

Let's start by *Refreshing Memories*...

In reminiscence of a time, when we were striving to build computation devices from technical modules with defined functions to perform complex operations...

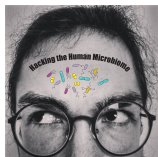
In reminiscence of a time after that, when we were seeking to create self-replicating, sustainable systems from biological bricks to understand life...

In reminiscence of a time after that, when we were aiming at the optimization of our own life based on trillions of foreign cells, bacteria, inside us...

That time is now...



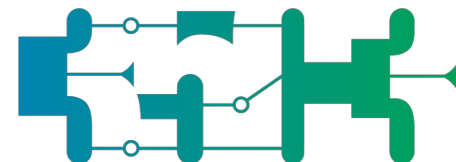
Hacking the Human Microbiome



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Germany



1. What is the Human Microbiome?
2. How can we study the Human Microbiome?
3. Is there a reasonable hype about the subject?
4. Where are the most demanding challenges?



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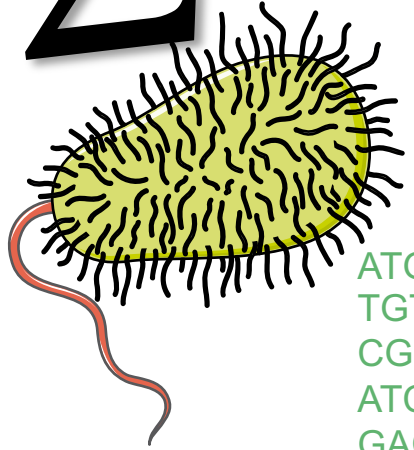
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 AAGCACTGGGGGAGACGCAAGGCC
 TGCTCTGGGCAGCTGGGTGAGGAG
 GGCCATGCCAGCGTGTGGTGAGC
 ACACCGGTGTGTGGCTGCTGCCG
 TTCCGGAAGAAGCG...

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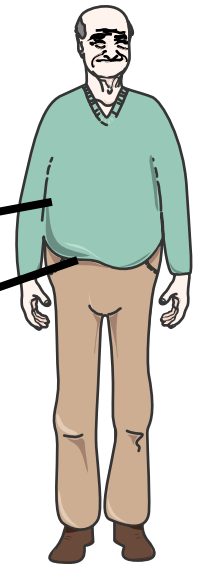


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 TGTTATCTGTCC
 CGGCACTGATC
 ATCATGACAGAAATCATCAACAGCCATAGC
 GACATGGAAATGGTGGCGACCGCGC...



doi.org/10.1371/
 journal.pbio.1002533



- Human Microbiome = All bacteria that live *inside* us.

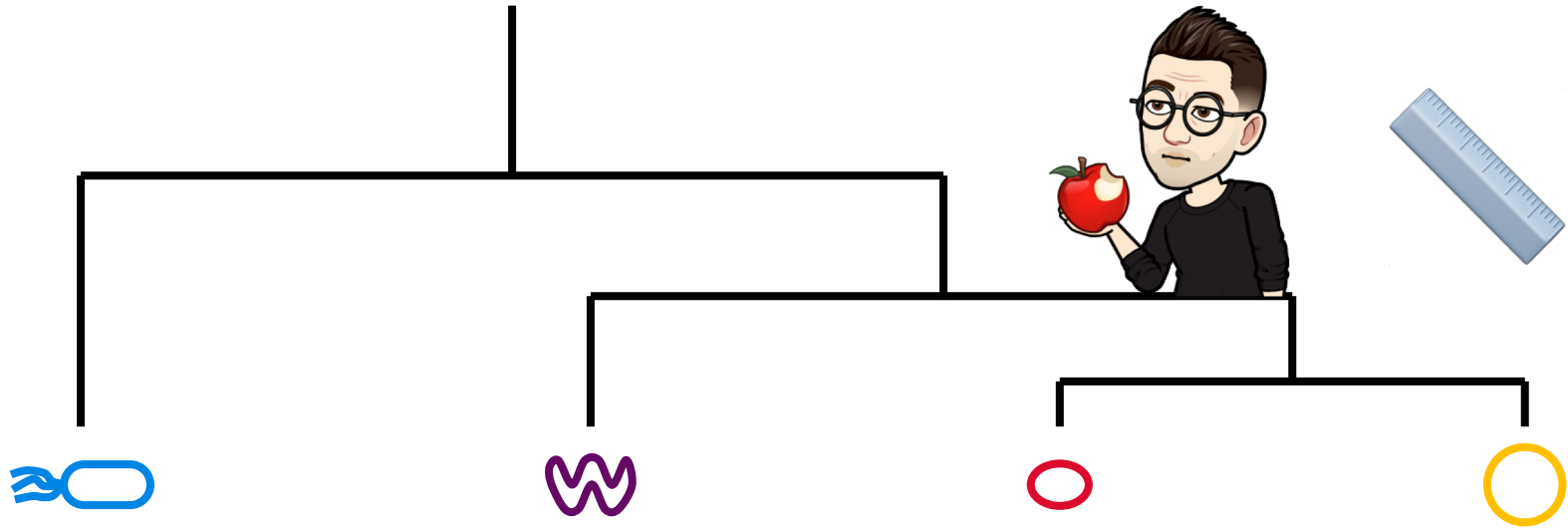
Sites of human microbiome:

- Skin
- Mouth
- Airways
- Spinal cord (?)
- Gastrointestinal tract



**The Human Microbiome is a complex community,
diverse and highly adapted.**





$\sim 10^{-6}m$
= $1\mu m$



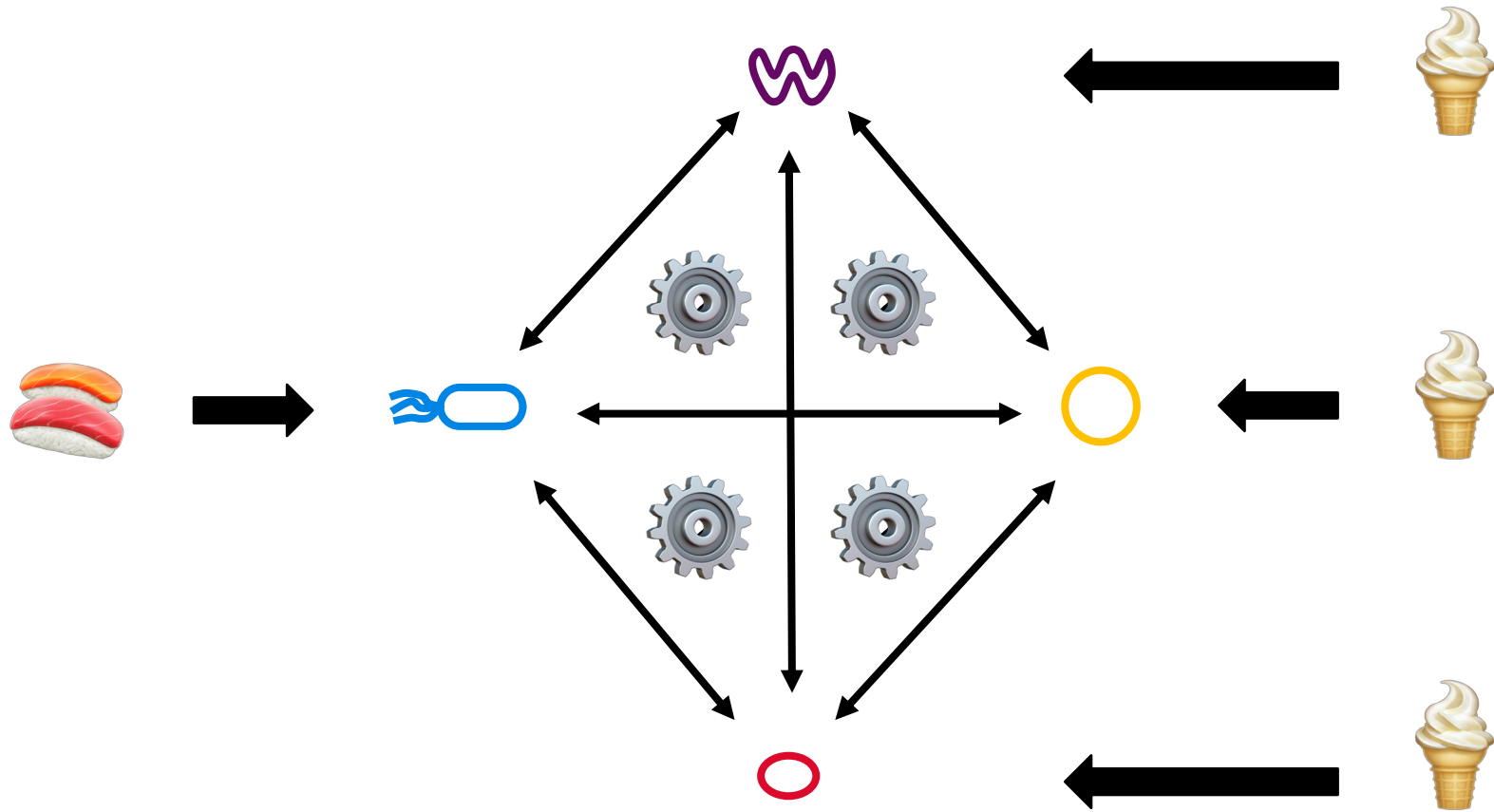
oxygen

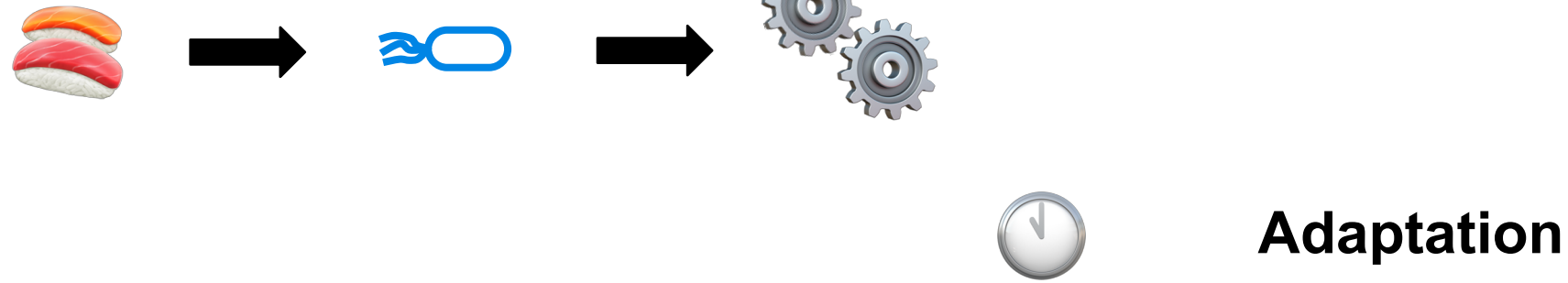
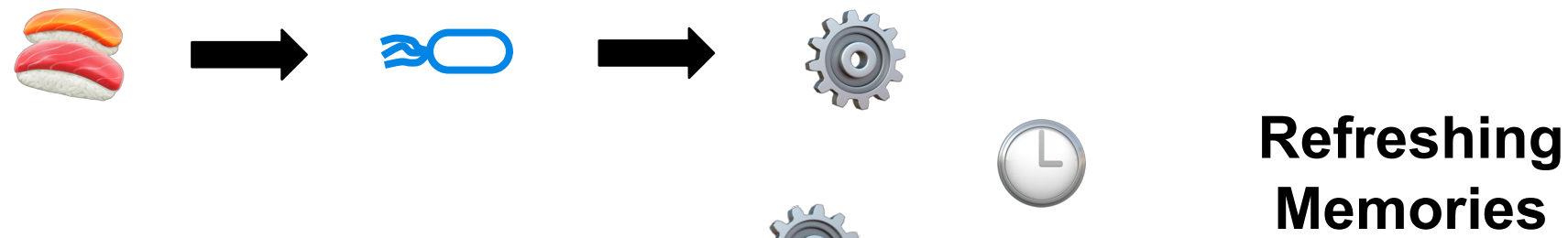


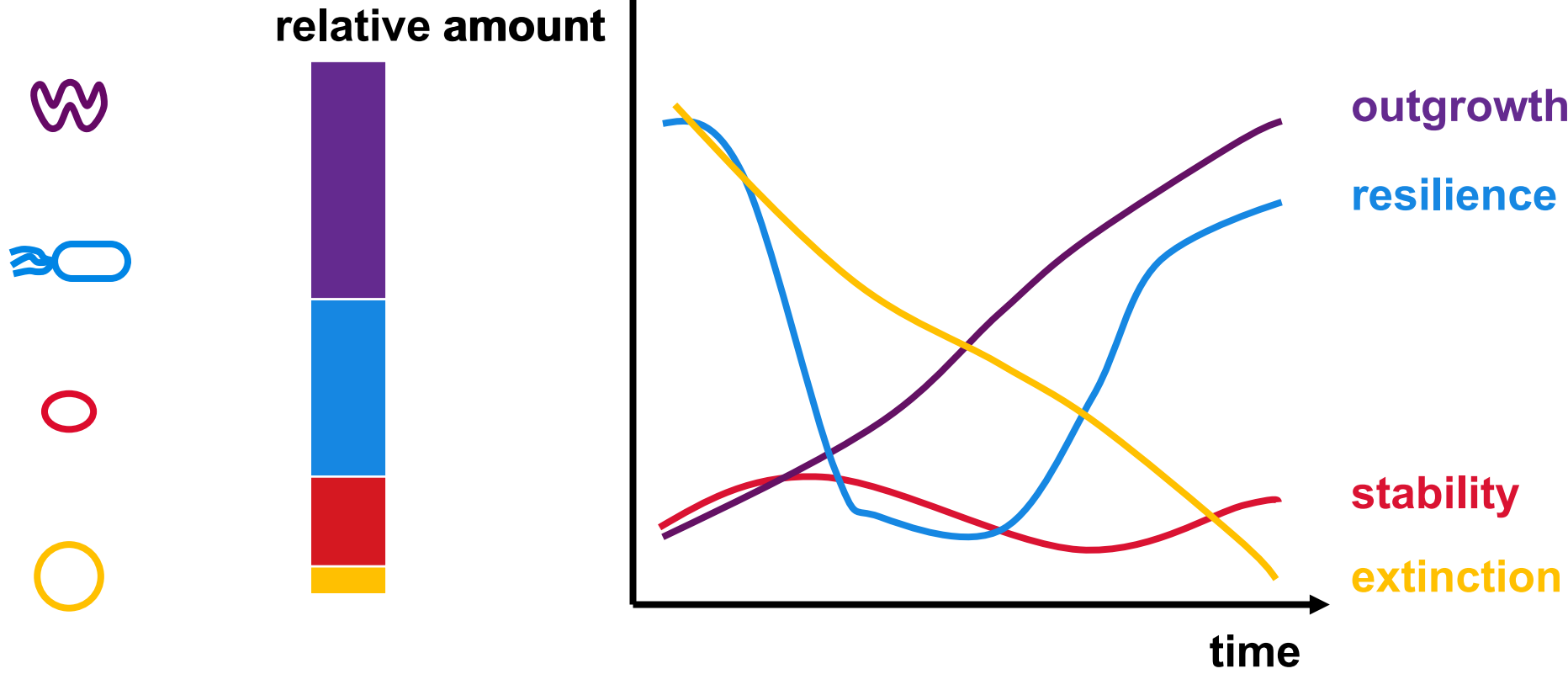
sugar

fat





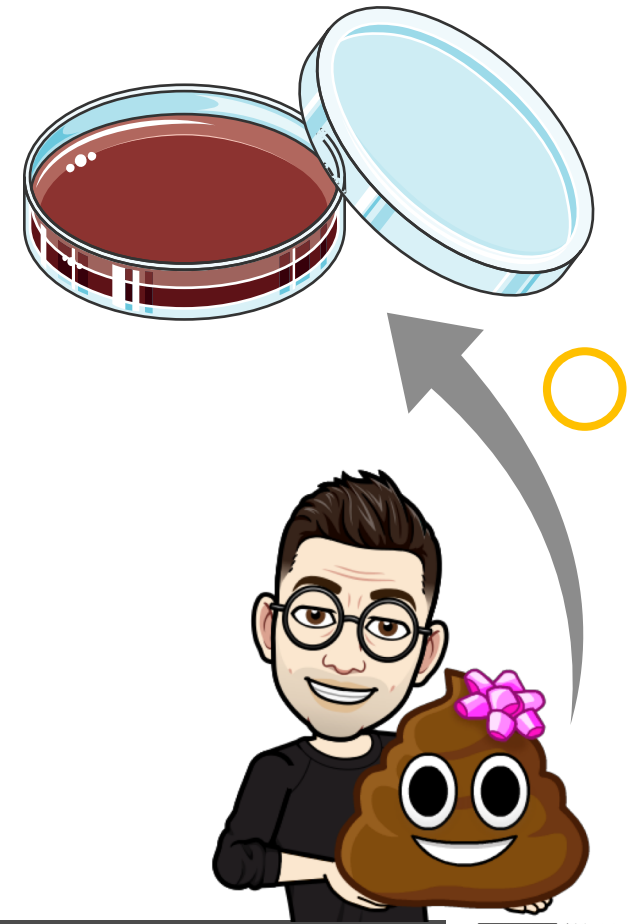
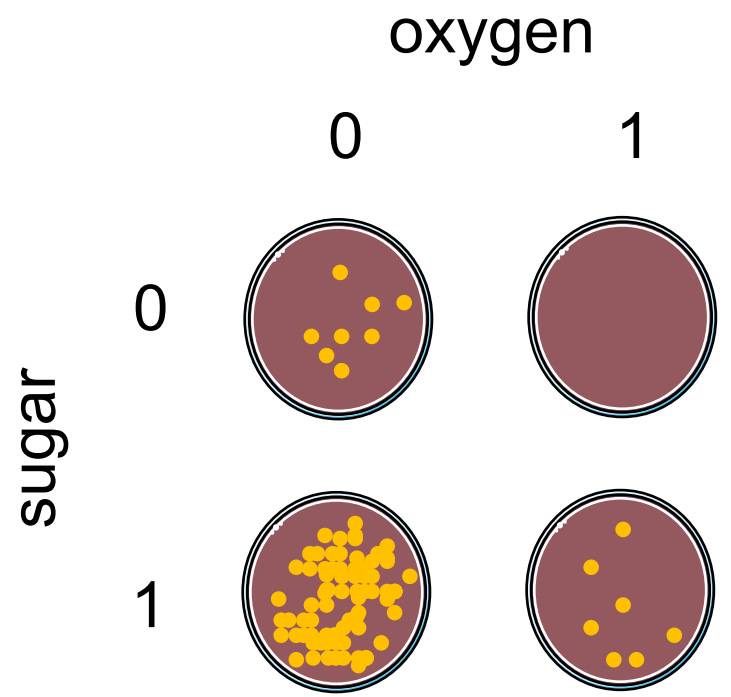




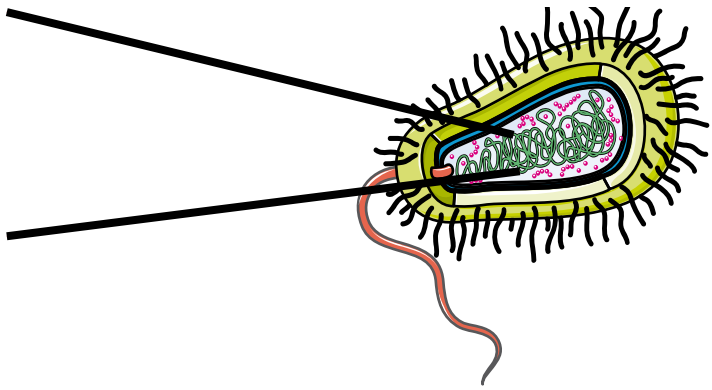
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2. **How can we study the Human Microbiome?**
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- extraction and analysis outside of the living animal



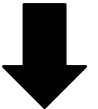
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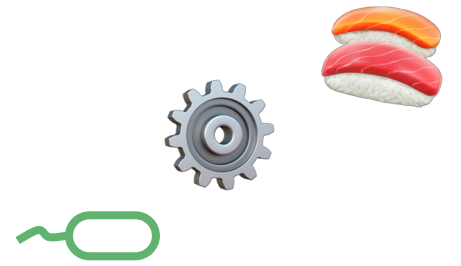
fragmentation
reading
alignment



matching

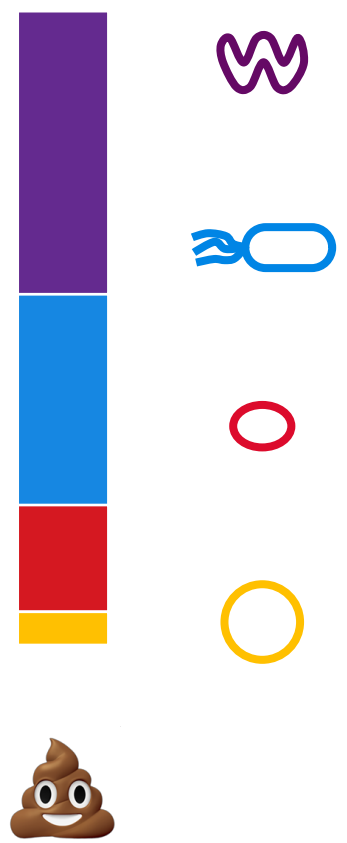
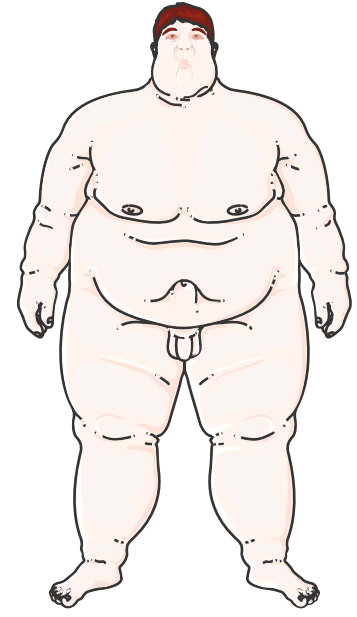
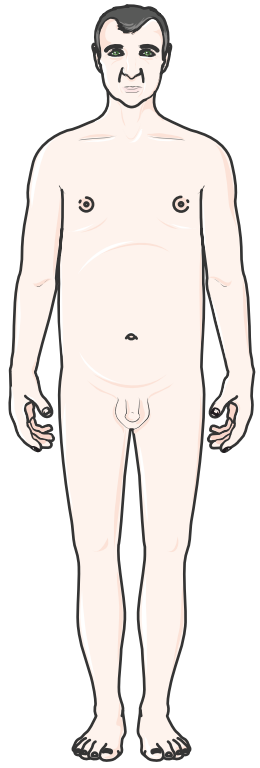
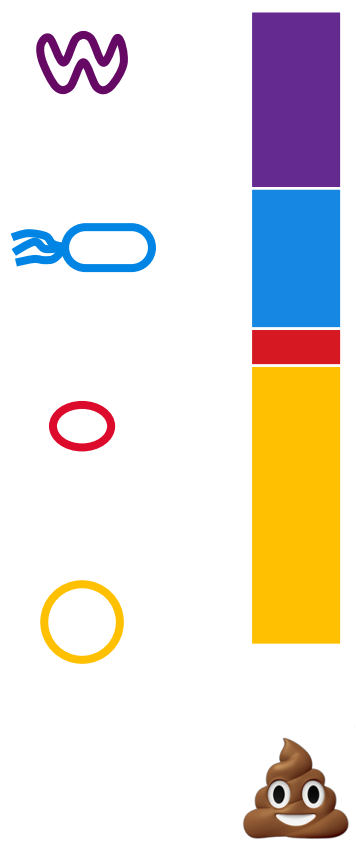


inference
reference

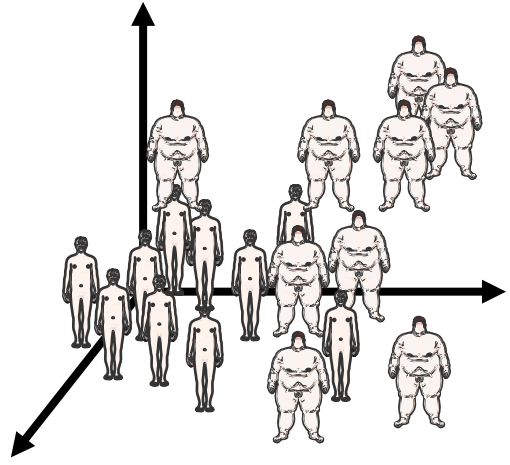


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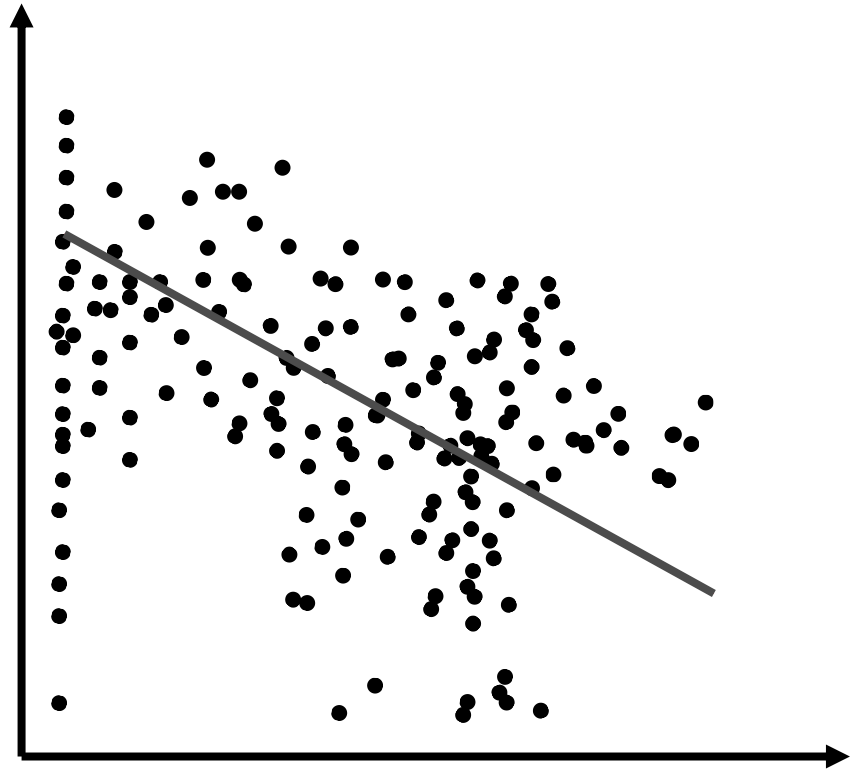




- n-dimensional feature space



body weight



amount bacterium

- rational interventions

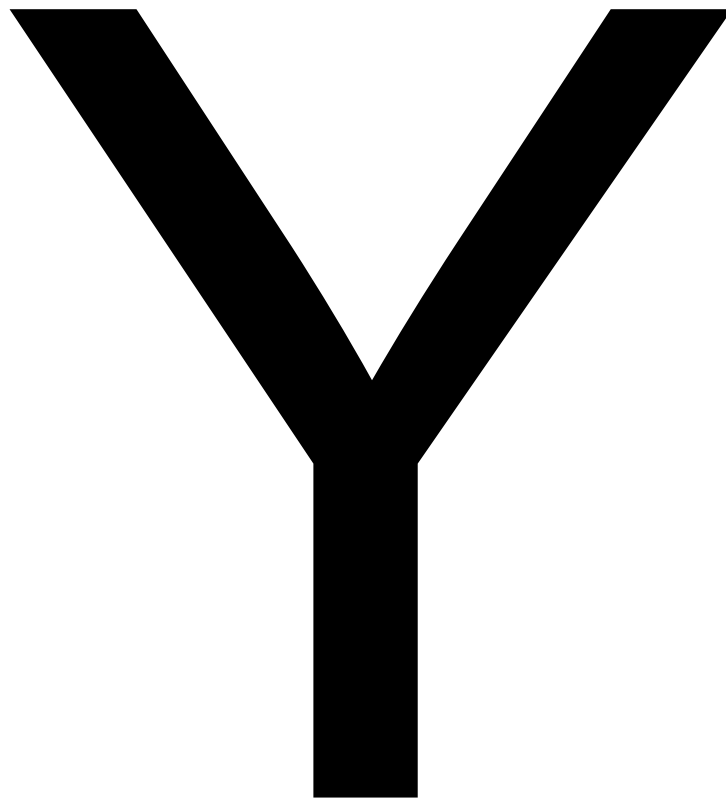


**IT IS
WHAT
IT IS**



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2. How can we study the Human Microbiome?
3. **Is there a reasonable hype about the subject?**
4. Where are the most demanding challenges?





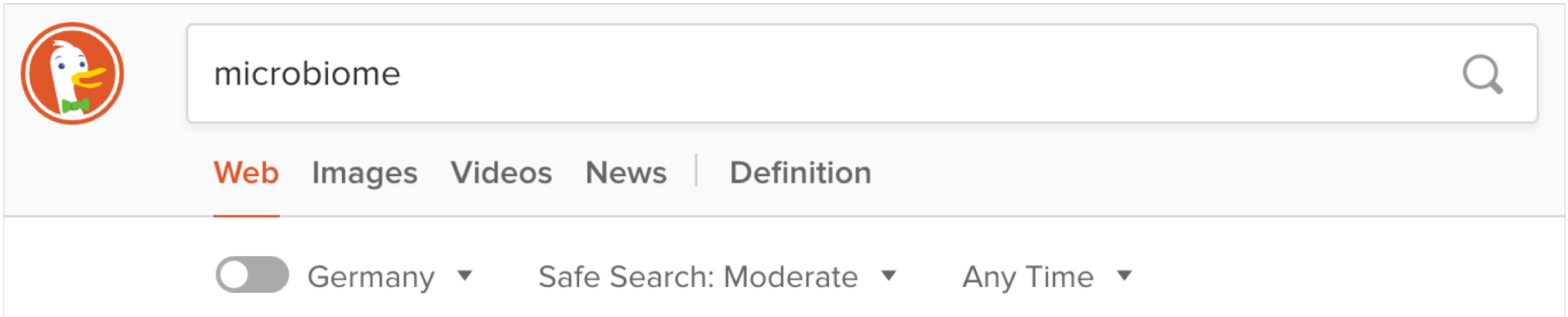
Contribution to:

- Eating habits
- Fitness state
- Susceptibility for infections
- Aging
- Cancer

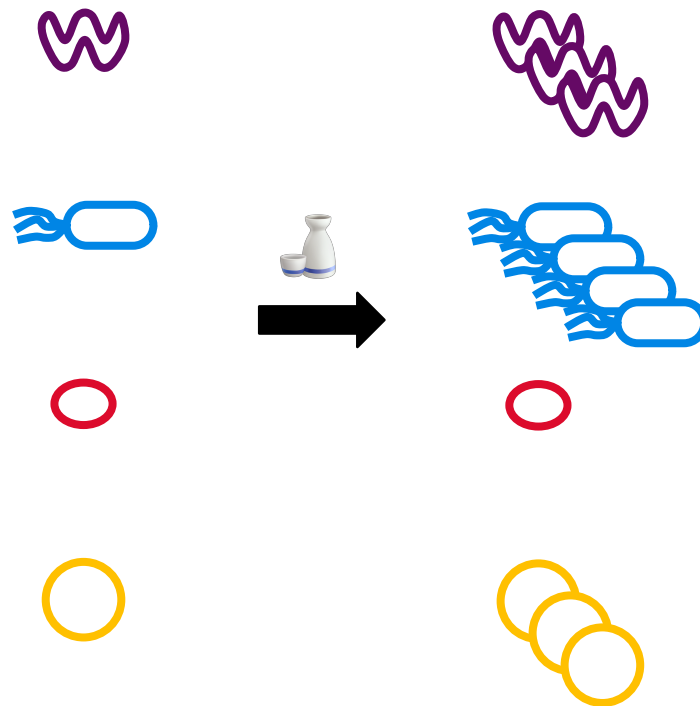


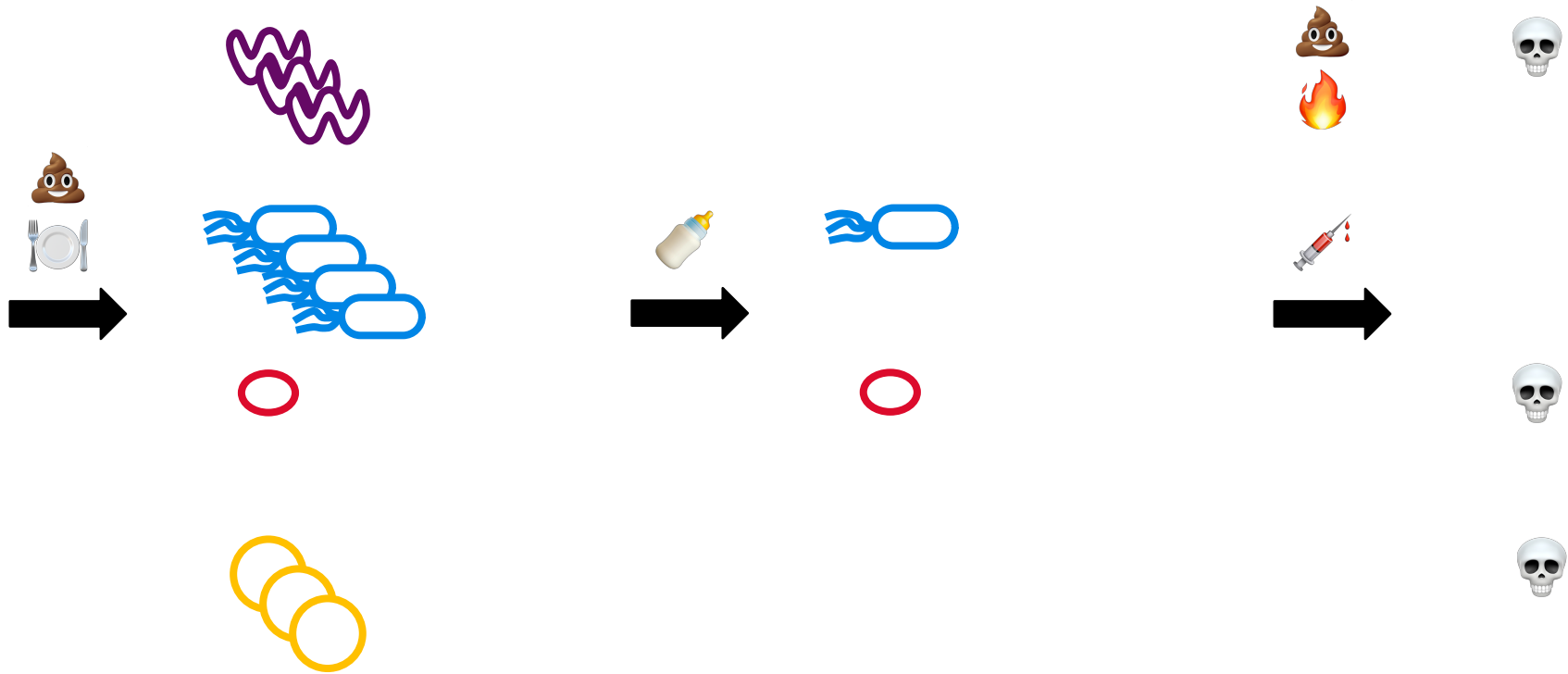
"Yesterday I interviewed a respected scientist of the comp-bio field who told me that the best diet for obese people is eating poop of lean people and let their gut microbiome work"

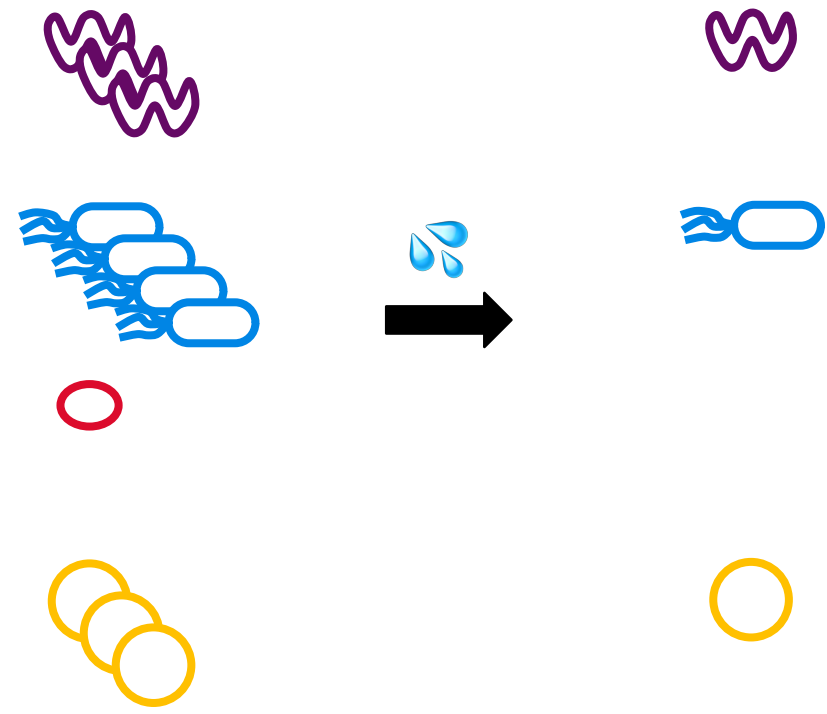
Dror Feuer @drorfo
Twitter, 28/12/2017















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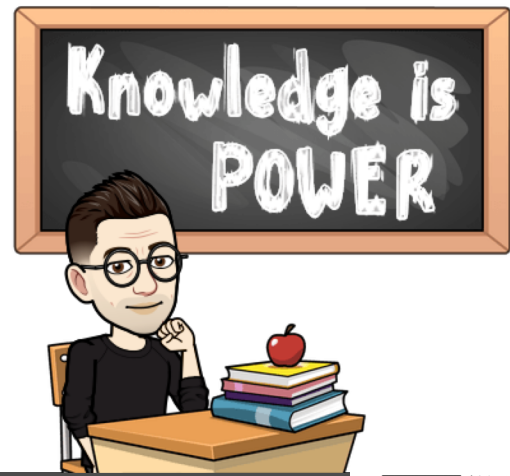
Do-it-yourself engineering of the Human Microbiome in its infancy **CHALLENGES?**

- despite available tools: Biosafety first 
- ethical standards for handling metagenome code 
- patenting of genetic sequences from the Human Microbiome? 
- sharing of sequenced diversity 



#scicomm

The Human Microbiome harbours a huge therapeutic potential that can only be harnessed if we share information faithfully.



Minerva Foundation, Max Planck Society



MAX-PLANCK-GESELLSCHAFT



The Weizmann Institute of Science, Rehovot, Israel



AmitLab for
Immuno-Genomics



Elinav Lab for
Host-Microbiome Interaction



Many Thanks!



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Let's end by *Refreshing Memories...*

The Human Microbiome is a complex ensemble of bacteria with non-intuitive interactions and inter-dependencies...

We are exploring mechanisms of regulation through Hacking by rational interference under controlled conditions...

Individuals try to monopolize technology, knowledge and data, constraining free and open research, rendering the potential of Hacking the Human Microbiome a threat through uneducated trials...

That time is over...

@lorenzadlung