



# VIDIUM

SYSTEMS BIOLOGY SOLUTIONS

## GUIDANCE TO SUCCESS

### AEROSPACE EXCELLENCE APPLIED TO LIFE SCIENCE

Climate change, pollution and public health care issues are direct consequences of the ignorance of living systems, including humans, which suffer from effects of unsuitable technologies as in energy, production or food. To create compatible and sustainable technologies there is a need for detailed knowledge of living systems to interact with them in a controlled way.

To address the challenge of living systems retro-engineering, VIDIUM approach is based on the **Continuum postulate** and we resolve the **paradox of means of analysis regarding complexity**.

From our combined experience in aerospace and biology we made the postulate of technological **continuum** between artefacts and living systems. Amazingly there are very strong similarities between the functional architecture of an autopilot and a cell.

Our interpretation is that engineers design artefacts as life do, by an iterative and selective process of trials and failures from legacy systems. Intelligence is just a way to channel and accelerate this random evolutionary process.

Even if living systems are considerably more complex, there is no fundamental difference with artefacts design.

If we agree on the technological continuum postulate, and if we admit that living systems are very much more complex than technologies, then the **paradox of the means of analysis** appears in relation to complexity.

Indeed, it is paradoxical that the analytical methods used in biology to retro-engineer ultra-complex living systems are inferior to those used in engineering on less complex systems.

And this paradox is only amplifying with the arrival of new experimental technologies in biology. Massive quantities of data are generated and unfortunately very little exploited by statistical approaches that just provide correlations but do not create knowledge.

#### **Man has never been to the moon with statistics!**

To resolve this paradox, VIDIUM Solutions combines knowledge and expertise in the aerospace field and life science disciplines.

We bring proven retro-engineering approaches, dynamic mechanistic models, deep learning and **knowledge management** initially designed by and for the aerospace industry to the Data-Driven medical field.

Our aim is to maximize decades of system engineering that led to the space conquest and apply it to the benefit of "Life conquest"!



# FOUNDERS

## Arnaud BONNAFFOUX

### **Why Vidium?**

VIDIUM is the extension of my personal reconversion from aeronautic to biology. I wish to bring to biology processes and methods that were proved and made successes in the aerospace domain. Biology is experiencing its big-data revolution at cellular and molecular level which requests new means of analysis.

### **What is your previous experience?**

I worked for 10 years at Thales Avionics designing and testing autopilots. This multidisciplinary activity requires pragmatism and rigour to guaranty efficiency, robustness and safety for critical autonomous system. Surprisingly, autopilots and cells share many commonalities in their behaviour and design, and that's one of the reasons of my reconversion. After a master's degree in molecular and cellular biology, I've developed during my PhD the WASABI framework for gene regulatory network inference, which is at the core of VIDIUM solutions.

### **What is your vision for VIDIUM for the next few years?**

Our objective is to be a global leader in insilico modelling and big-data analysis in biology. In concrete terms, we hope to contribute, thanks to intensive collaborations with our customers, to important discoveries and development of new treatments. But the very sense of our mission is more global and long term to reconcile technology and Life in a sustainable way.

**Dr BONNAFFOUX and Dr BOU-ANTOUN joined their experience and skills in their complementary domains to create and develop VIDIUM.**



## Sami BOU-ANTOUN

### **Why Vidium ?**

For years after my medical and science studies I was looking for means to predict some genetic disorders but I lacked the "engineering" knowledge essential to step forward in such an ambitious project.

Meeting Arnaud triggered the project by combining his background in the aerospace field and mine in research and development.

Every successful entrepreneurial project is the result of an encounter of persons, ideas, and clear project. This is the case with Arnaud.

Vidium, is the result of a common vision on how to get "out of the box" and make two worlds that never communicated before meet to the benefit of humanity!

### **What is your previous experience?**

I am a serial entrepreneur. After medical studies and a PhD in Science I worked for different consulting companies for the pharma industry before tempting my first entrepreneurial adventure. Five companies. Some failures and many successes. I just finished the development and out licensed a medical device in the women's health field that replaces antibiotics in the treatment of some intimate infections. I am also involved in a project in cancer immunotherapy where we developed a novel mechanism of action in the treatment of some cancers.

Parallel to my projects I helped other entrepreneurs come out with their projects. I also teach Management of Innovation at Lyon III University.

### **What is your vision for VIDIUM for the next few years?**

My vision? To become the undisputed paradigm changer in the data driven medicine and research.

# STRATEGY

## THE NEEDS IN DRUG DISCOVERY

The pharmaceutical industry is under growing pressure to develop cost-effective new medicines. The trends in industry R&D productivity have been moving in the opposite direction for a number of years.

The general failure rate is more than 90%. Costs are measured by billions of dollars. All players need to secure their research **increasing the success rate** and **reducing their costs**.

## FAIL-FAST STRATEGY IS LIMITED

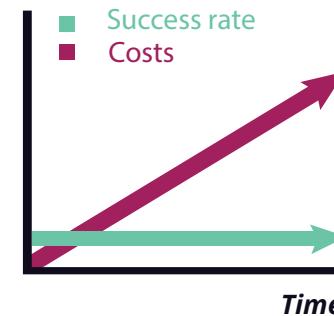
Some companies offer their services to reduce trials costs with a **Fail-fast strategy**. Global costs are reduced but **global success rate does not change**. Fail-fast approaches are based on **statistical analysis** that only provide **correlations** from data, **not knowledge**.

*"We are drowning in a sea of data and starving for knowledge"* (Sydney Brenner)

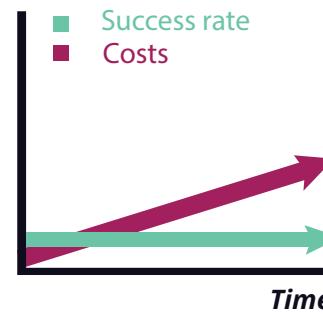
## VIDIUM STRATEGY INCREASES SUCCESS RATE

VIDIUM unique iterative approach solutions enable to **increase global success rate** by **capitalizing and operating knowledge** in executable mechanistic models. Knowledge is extracted from data by a **retro-engineering** approach. Executable mechanistic models are **improved at each iteration**.

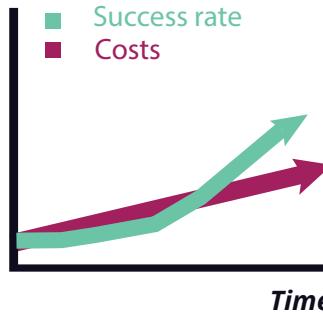
### Standard strategy



### Fail-Fast strategy



### VIDIUM strategy



## Our mission

Vidiум supports your research to significantly increase your chance of success in the development of new treatments involving gene interactions

## How we work

We extract maximum information integrating your multi-omic data for your problem and predict « what if ? » results from biological relevant in-silico models

## Your benefits

- ✓ Save time & cost with rational design of experiment
- ✓ Capitalize knowledge at each experiment
- ✓ Increase your chance of success

# INNOVATIVE TECHNOLOGY

## A LITTLE SCIENCE...

Genes Regulatory Networks are very important and involved in many critical biological processes such as development, immune response or cancers. Their reconstruction raised great expectations to better understand and develop innovative and robust gene therapy, regenerative medicine or personalized medicine.

## VIDIUM OUTPERFORMS EXISTING SOLUTIONS

Many methods based on statistic or mechanistic models were developed to reconstruct Genes Regulatory Networks. But they face common issues that we solve **developing the WASABI framework inspired from aerospace while considering state-of-the-art knowledge and technologies in biology and Artificial Intelligence.**

### Existing methods are limited :

- Statistical methods are limited to correlations and thus **cannot make new predictions**
- Mechanistic methods, such as Boolean or ODE models, cannot be up-scaled
- Both make over-simplifying assumptions **reducing biological interpretability**
- Both do not integrate multi-scale/level data



**The benefits of our WASABI solution compared to existing competitors are:**

- Accuracy of our predictions with the MOST realistic and mechanistic cellular model
- Computational Efficiency thanks to an innovative iterative "divide and conquer" strategy which enable scalability using parallel computing and machine learning algorithms
- Capitalization of knowledge with rational iterative design of experiment
- Versatility with easy integration of dynamic multi-scale/level data from latest technologies and tailored analysis

	Omic scale	New Predictions	Biological interpretability	Multi scale/level data integration
Statistical	✓	✗	✗	✗
Mechanistic	✗	✓	✗	✗
WASABI	✓	✓	✓	✓

(For a complete description please refer to the pre-print version of the scientific article Bonnaffoux et al., BioRxiv, 2018.)



Contact us

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