
TO UNDERSTAND AND SOLVE,
SHARE, FORESEE

ANTOINE DANCHIN

Our work at AMAbiotics, a small biotech company based near Paris (France) and in Hong Kong (China), aims at providing the general public with applications derived from knowledge created by ourselves or, most often, created by the international community, and that we organize into an outcome that becomes amenable to industrialization.

The “general public,” to which by definition we all belong, is motivated by two general forces: on the one hand by sheer curiosity—man is driven by the insatiable curiosity celebrated by Rudyard Kipling—and on the other, by his quest for well-being. There is no contradiction here; curiosity nourishes the part of dream, which occupies our minds, and it allows us to make the discoveries that contribute to our well-being.

The deepest misunderstandings about the role of research that plague most human societies derive from the mistaken yet widely spread assumption that it suffices to want (or simply wish) to obtain the objects of our desires. Desiring is certainly not enough, because, by its very nature, discovery is *unpredictable*. If it were enough to want something, then there would be nothing to discover. We would simply need to guide the natural course of things in the right direction. We all know that this is an impossible ambition (which would destroy any interest in discovery anyway).

This is exactly what Louis Pasteur understood. First, it is essential to take the social demand into account, to be driven by the *motivation* of the people we live with ¹. Second, this must not mean that this motivation, by itself, is enough to lead to discovery. The role of a motivation is simply to allow one to choose between the far too many paths that are offered to our desires. The potential for novel knowledge is without any limitation. And once a motivated path is chosen, it needs to be explored using the scientific method ², which is the only way to be sure that it may lead to discoveries.

For example, we know that wine and beer, from time to time, become sour. This used to happen without known causes, and this asked an obvious question: is there a cause or causes to this unwanted corruption of these common beverages. Some correlations had been observed with a

AMAbiotics, Genescope, Evry, France. / www.amabiotics.com
/ antoine.danchin@normalesup.org

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variety of phenomena, but correlations are not causes. Could we use these observations to understand the causes of the process? In the same way, silkworms were suddenly dying from a terrible disease that drove to unemployment all the workers in the silk factories of southern France. The government called Louis Pasteur for help, as he had solved the riddle of the diseases of beer and wine³, creating from this very practical motivation the bases of modern microbiology...

Motivation drives the need to ask questions. Questions lead to conceptual and experimental research, and there is no difference with those performed by «pure» academic research when they are driven by personal curiosity. And as a consequence motivation produces discoveries. This is exactly what research is meant for. The fate of these discoveries is of two types. First, they serve as starting points for the creation of the general knowledge that is used to progressively build up our common representation of the reality we live in. Second, they lead to applications that may be used by the world of industry, fulfilling public demands and providing work for the people. The study of the diseases of beer and wine, beside being at the forefront of the creation of a whole scientific discipline, microbiology, led to processes that are still in use today, in particular in the various industrial methods used to produce beer and other fermentations.

This outlines the general background of our values and our business model. We start from general and widespread demands and, as a starting point, from the hardships endured by patients submitted to long term medical treatments. More generally we are driven to work on the quality of our environment, soil and water in particular, which are also enduring harsh treatments, and we try and understand the metabolic alterations that go in parallel with these situations. This allows us to discover novel metabolic pathways and novel interactions. Using this knowledge, which we progressively make public (needing a piece of software for our specific needs, but finding that this software is of general interest we make it available to the public, for example⁴), we can derive applications, that are, naturally, protected by the intellectual property rights needed for the functioning of the company and for the work of its employees.

Because of our perception of research as a motivated activity, we privileged the engineering view promoted by what is known as synthetic biology (that we prefer to name «symplectic» to take into account the complexity of life's interactions⁵), with this central question in mind: what we should not forget if we had to construct a living organism? With this approach we pave the way of discovery while making life more understandable to the general public.

As can be seen, this win/win model, allows us to build up a harmonious collaboration with the academic world, as academy—with creation of

novel knowledge—and industry—with creation of effective applications—both find interest in our work.

This model, finally, because of its deep roots into social demand, poses from its very beginning the ethical, safety and security questions that should be compelling for all. Indeed we, too, belong to the general public, and our concerns are the same as those of everybody. We thus participate within an intellectual intelligence that is too often absent from academic research, leading to deep misunderstandings about technology-driven research in biology. Misunderstandings that led to real sufferings in our societies, whether in its imagination, or in the wrong usage of our common resources, the limits of which we are now all aware of.

NOTES

- 1 Danchin A. "Motivated research," *EMBO Rep* 2010, 11(7): 488.
- 2 Danchin A. "Science and technology: a Western imbroglio," *Projections* 1992, 7/8: 39-48.
- 3 Pasteur L. "Etudes sur la bière, ses maladies, causes qui les provoquent, procédé pour la rendre inaltérable, avec une théorie nouvelle de la fermentation". Translation, "The diseases of beer, their causes, and the means of preventing them," Paris; translation, London: Gauthier-Villars; translation MacMillan & Company; 1876, translation 1879.
- 4 Engelen S., Vallenet D., Medigue C., Danchin A. "Distinct co-evolution patterns of genes associated to DNA polymerase III DnaE and PolC. *BMC Genomics* 2012, 13: 69.
- 5 de Lorenzo V., Danchin A. "The discovery of new worlds and new words," *EMBO Rep.* 2008, 9.