

Gene !!i! dance

Digital twins to unlock the microbiome

BiomeFUN 2025 Belgrade

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cybiome

Virtual Microbiome Solutions.

We are living at exciting times

Means of productions uncoupled from access capital

- Cost of computing close to or equal to zero
- Cost of code generation dropping exponentially

Forget beaten paths. You can become what you want.

All you need is a laptop and a zest of entrepreneurial spirit

We are living at exciting times

There is no lack of problems to tackle

- Climate change
- Soil degradation
- Pollution
- Emerging diseases
- Antimicrobial resistance
- Maybe one day there will be no more beer.

Climate crisis will make Europe's beer cost more and taste worse, say scientists

Experts say hop yields and quality will continue to drop by 2050 if farmers don't adapt to higher temperatures



📷 The quantity and quality of hops, a key ingredient in most beers, is being affected by global heating, according to the study. Photograph: Charly Triballeau/AFP/Getty Images

All these problems can be answered with microbes

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My journey between academia and entrepreneurship

Classical academic career until 2018

- in Switzerland, Argentina, Germany, Netherlands.
- Built at zenith PI of a group of 4 postdocs and 8 PhD candidates.

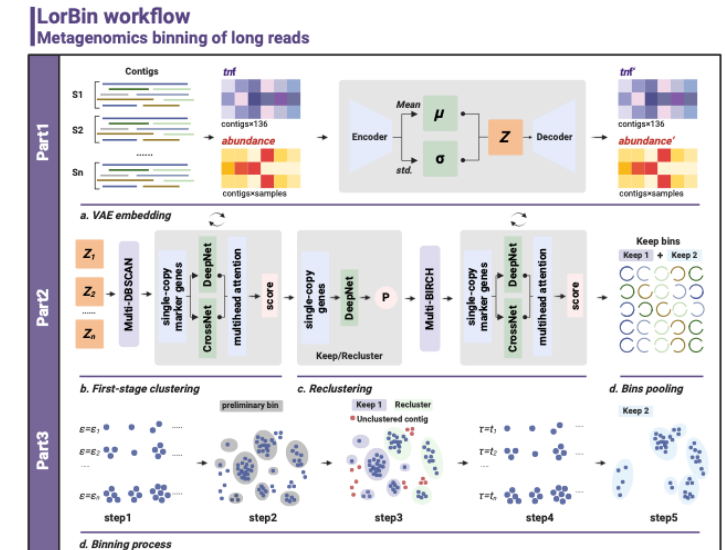
Built and grew a spinoff to create real world applications

- Custom prebiotics for soil and seed
- Developed in partnership with the best seed and agrochemical companies
- Fully bootstrapped

My journey between academia and entrepreneurship

How does a typical day looks like?

- Wake up
- Make coffee
- Drink coffee
- Build tools to streamline information retrieval
- Use them to unravel the secret life of microbes
- Make scalable, real-world application
- Find someone who will pay for them
- Reinvest the money in more cool science



Xue et al, Accepted in Nature Communications

My journey between academia and entrepreneurship – the shiny side

Professor at Nanjing Agricultural University

- Stanford ranking of top 2% most cited scientist
- Outstanding talent (NSFC)
- H index 63, 14'400 citations

Serial entrepreneur

- Founded three profitable companies
 - Blomitec – Sustainable agriculture solutions
 - Cybiome – Digital twins
 - Genedance – your microbiome plugin



ARTICLE

Received 30 Oct 2014 | Accepted 19 Aug 2015 | Published 24 Sep 2015

[DOI: 10.1038/ncomms9413](https://doi.org/10.1038/ncomms9413) OPEN

Trophic network architecture of root-associated bacterial communities determines pathogen invasion and plant health

nature ecology & evolution

Brief Communication

<https://doi.org/10.1038/natevol.2015.023>

Microbe-induced phenotypic variation leads to overyielding in clonal plant populations

Received: 23 December 2022

Accepted: 6 December 2023

Waseem Bazzi^{1,2,3}, Gopali Jiang^{1,2}, Nico Eisenhauer^{1,2}, Yishuo Huang¹, Zhong Wei^{1,2,3}, Qirong Shen¹, George A. Kowalchuk¹ & Alexandre Jousset^{1,2,3}

nature
microbiology

LETTERS

<https://doi.org/10.1038/s41564-023-0119-6>

Competition for iron drives phytopathogen control by natural rhizosphere microbiomes



ARTICLE

<https://doi.org/10.1038/s41467-021-24005-2> OPEN

Rapid evolution of bacterial mutualism in the plant rhizosphere



Targeted plant hologenome editing for plant trait enhancement

Mohammadhossein Ravanbakht¹, George A. Kowalchuk¹ and Alexandre Jousset²

SCIENCE ADVANCES | RESEARCH ARTICLE

PLANT SCIENCES

Initial soil microbiome composition and functioning predetermine future plant health



Phage combination therapies for bacterial wilt disease in tomato

The ISME Journal
<https://doi.org/10.1038/s41396-019-0501-1>

ARTICLE

Root-associated microorganisms reprogram plant life history along the growth–stress resistance tradeoff

... and the not so shiny side

This is the truth behind

- >1'000 manuscript rejections
- >50 failed proposal applications
- >20 failed professor position application
- Unceremoniously dumped by university
- Dozens of customers lost to stupid mistakes
- Previous company imploded after 6 years of founder disputes



*...And If I could go back and make my amends
I'd make all those mistakes again...*

Alestorm

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Microorganisms for a better world

Microorganisms underpin our life on earth

Food: Feed plants, keep them healthy and nutritious

Health : Live 120 years in top shape

Cleantech: Remove pollutants

How can we unlock their power?



Microbiome is a black box

“The bioinformaticians have only interpreted the microbiome in various ways; the point, however, is to change it”



Digital twins turbocharge research

Digital twins reproduce the microbiome as computer simulation

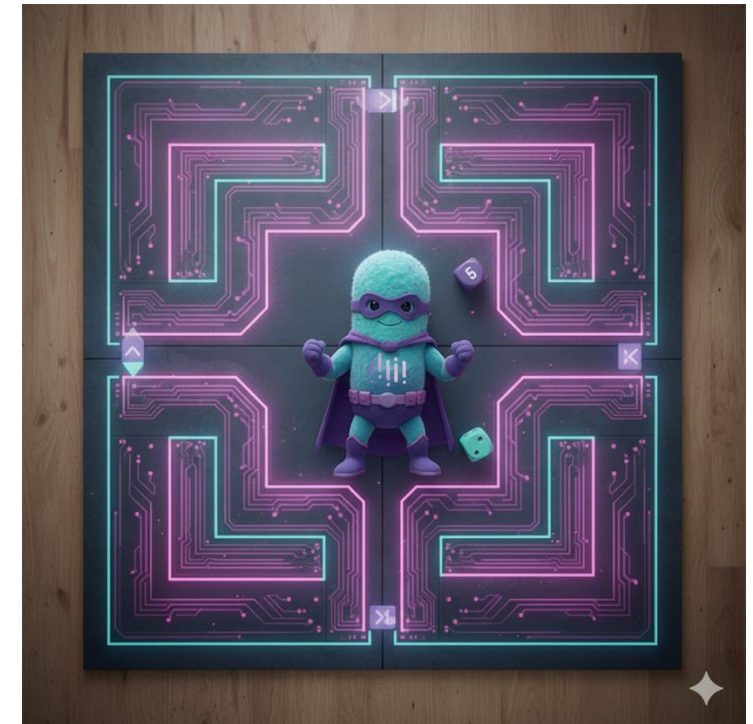
- From genome to insights, skip the tedious research
- Reproduce all key aspects of the bacteria
 - Resource use
 - Secondary metabolites
 - Growth preferences
 - Life history strategy
 - Size



Digital twins turbocharge research

Wargame your microbiome instead of running experiment

- Simulate millions of potential treatments relevant for your system
- Predict optimal interventions
- Skip the lab /greenhouse /animal testing



Digital twins under the hood

Property inference

- Scan genome to retrieve as many traits as possible
- Leverage developments in AI for biological sequences.
- Identify the target properties (single traits or emergent)

Scalable digital microbiome assembly

- Reconstruct digital microorganisms out of cheap amplicon reads
- Infer the growth conditions automatically
- Encode planned interventions
- Simulate microbiome response

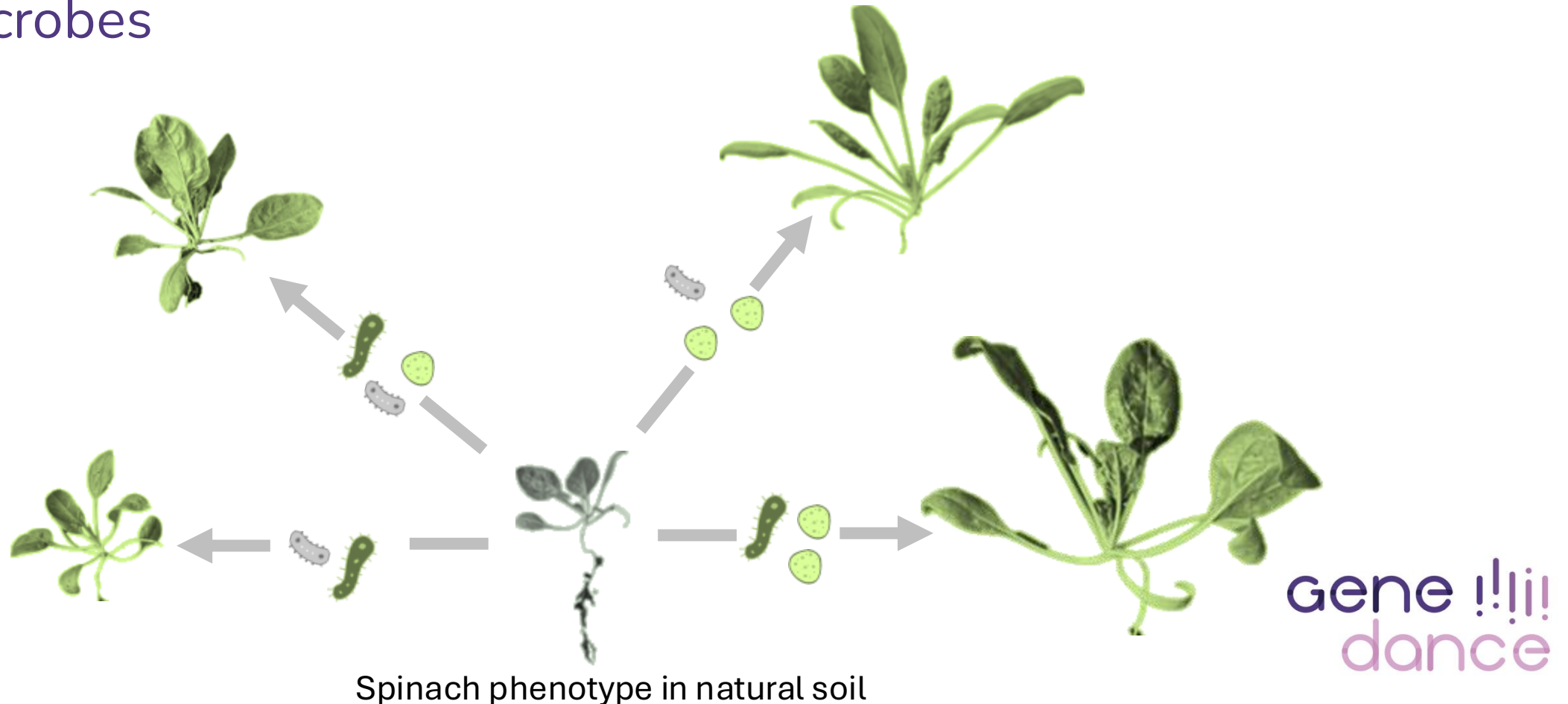
Does it work?

Yes! These are our main use cases:

- Rapid active molecule discovery
- In vitro scan of biologicals

For whom?

Selective microbiome stimulation can be used wherever you find microbes



For whom?

We provide the picks and shovels for the next microbiome revolution

Biotechnology companies

- Design consortia for maximal efficacy in your target system

Farmers

- Survey soil health, proactively answer threats

Seed companies

- Improve seed quality with the matching microbes

Health sector

- Monitor and control antimicrobial resistance

My latest baby

Genedance is here to make your life easier

- Plug in complex DNA sequencing, bioinformatics and interpretation into you're your work
- No technical skills needed
- Automated interface saves you consultancy costs
- Fully auditable and audience-specific reporting

Special launching offer - Sequencing for BiomeFUN participants

Amplicon sequencing (100k paired reads): 26€

Metagenome (short reads, 6 Gbp): 85€

Use BF25 promo code. Contact me directly per email : alexandre.jousset@genedance.com



Lessons from 6 years entrepreneurship

Entrepreneurship is the best thing in the world

- You just need to be delusional, the rest will come from itself

Assemble the right team

- And good luck trying to figure out what is “right”

Fail, start again, fail again, try, succeed.

- Or die trying

*“Auf und nieder, immer wieder
Das Leben ist Musik, es braucht neue Lieder”
Die Apokalyptischen Reiter*

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Take-home message

There is so much more to life than the academic path.

You have unprecedented opportunities, (mostly) uncoupled from your current social, economic and geographical conditions.

Don't hesitate to contact me, I am here to help,

alexandre.jousset@genedance.com

Thank you!

Internship positions available!



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra



cousin



Fachhochschule
Nordwestschweiz



南京農業大學

NANJING AGRICULTURAL UNIVERSITY

