

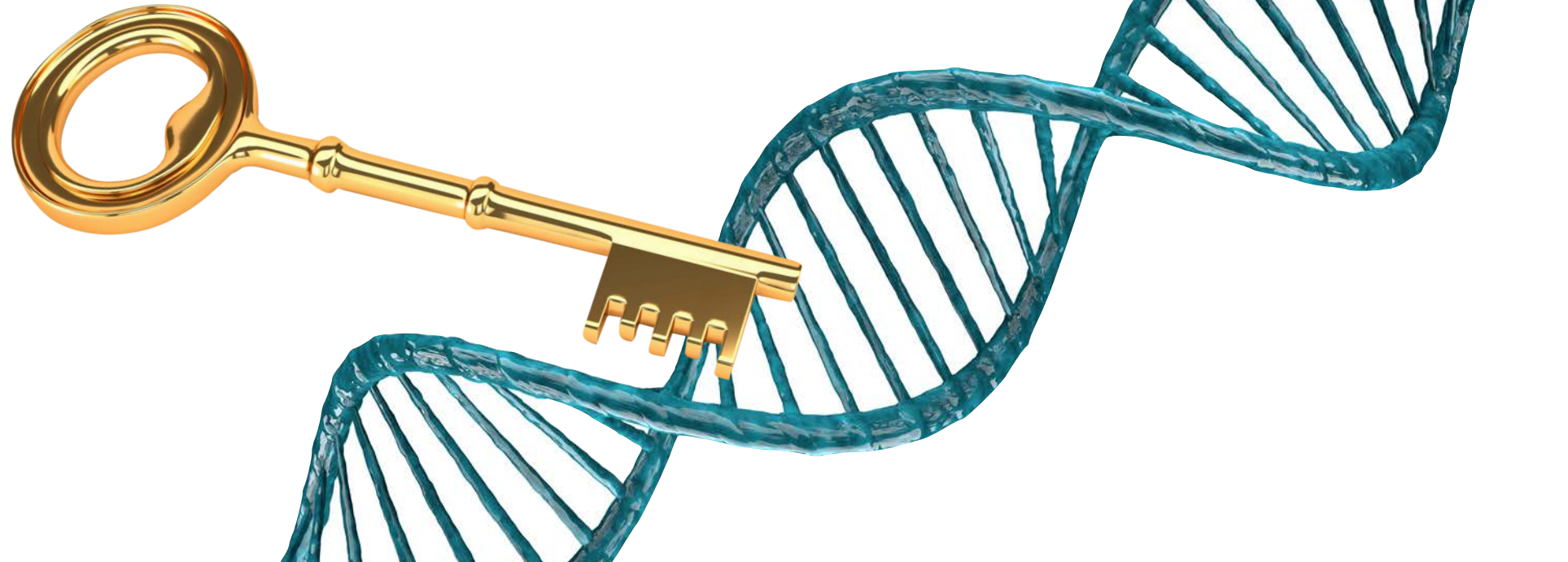
The Microbiome's Role in the Aging Process

Rob Knight, Ph.D.

Wolfe Family Endowed Chair of Microbiome Research
at Rady Children's Hospital of San Diego
Professor, Pediatrics, Bioengineering, & CSE at
University of California San Diego

Looking in the human genome for
the **key** to **aging**...

...has cost **billions!**

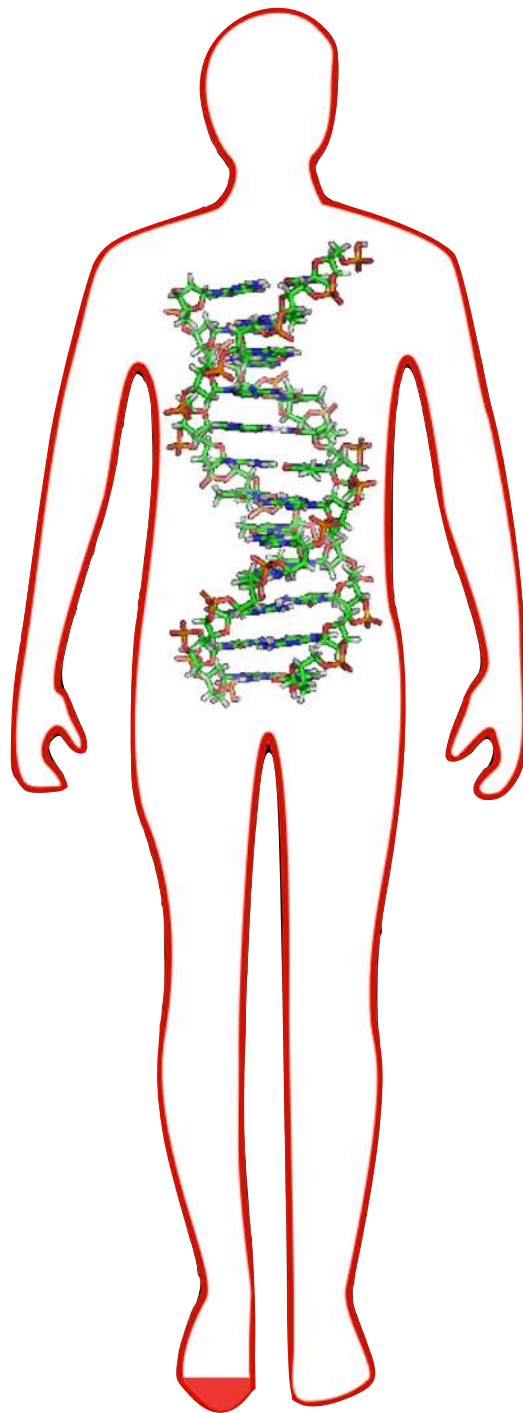




...are we looking in the
right place?



20,000
human genes



2-20 million
microbial genes

1%

We ignore 99%
of our genes...
the ones we
can *change!*

We can build predictive models
for many traits related to longevity
from the microbiome



Classifying lean/obese*:

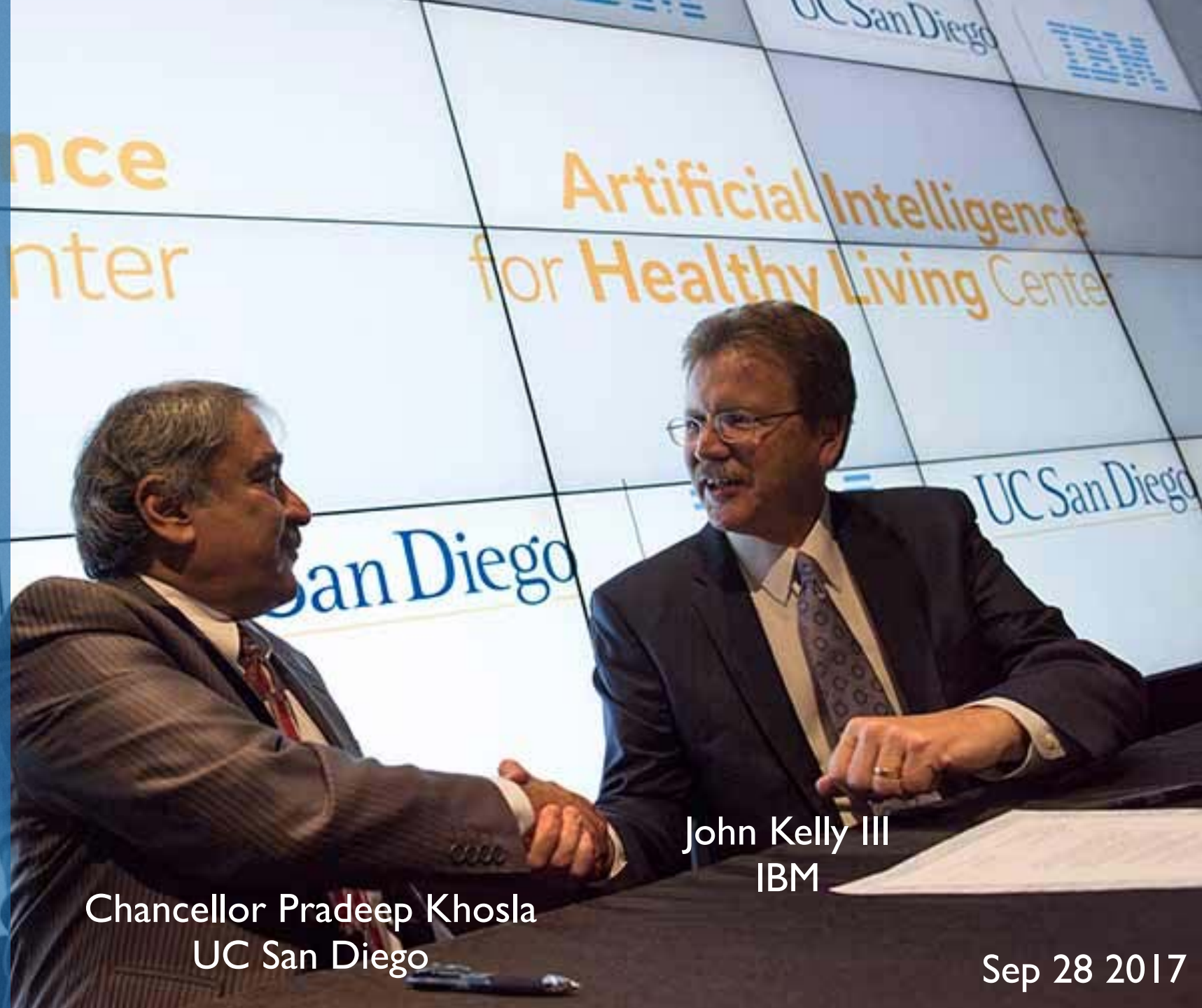
57% accuracy from human genes

vs

90% accuracy from microbial genes

*Random Forests classifier

O I R A R N Z E S H N S T W I N O
R I R S I W O K R O M E
H I O R I K O N R O M E
A N O I I Z O N R O M E
A E O R I Z O N R O M E
I N O K I O R H A T M I R
M V O R N O Z I R O E T W
A T O R I Z O N Z O M O T
A H Z R Z I R K R O M E
E I H R S Z O N E T W O R
A R O R I Z O N W O R T
O A I N S Z O I R O M N T
I O H O H I Z A W R O M Z
I O O R I N S E R O M E
A Z N O I I O R O M Z
V O A N H E I Z O A Z I O N N E T
O N I H O H I Z O N R O M E
A I O E I Z O I E T W E
A I O R I Z O N R O M E
I A O R I Z O N O O M T O
A Z N O W I E R O M I
R I Z O N O N O A E Z E I M O K
E I O R I Z O N R O M E
I A O R I Z O N E T W O R
A O I E I Z O N E T W O R
A T O Z O R I K O Z O K
A I O R I N O Z N R Z O T
A I H O R I Z O N S N E T W O R K

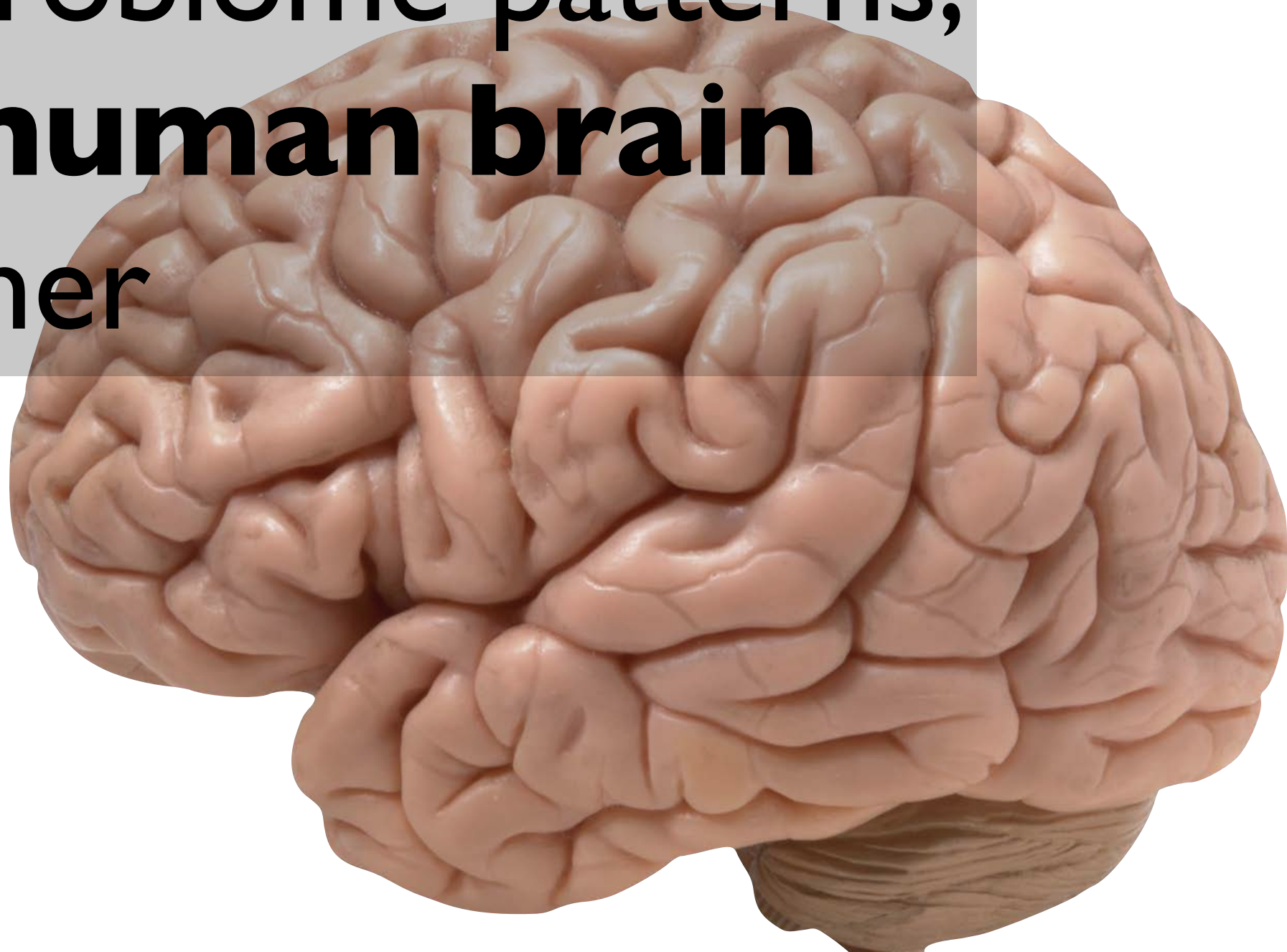


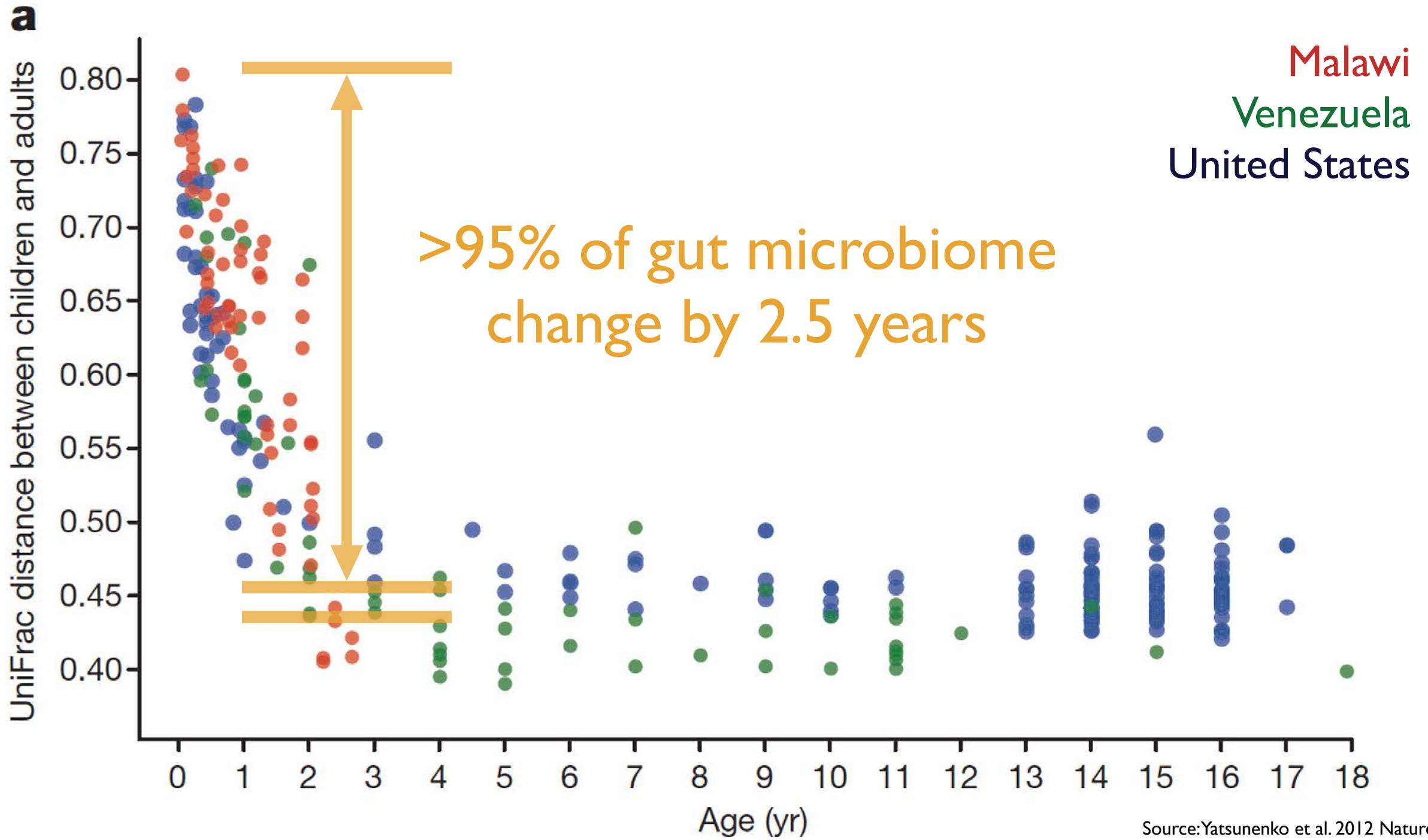
Chancellor Pradeep Khosla
UC San Diego

John Kelly III
IBM

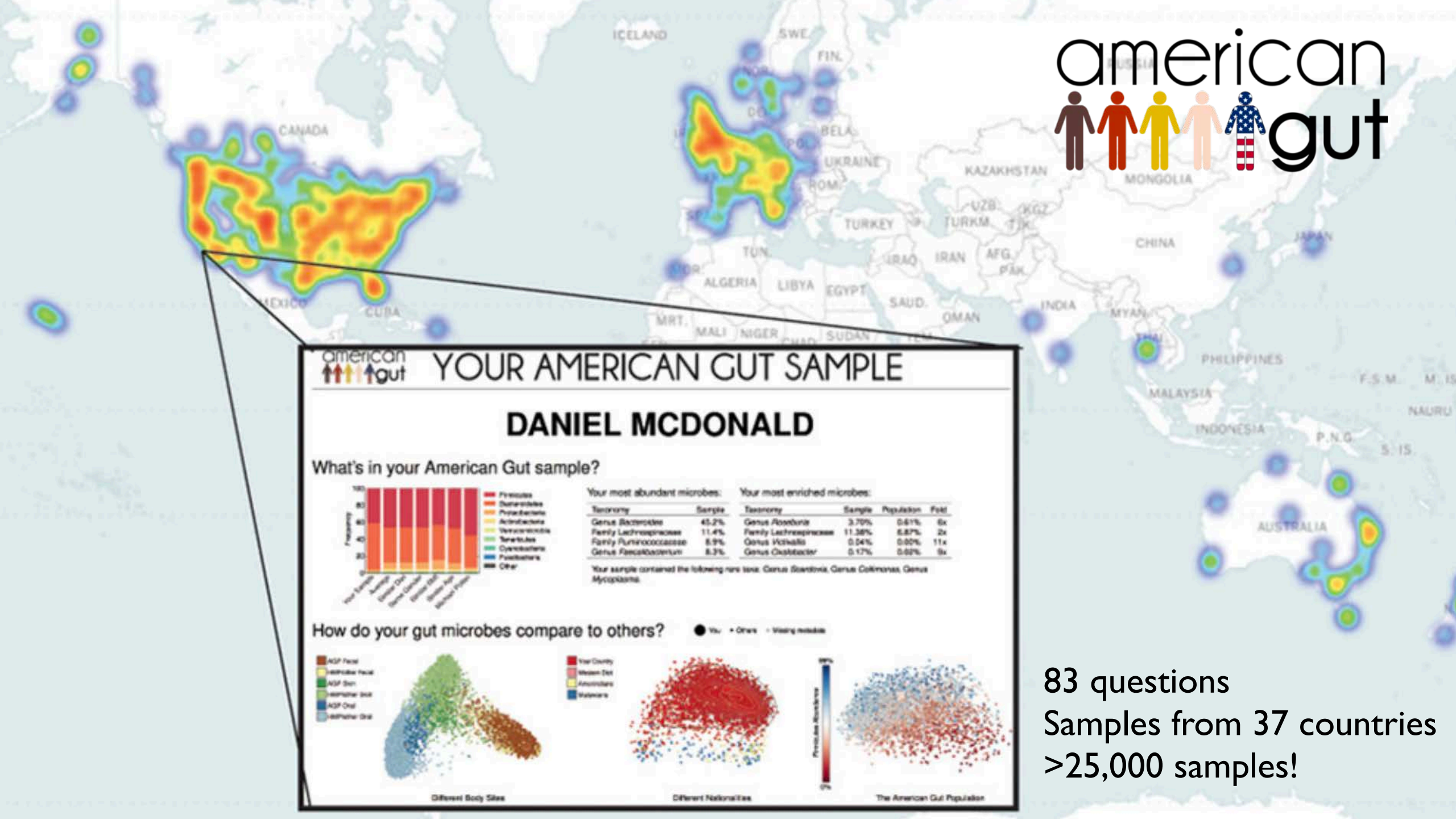
Sep 28 2017


Some microbiome patterns,
even the **human brain**
can decipher





american gut

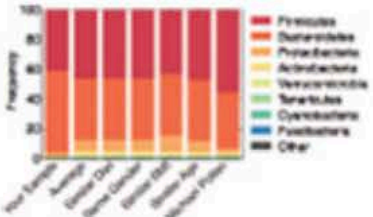





YOUR AMERICAN GUT SAMPLE

DANIEL MCDONALD


What's in your American Gut sample?



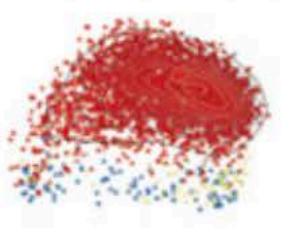
Your most abundant microbes:		Your most enriched microbes:			
Taxonomy	Sample	Taxonomy	Sample	Population	Fold
Genus Bacteroides	45.2%	Genus Akkermansia	3.70%	0.61%	6x
Family Lachnospiraceae	11.4%	Family Lachnospiraceae	11.38%	5.87%	2x
Family Furcococcaceae	8.9%	Genus Vichhalla	0.04%	0.00%	11x
Genus Faecalibacterium	8.3%	Genus Oxidobacter	0.17%	0.02%	9x

Your sample contained the following rare taxa: Genus Starobria, Genus Collinsella, Genus Mycoplasma.


How do your gut microbes compare to others?



Different Body Sites



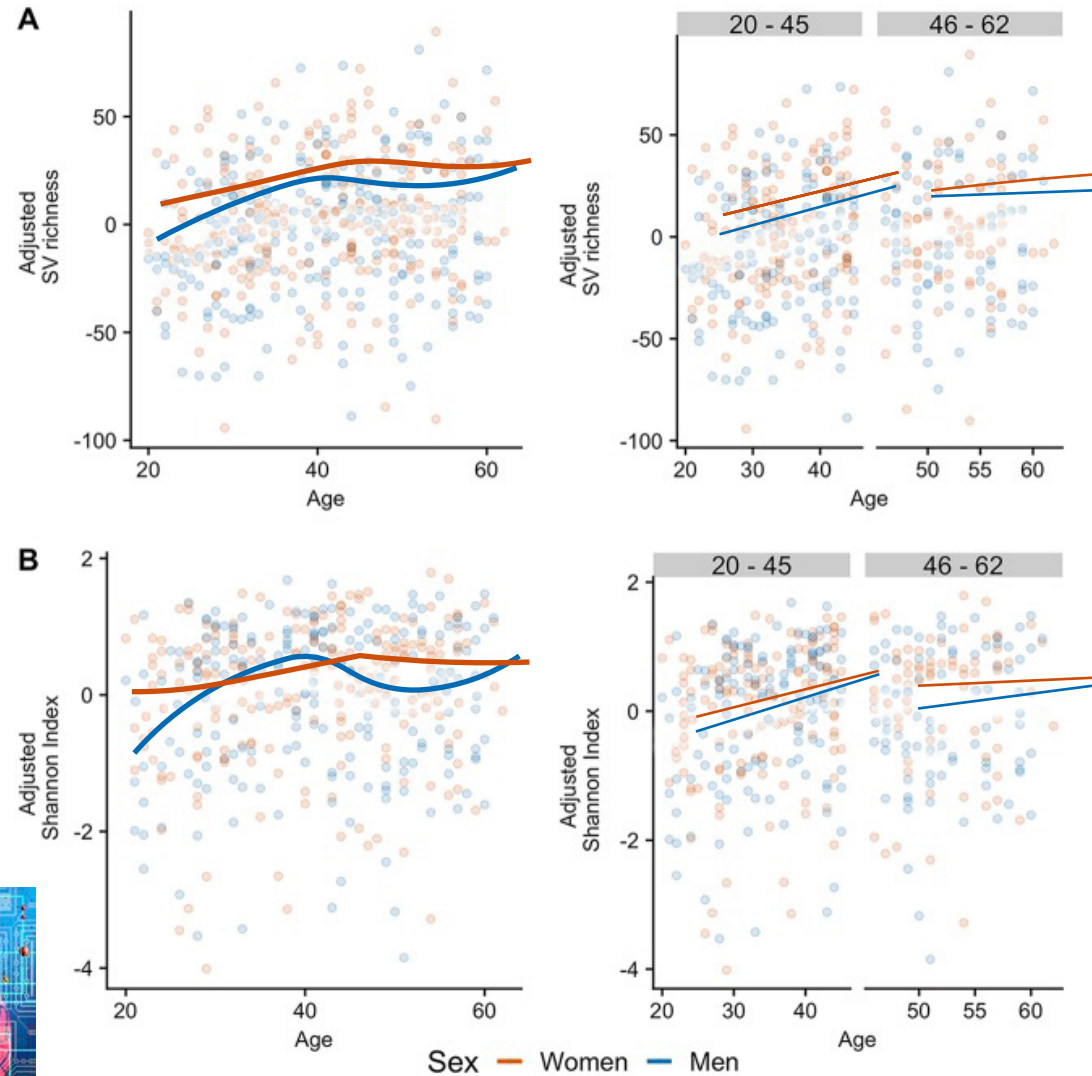
Different Nationalities



The American Gut Population

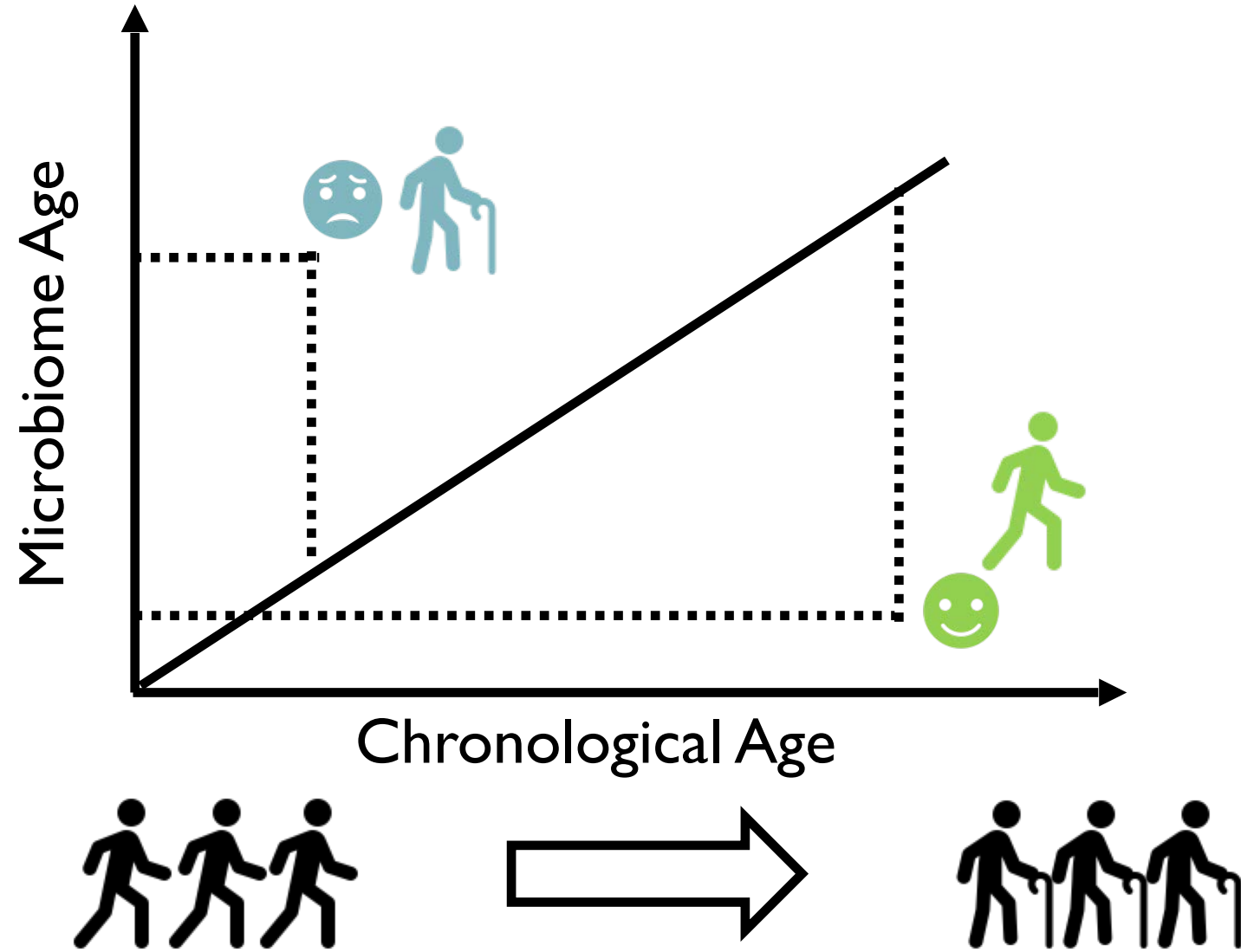
83 questions
 Samples from 37 countries
 >25,000 samples!

Microbiome changes with age in adults are subtle...



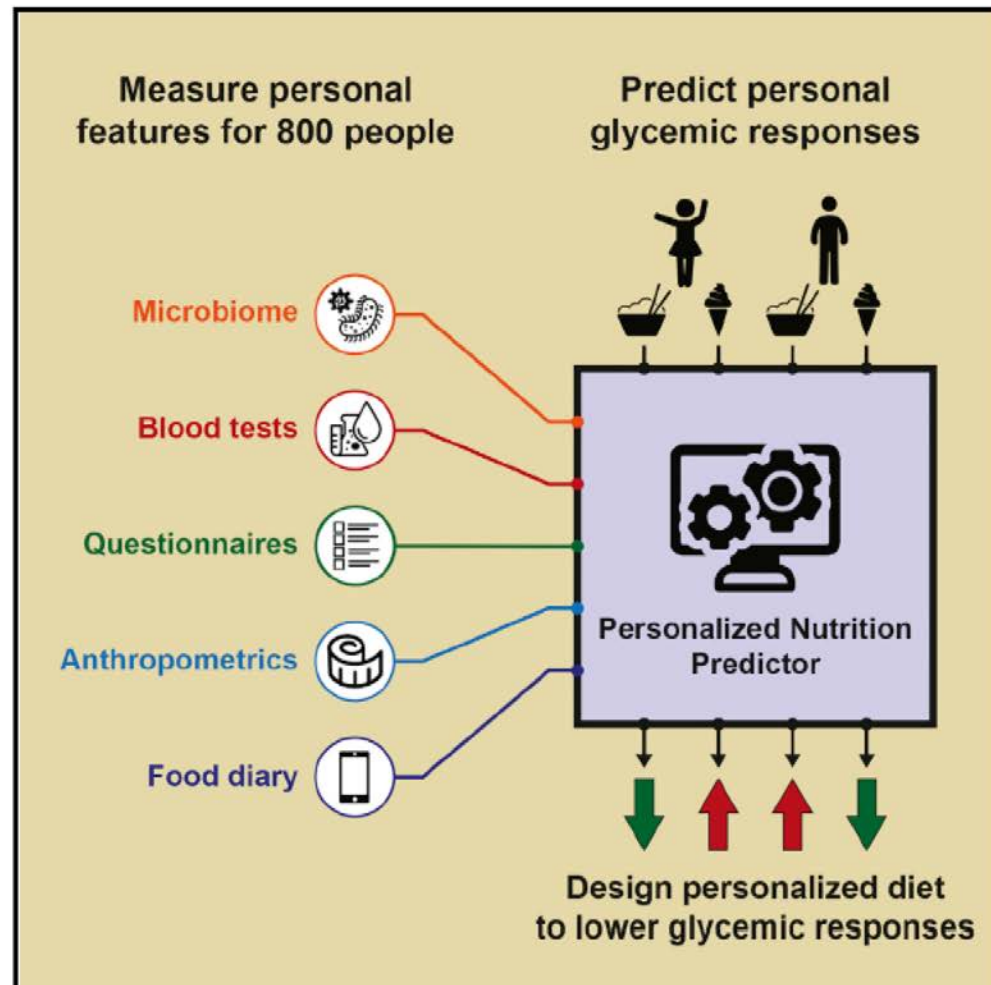


How does your microbiome age compare to “normal”?



Personalized Nutrition by Prediction of Glycemic Responses

Graphical Abstract



Authors

David Zeevi, Tal Korem, Niv Zmora, ..., Zamir Halpern, Eran Elinav, Eran Segal

Correspondence

eran.elinav@weizmann.ac.il (E.E.),
eran.segal@weizmann.ac.il (E.S.)

In Brief

People eating identical meals present high variability in post-meal blood glucose response. Personalized diets created with the help of an accurate predictor of blood glucose response that integrates parameters such as dietary habits, physical activity, and gut microbiota may successfully lower post-meal blood glucose and its long-term metabolic consequences.




or ?
Your
microbes
decide!




ALZHEIMER
GUT MICROBIOME
PROJECT

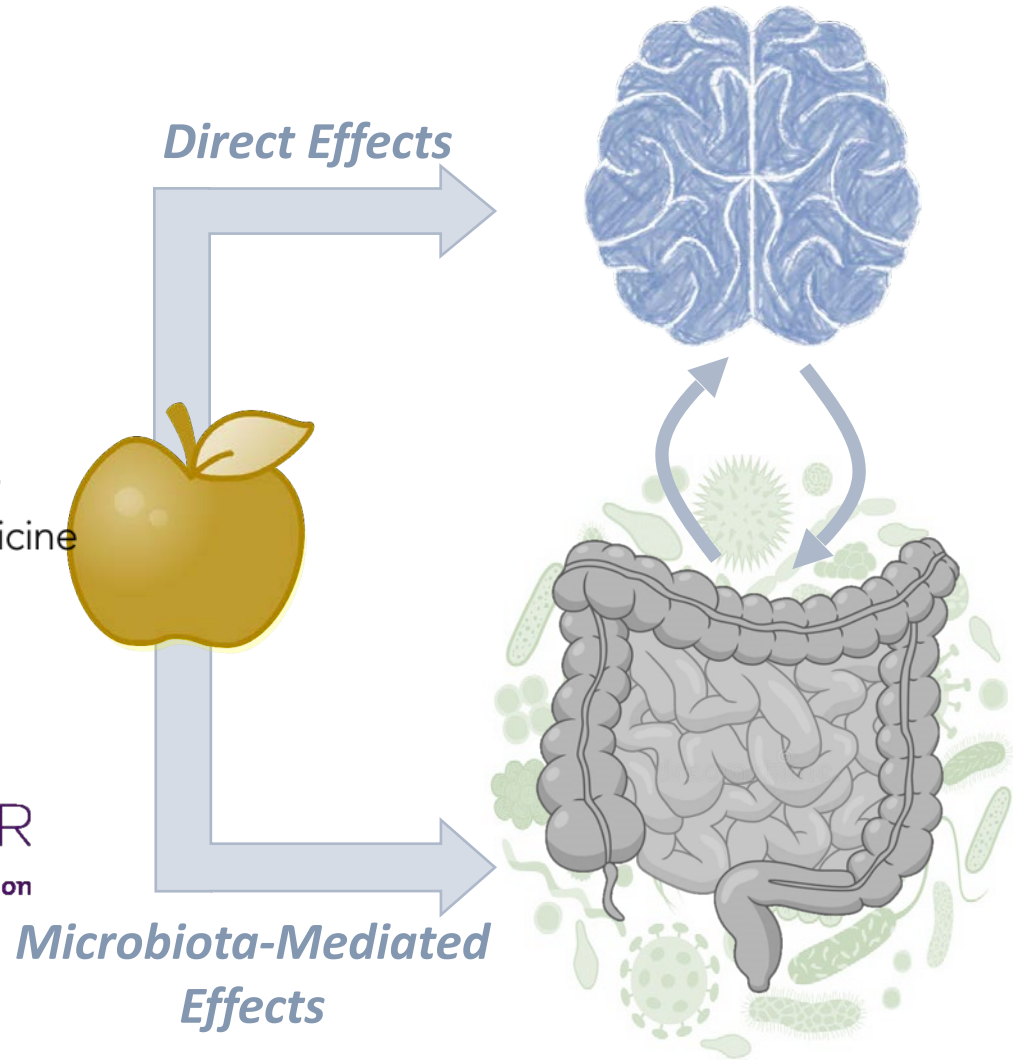
Diet/Microbiome AD Studies

U19AG063744


mind

 Wake Forest®
School of Medicine
BEAT-AD

 **U.S. POINTER**
alzheimer's association



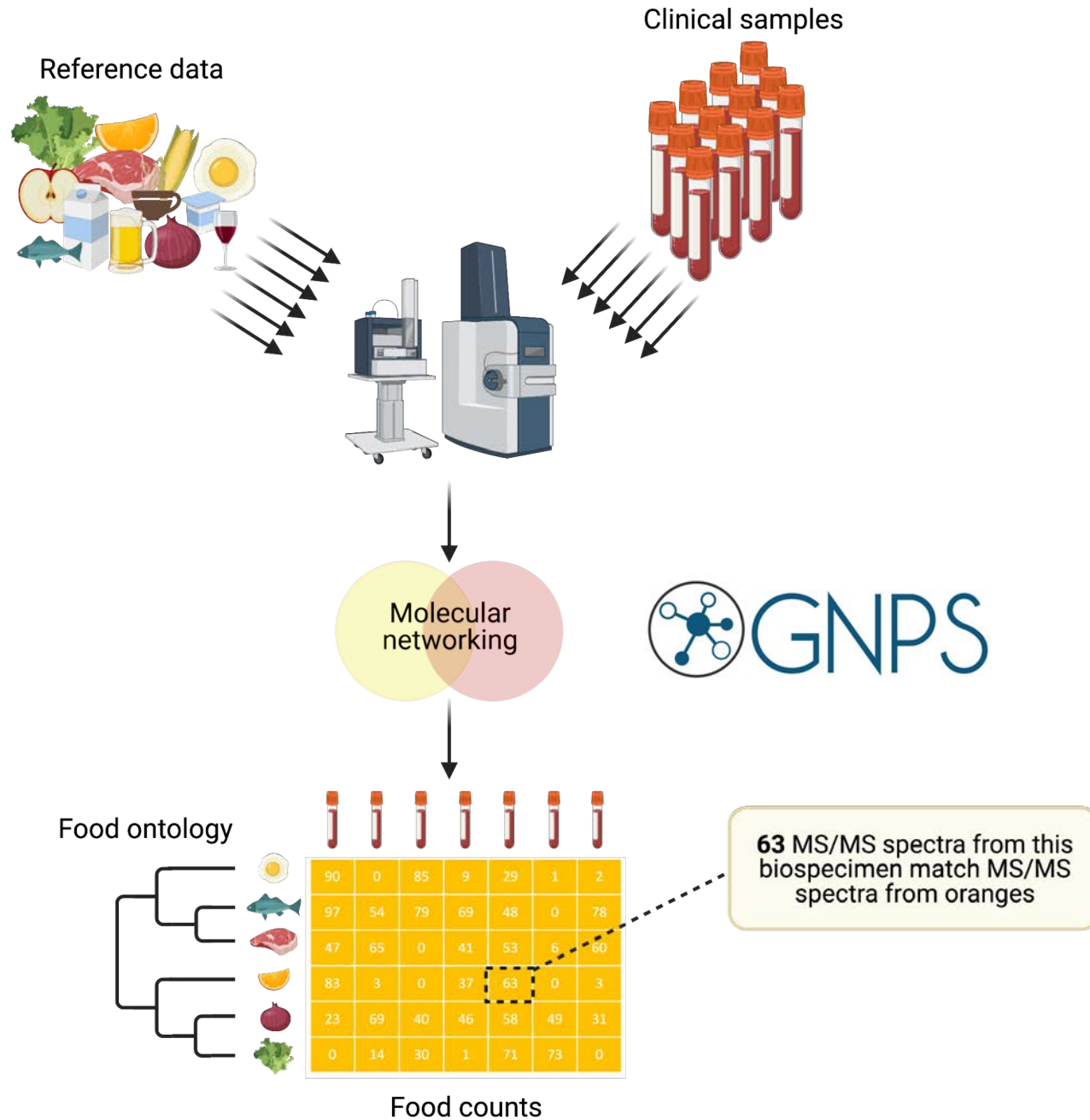
MIND:
Mediterranean-DASH Diet Intervention
for Neurodegenerative Delay

BEAT:
Brain Energy for Amyloid
Transformation in Alzheimer's Disease
Study

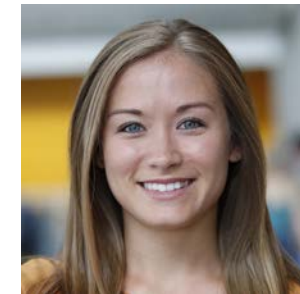
**Influence of Controlled Diets on
Gut Microbiome, Metabolome,
and Cognitive Function**

POINTER:
U.S. Study to Protect Brain Health
Through Lifestyle Intervention to Reduce
Risk

Reference data driven metabolomics Diet readout from clinical samples



Julia Gauglitz

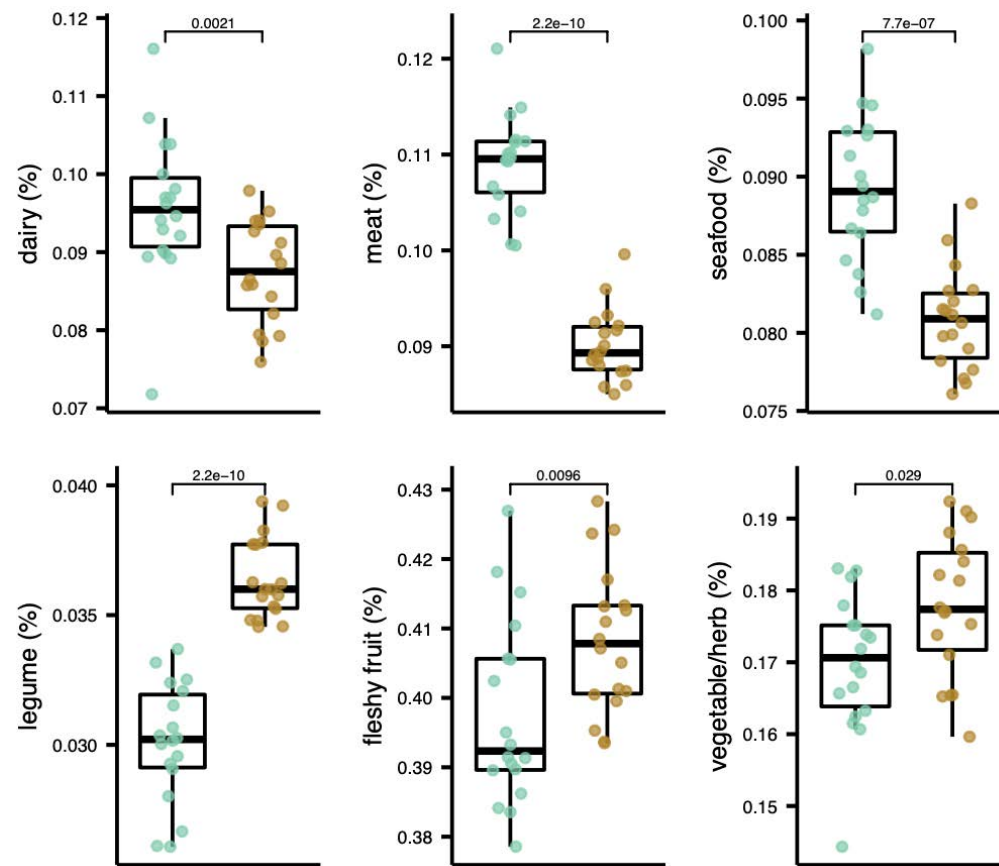
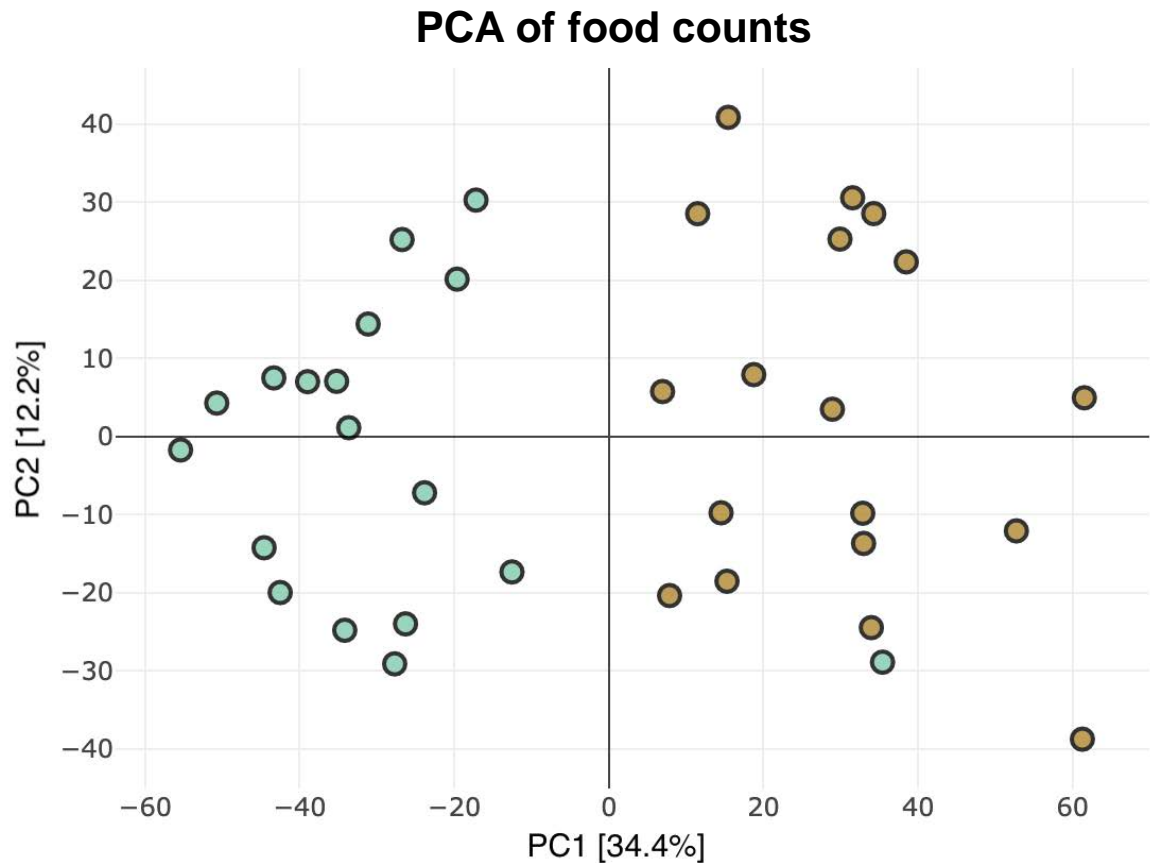


Kiana West



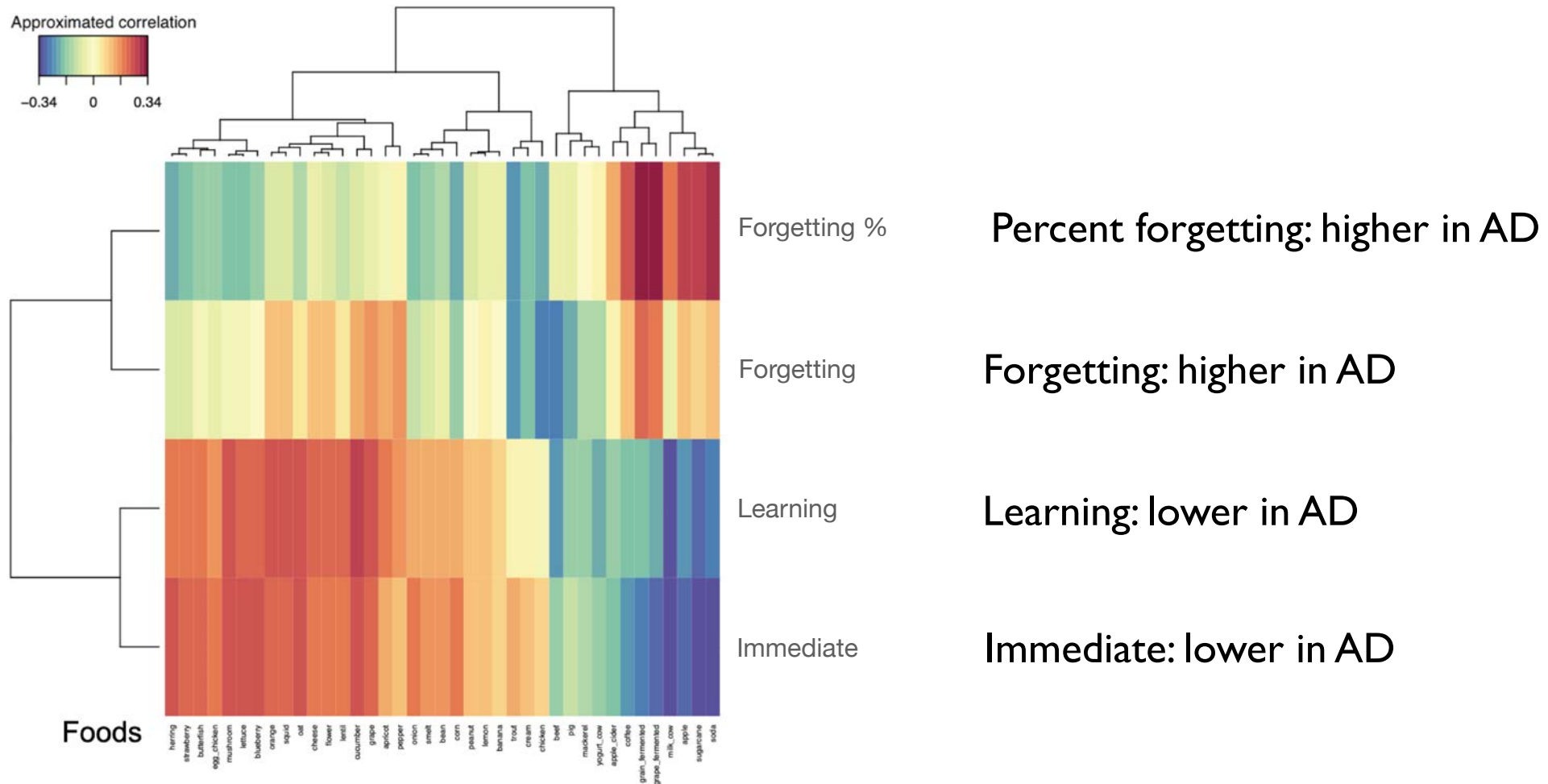
Wout Bittremieux

Diet readouts from fecal samples distinguish omnivores from vegetarians?



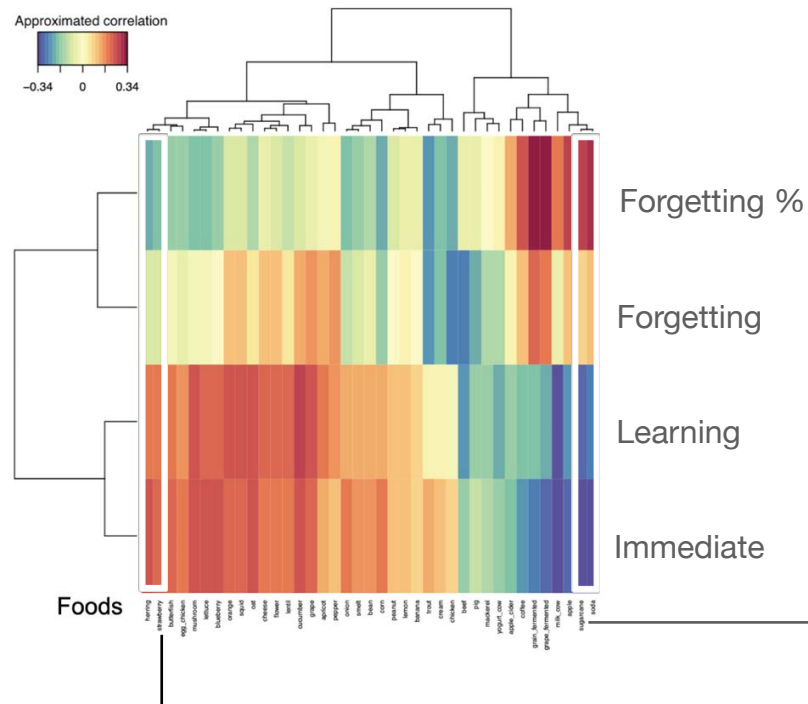
Foods that correlate with memory: Rey's Auditory Verbal Learning Test (RAVLT)

Scored based on: Number of words recalled from a list, read to the patient verbally



Foods that correlate with memory: Rey's Auditory Verbal Learning Test (RAVLT)

Scored based on: Number of words recalled from a list, read to the patient verbally



Sugarcane (sugar), Soda
= Worst forgetting/inability to learn



Fish, Strawberry, Mushroom
= Improvement in learning

Correlation is not causation but enables hypothesis formulation with diet and disease severity

A diet soda a day might affect dementia risk, study suggest

By American Heart Association News

Study: Diet soda could increase chances of stroke, Alzheimer's

Business

Drinking Too Much Soda May Be Linked to Alzheimer's

submitting my information, I agree to the [Privacy Policy](#) and [Terms](#) and to receive offers and promotions from Bloomberg.



The New York Times

Sugary Drinks Tied to Accelerated Brain Aging

DRINKING SODA TIED TO POOR BRAIN HEALTH AND ALZHEIMER'S RISK

NEWS

Diet Sodas May Raise Risk of Dementia and Stroke, Study Finds

People who drink diet sodas daily have three times the risk of stroke and dementia compared to people who drink one less than once a week.

HEALTH

Another downside to soda and chips: Your memory

A new study shows eating large amounts of ultra-processed foods can significantly accelerate cognitive decline.



Sugar does rot your brain after all: Scientists connect to Alzheimer's

High sugar intake may increase risk for Alzheimer's disease

The Atlantic

Adding just two-and-a-half teaspoons of sugar to your tea **DAILY** increases your risk of Alzheimer's by 54%, study finds

HEALTH

The Startling Link Between Sugar and Alzheimer's

nature neuroscience

Explore content ▾ About the journal ▾ Publish with us ▾ Subscribe

[nature](#) > [nature neuroscience](#) > [news & views](#) > article

Published: 26 March 2015

Sugar and Alzheimer's disease: a bittersweet truth



Sweet Trouble: How Sugar Intake Might Increase Alzheimer's Risk

Scientists reveal link between sugar intake and brain disease



National Library of Medicine
National Center for Biotechnology Information

Latest Newsletters

Advanced



PMCID: PMC7103640
PMID: 32265686

Front Aging Neurosci. 2020; 12: 76.
Published online 2020 Mar 20. doi: 10.3389/fnagi.2020.00076

Fish Intake May Affect Brain Structure and Improve Cognitive Ability in Healthy People

Keisuke Kokubun,¹ Kiyotaka Nemoto,² and Yoshinori Yamakawa^{1,3,4,5,6}
▶ Author information ▶ Article notes ▶ Copyright and License information ▶ Disclaimer

Fish Intake, Genetic Predisposition to Alzheimer Disease, and Decline in Global Cognition and Memory in 5 Cohorts of Older Persons

Cécilia Samieri¹, Martha-Clare Morris², David A Bennett³, Claudine Berr⁴, Philippe Amouyel⁵, Jean-François Dartigues¹, Christophe Tzourio¹, Daniel I Chasman⁶, Francine Grodstein^{7,8}

The Atlantic

HEALTH

Study of the Day: People Who Eat More Fish Enjoy Improved Memory

By Hans Villarica



TWO SERVINGS OF FISH A WEEK MAY HELP PROTECT AGAINST DEMENTIA

from research organizations

Science News

Eating fish reduces risk of Alzheimer's disease, study finds

The Relationship of Omega-3 Fatty Acids with Dementia and Cognitive Decline: Evidence from Prospective Cohort Studies of Supplementation, Dietary Intake, and Blood Markers

Bao-Zhen Wei ↑ • Lin Li ↑ • Cheng-Wen Dong • Chen-Chen Tan •
for the Alzheimer's Disease Neuroimaging Initiative • Wei Xu 人 信 • Show footnotes

Published: April 04, 2023 • DOI: <https://doi.org/10.1016/j.ajcnut.2023.04.001>



Institutions & Management



Caltech



UC San Diego
School of Medicine



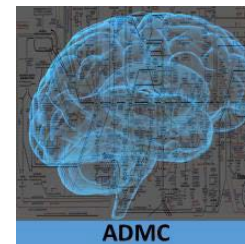
AMERICAN
GUT PROJECT



THE
MICROSETTA
INITIATIVE



Duke University
School of Medicine

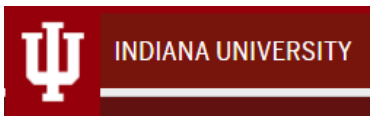


ADMC

Management Team



ACCELERATING MEDICINES PARTNERSHIP (AMP)



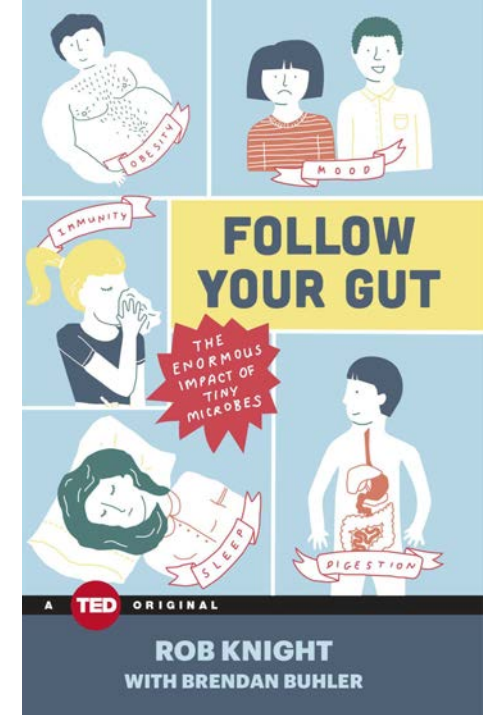
Thanks to: Knight lab, and over 1000 collaborators! (Sorry if I didn't mention you by name)



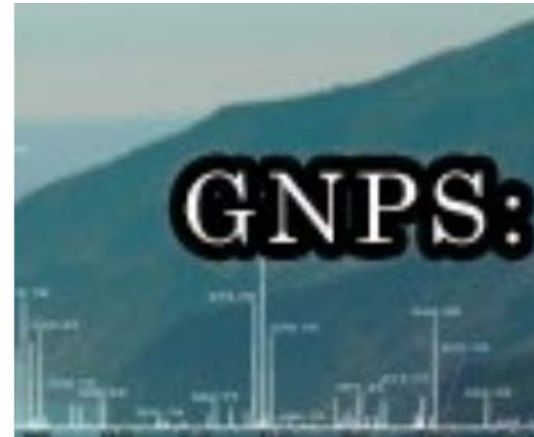
Funding: NIH, Gates, HHMI, CCFA, NIJ, DOE, DARPA, USDA, Keck, Sloan, Moore, Templeton, DOD, NSF, Wolfe Family, tens of thousands of members of the public

Thanks!

robknight@ucsd.edu



qiita.ucsd.edu



gnps.ucsd.edu

