

# Key learnings and proposals to address the major challenges of life sciences discoveries!

(Extract of a presentation given by Manuel GEA during a Prospective Workshop  
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## What must be clarified to change the R&D paradigm?

1. In life sciences, with less than 5-10% success rate, a dominant recurrent thinking that fails may be “false”, even if supported by Key opinion leaders or digital giants such as Google or Watson!
2. The Academic World is not “the only” source of innovations.
3. “Discovery” means finding “unknown” facts.
4. Simulating a system supposes to have understood and described it before beginning with.
5. In life sciences, Big Data may lead to Big Garbage if the data produced are not correctly contextualized.
6. “New therapies” do not necessarily mean new drugs.
7. Combinations of existing drugs are patentable!
8. The cost of drug development is not 1 billion € per drug for a SME. It is around 250 M €, but in case of failure the SME is “dead”.
9. Scientific Proof of concept on humans does not mean clinical trials.
10. Nevertheless, it MUST be remembered that Models are Aids to thought, NOT a replacement for it!!

## Key learnings about life sciences issues

11. The mechanisms of life are complex, non-linear and integrative. They are “built” to survive.
12. In “living complex” systems, the functions of biological components and mechanisms are event and context-dependent.
13. Classical “Cartesian” modeling concepts & approaches, valid for the majority of man-made artifacts, imply the concept of a “blue-print”. But this concept is at the opposite of biological reality
14. ... While “Cartesian” Bioinformatics and Mathematical tools have proven to be efficient to collect, structure, analyze, simulate specific functions to test or to generate innovative hypotheses, yet...
15. ...The “garbage in, garbage out” reality, tells us that the information produced and published (even in leading scientific journals) is necessarily ALWAYS incomplete, biased and erroneous to unknown extents.

## Proposals to develop Integrative Biology teams

1. Develop new training programs for the future integrators through smart selection processes and open-minded educational organizations.
2. Develop multidisciplinary training programs for both IT integrators and biology Integrators to build complete integrative biology teams.
3. Create for these “generalists” “successful” jobs evolution adapted to their specificities and profiles.
4. Introduce “general semantic” and other “soft” knowledge in life sciences and technologies educational programs to train people think “out of the box”.
5. Reintroduce physiology in the educational courses.
6. Support and protect people who think differently.
7. Systems biology must be considered as a biology driver research process supported by IT tools to help them work.

## Key learnings about innovation

1. The experts’ consensus evaluation process, well adapted for incremental innovation evaluation, is clearly the number one serial killer of disruptive innovation.
2. Disagreement amongst experts should be considered a necessary, but not sufficient, condition to detect disruptive innovations.
3. The great disruptive discoveries come from challengers such as Pasteur who discovered that most infectious diseases were caused by germs against the medical establishment since Felix Pouchet in 1859 had published a prevailing work in favor of spontaneous generation theory.
4. Similarly the Australian scientists Barry Marshall and Robin Warren were obliged in 1984 to infect themselves with *Helicobacter pylori* to prove that it was the gastric ulcers cause.
5. Three types of Innovations are complementary: technology, organizational and usage innovations must be equally supported and evaluated.

## Proposals for open and disruptive innovation

6. A specific evaluation track could be defined: evaluation of the innovation by experts of the domains where the technology comes from, and by open minded potential users of the innovation applications.
7. 25% of institutions/companies R&D budgets should be dedicated to this specific track.
8. Research “supposed of no interest” for industry or VCs should be supported and funded to prepare the future and regenerate diversity of concepts and ideas.
9. Develop multidisciplinary team spirit and training built on already existing prototypes that can gain support (example: Alliance of Essec Santé, Centrale-Santé and FSM)