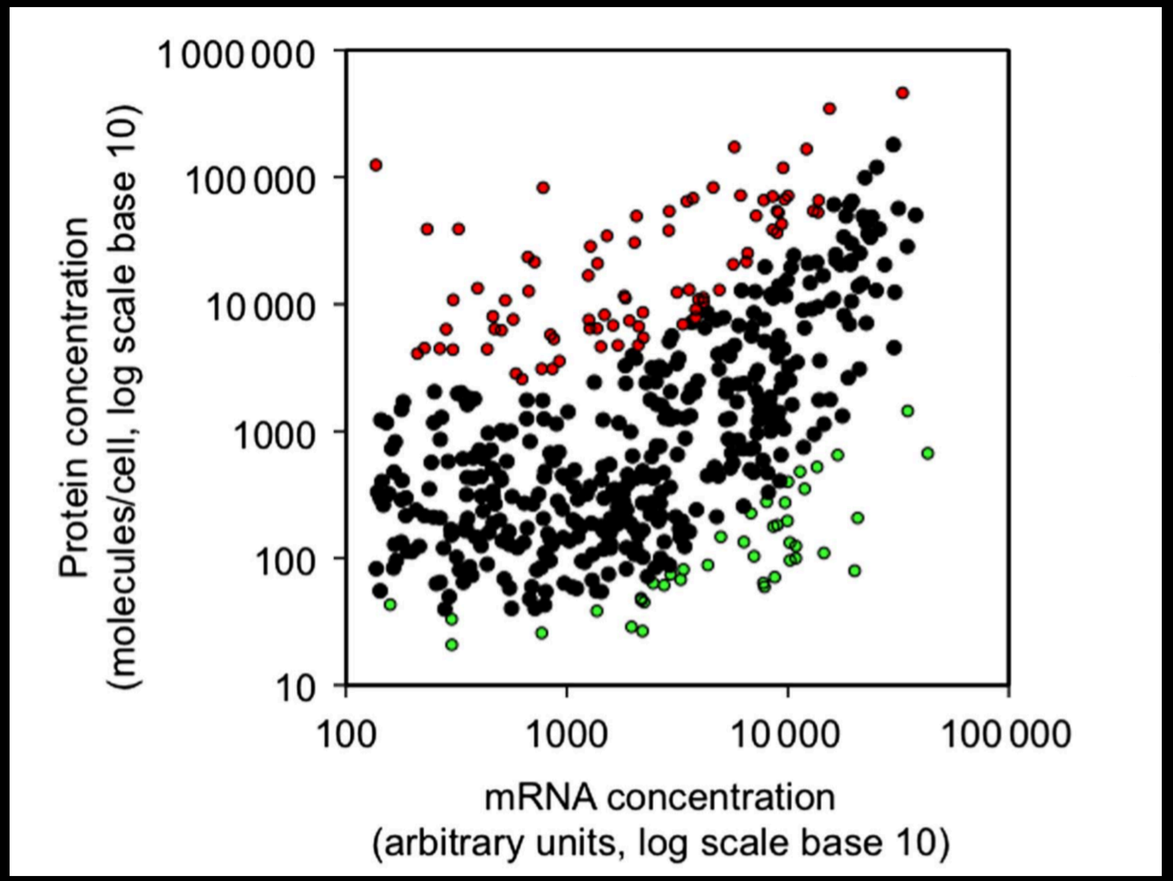

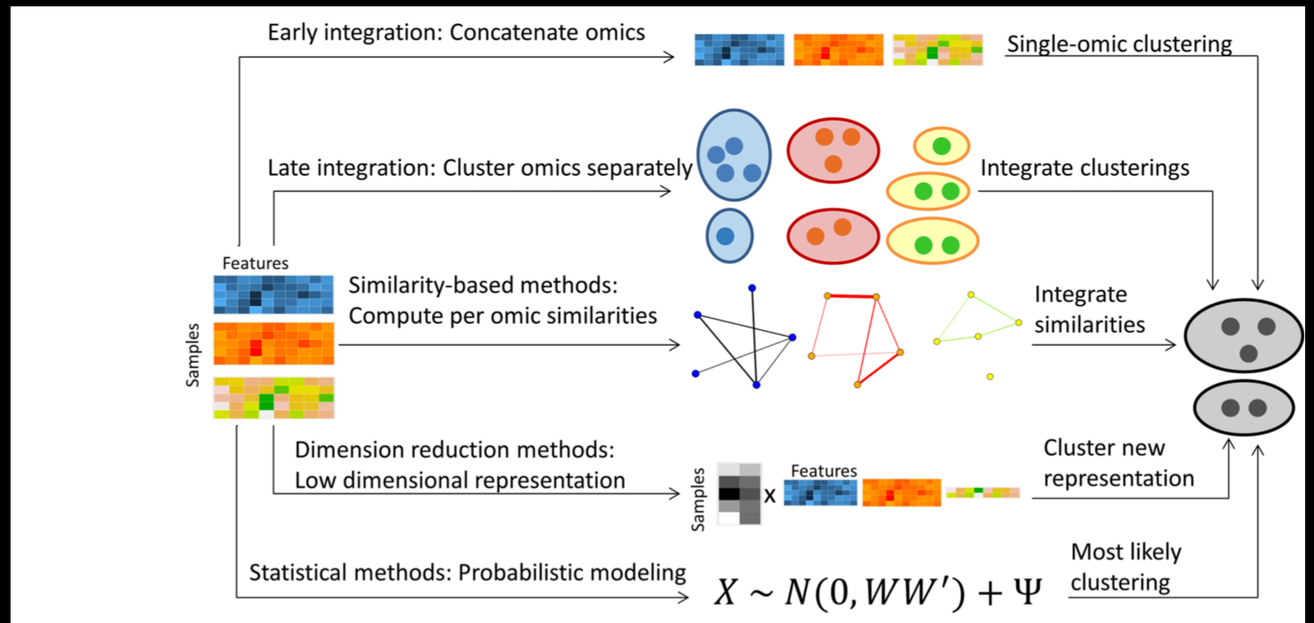

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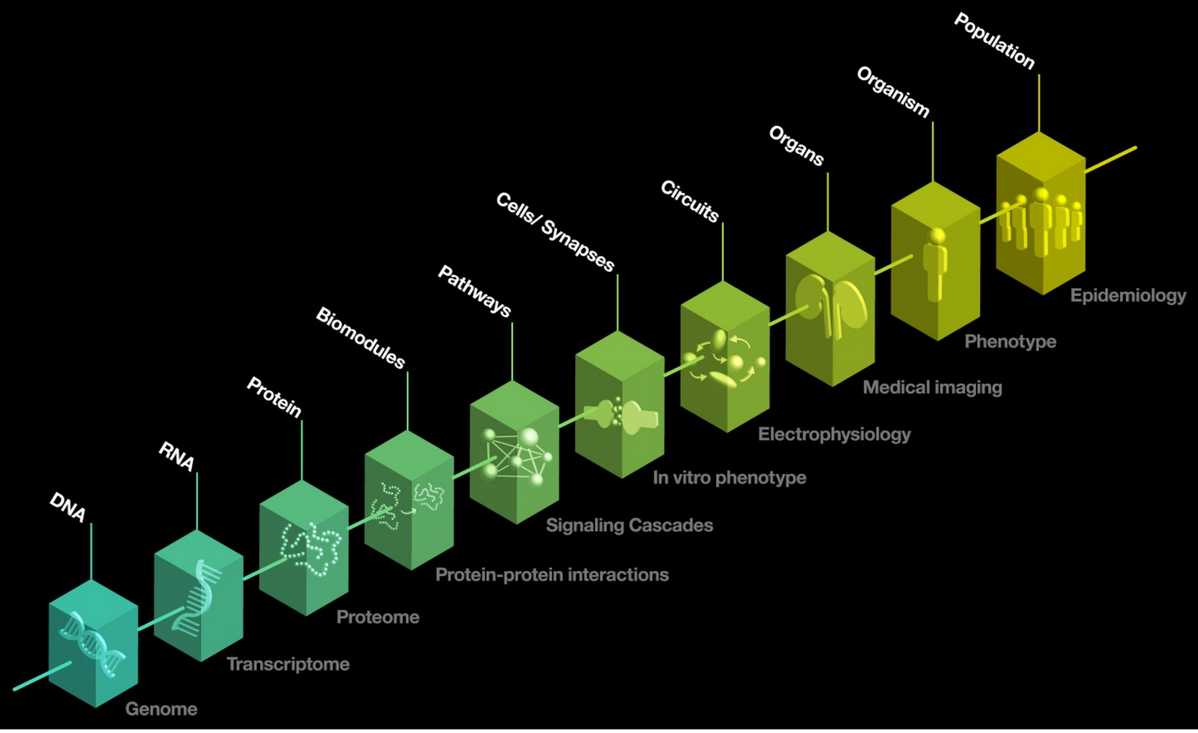

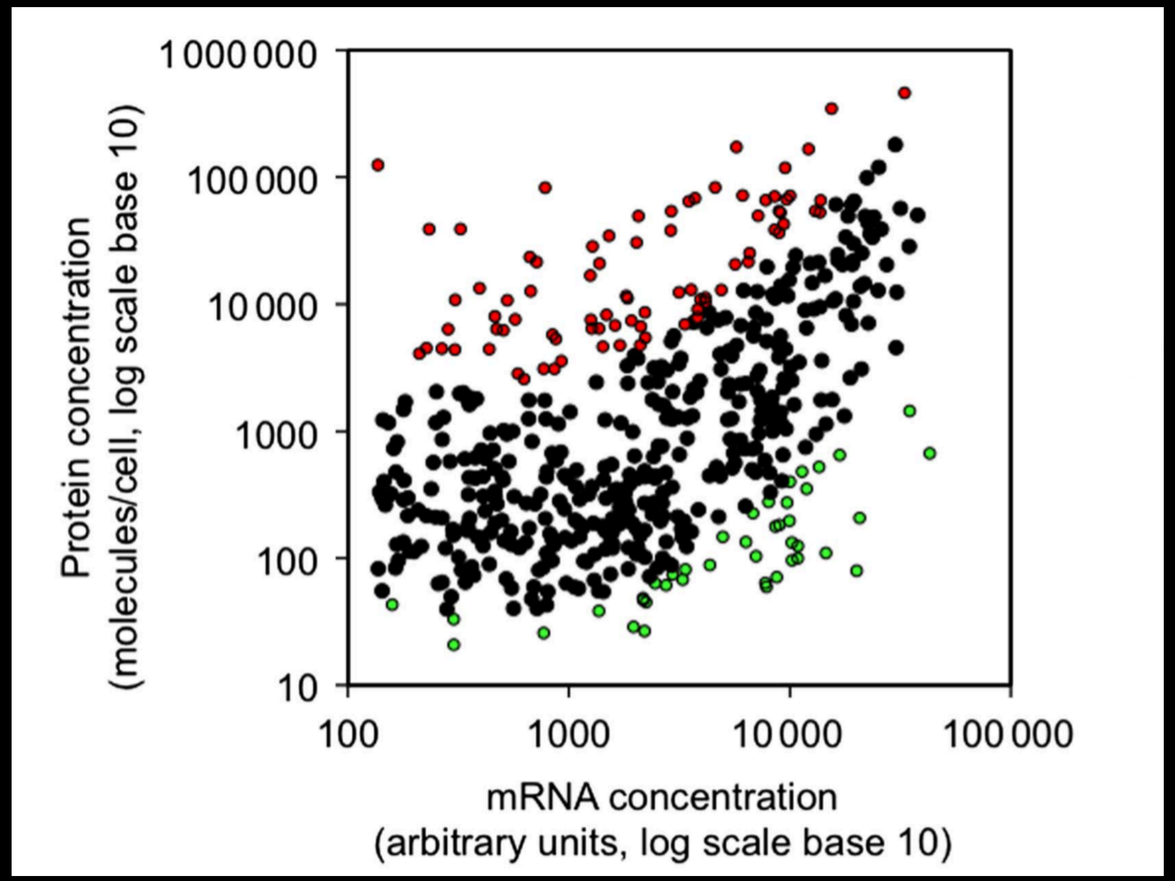

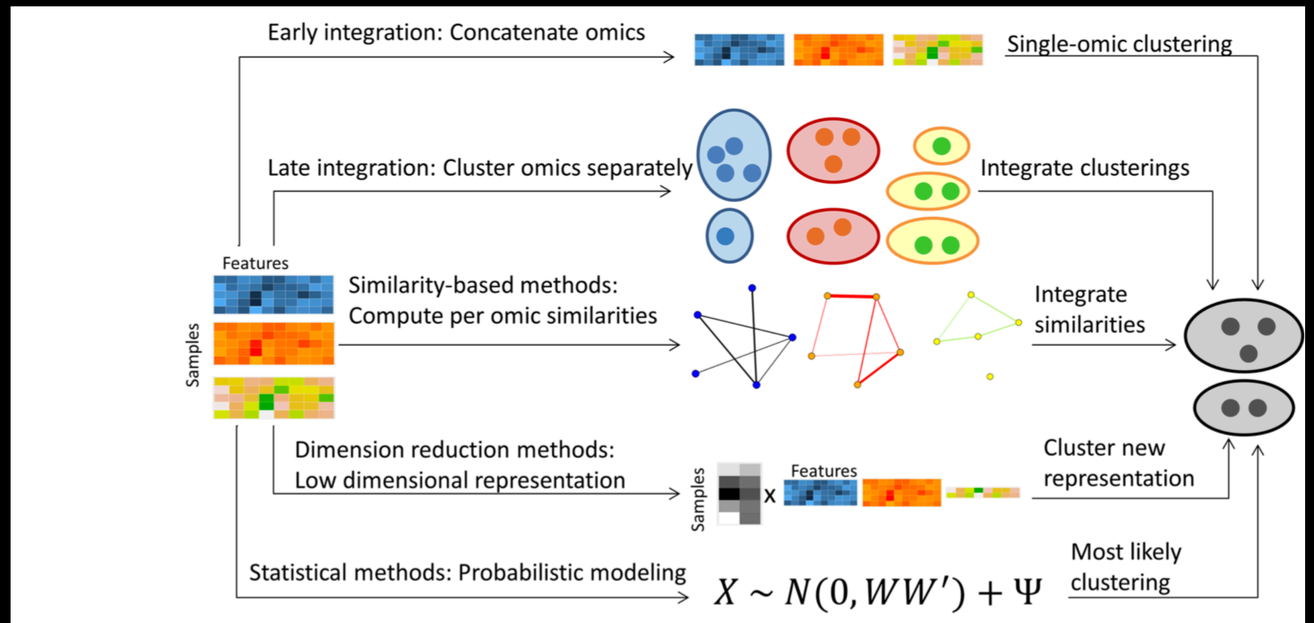

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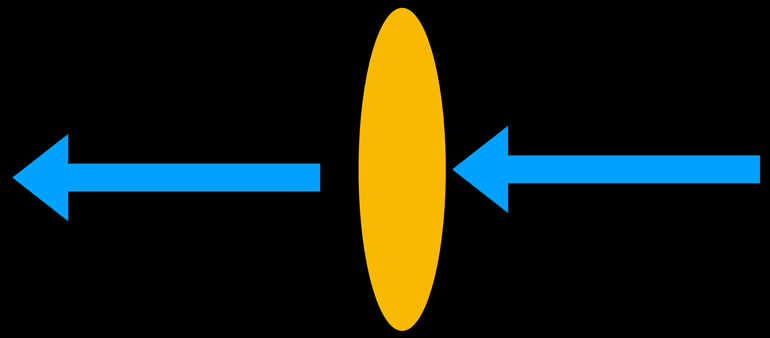


wrapper

group coding exercise

experience

30 minutes

30 minutes

3 people per breakout group

30 minutes

3 people per breakout group

free choice of tools

30 minutes

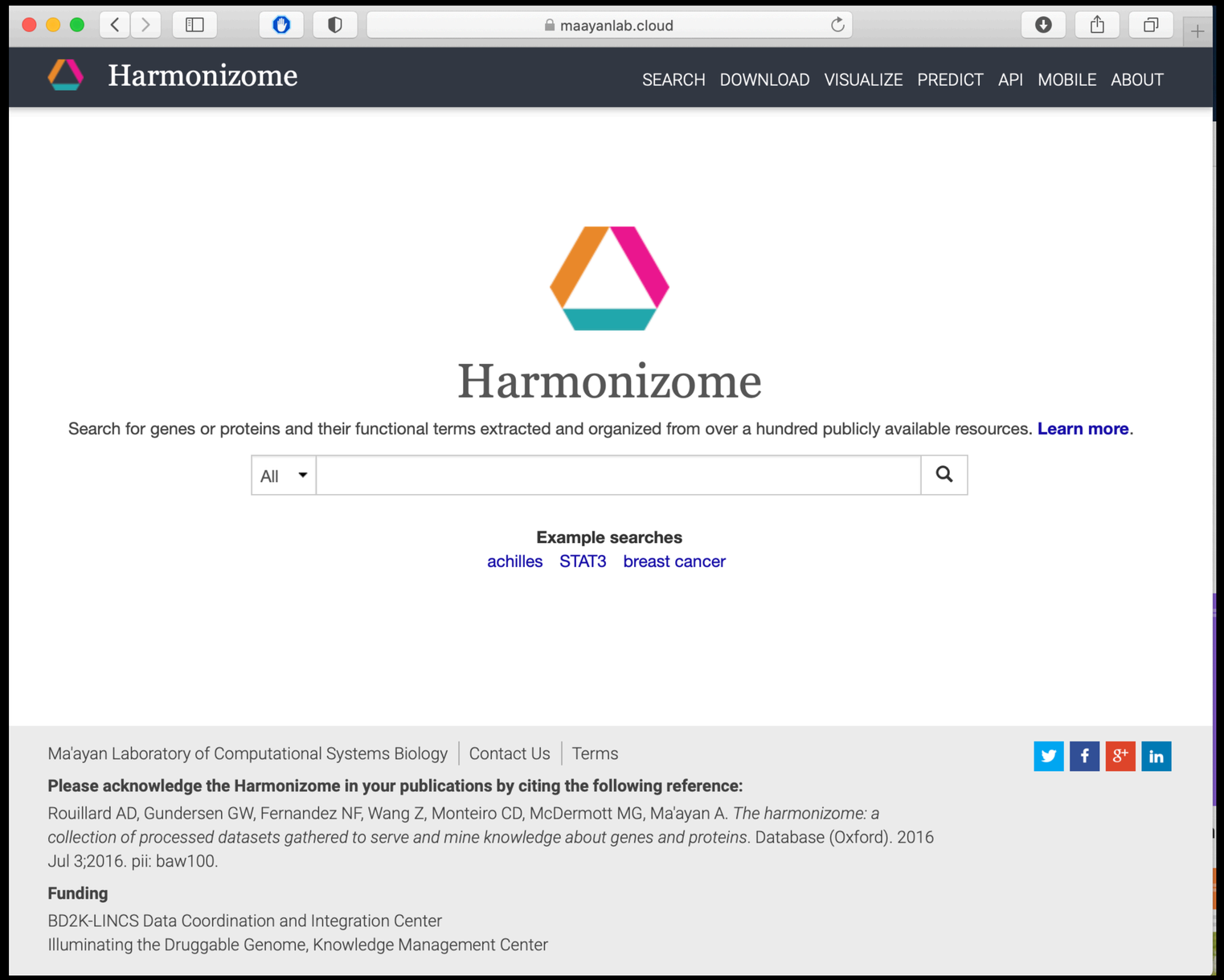
3 people per breakout group

free choice of tools

Are similarities between genes conserved across scales?

Data Source: https://maayanlab.cloud/Harmonizome/

subset: https://northwestern.box.com/s/dvrxld7ioe6jgm2srrs7rj8mzkqpkhsa (see handout)



Provides precomputed similarities between genes.

Are similarities between genes conserved across scales?

Note: while you might answer this within 30 minutes, identifying possible challenges is even more valuable.

Suggested: a) take two datasets that intrigue you – possibly small to limit download time b) work / talk with your fellow team members

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subset: https://northwestern.box.com/s/dvrxld7ioe6jgm2srrs7rj8mzkqpkhsa (see handout)

Template code: https://github.com/tstoeger/course_multi_omics/blob/main/how_well_do_different_views_on_biology_correlate.ipynb

Ask anonymously on: https://padlet.com/thomasstoeger/a4mtvpym671dwgnl