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How François Jacob bridged the gap between the “two cultures”

Michel Morange

Centre Cavaillès, République des Savoirs, USR 3608, Ecole normale supérieure, 29 rue d’Ulm, 75230 Paris Cedex 05, France

Email address: morange@biologie.ens.fr

Abstract

While the scientific contributions of François Jacob were outstanding, I also consider that his conception of science, and of its place among other forms of knowledge, is also highly original, and important for the future of science in our societies. His contributions to the history and philosophy of science were neither a hobby nor a secondary activity, but they were for him a natural complement to his scientific work. He fully opposed the concept of the two cultures, the literary and the scientific, proposed by C.P. Snow. For Jacob, concepts, metaphors and models circulated between the various spheres of human activity. This is obvious in his own work. This “open” conception of scientific activity did not prevent him from defending the specificity, and the superiority, of scientific knowledge.

Keywords: history of science; night and day science; philosophy of science; the two cultures; tinkering

1. Introduction

I will not dwell on the ten years that I spent in François Jacob's lab, nor on the profound influence he had on my research work in biology. I will focus instead on the various contributions he made to the history and philosophy of science. These played a major role in the development of my own interests in these matters, which I discussed with him on various occasions after I left his lab.

I will first briefly describe his main contributions, and then question the relations between his scientific activity and his contribution to the history and philosophy of science.

2. François Jacob's contribution to the history and philosophy of science

It is not unusual for a scientist to turn towards the history and philosophy of science at the end of his career. It is a way to position his contribution to the general history of science, as well as to appreciate the impact this work and that of contemporaries has had on the philosophical dimension of the scientific enterprise.

Jacob's output does not fit this traditional way of linking science and reflection on science. I will limit my study to his four non-scientific books. He also wrote a series of articles on these issues, but they were mostly a development of questions already addressed in his books, or their content was later incorporated in forthcoming books.

The first, *La logique du vivant: une histoire de l'hérédité* (*The Logic of Life: A History of Heredity*), was written in 1970 (1). Jacob was still fully active in the lab and already engaged in a

radically new project, the study of the early phases of development of the mammalian (mouse) embryo. As I will discuss later, this book was a new way to write the history of biology.

His second major book was his autobiography *La statue intérieure* (*The Statue Within: An Autobiography*), published in 1987 (2). Many scientists have written autobiographies, but Jacob's is atypical. First, it was received as a literary work that opened to him the doors of the French Academy. In it, only 15 years of his scientific activity are described, and they occupied only one third of the book, a similar space being devoted to his childhood, and to the time he spent with the French Free forces between 1940 and 1944.

Two other books published by Jacob are an inextricable mixture of science and reflections on science. In *Le jeu des possibles* (*The Possible and the Actual*) (1981), he developed the comparison he had introduced earlier between the action of evolution and that of a tinkerer: a metaphor initially proposed by Darwin, but expanded by Jacob on new scientific bases, and which met with huge success (3). In *La souris, la mouche et l'homme* (*Of Flies, Mice and Men*) (1997), Jacob included information on the second part of his career and the recent developments that had taken place in biology, but also a long comparison between science and art, and more generally between science and other forms of knowledge (4).

What is the most remarkable in these last two works, but which also somehow pervades all of Jacob's books, is the permanent circulation of concepts and reflections between science and the humanities, and the humanities and science. This circulation is so intense that it is impossible to place these books in one specific category.

3. The non-significance of a separation between the two

cultures

What is most important for me in François Jacob's contributions is his implicit demonstration that there is no distinction of nature between his activity as a scientist and his historical and philosophical considerations of science. This does not mean that Jacob mixed these two activities in his life. In his lab, he was doing science, and discussing science with his collaborators. Science and reflection on science took place at different times and places.

Nonetheless, I interpret Jacob's dual production as a strong opposition to the so-called "two cultures" described by C.P. Snow in 1959 (5). Jacob did not deny that, unfortunately, scientists often ignore the arts and humanities, while artists, writers, and historians have no knowledge of science and of its recent developments. What he opposed was the idea that there are two radically different forms of culture, that are impermeable – incommensurable in Thomas Kuhn's words – with one another. The situation is even worse today than in 1959: the term culture is often only used to designate knowledge of the arts and humanities; scientific knowledge is placed on the side of technological knowledge, unable to generate a culture. This critique, which was implicit in the way Jacob did not respect the boundaries between different disciplines, was only made explicit once, when he presented his autobiography. When asked about the success of his book among a wide readership, a book praised for its style and elegance, he admitted that he was happy to have overcome the challenge that was the production by a scientist of a literary work: "literary quality" is often what distinguishes texts produced by scientists and, for instance, by writers. The attention paid by Jacob to his style, his admiration for Buffon, whose style was unanimously praised, were arguments

demonstrating that the barrier between the two cultures can be overcome.

This absence of distinction between the two cultures, which means that science, and the history and philosophy of science, do not belong to different domains of knowledge, was supported by arguments found throughout Jacob's books. The first argument is the oft discussed parallel between the transformations occurring in science and in the arts: the Renaissance was a new way to represent nature and human bodies in painting and sculpture as well as in science. There is a spirit of the time, a *zeitgeist*, which is a common good shared by scientists and artists alike. The "episteme", the constraints that limit the discourses of one specific time, described by Michel Foucault in *Les mots et les choses* (*The Order of Things: An Archaeology of the Human Sciences*) in 1966 (6) – a book that had a deep influence on Jacob (7) – is common to all disciplines and human activities, even if each discipline has its own constraints that it does not share with others. *The Logic of Life* was not the traditional description of the successive discoveries in biology, but of the contexts that allowed these discoveries to be made.

More importantly even, the way scientists and other producers of knowledge generate this knowledge is not different: myths and scientific knowledge respond to the same request – to explain the complexity of nature by appealing to a simple unknown. To extend this comparison, Jacob introduced his famous distinction between day and night science. Day science is the well-organized and rational construction that is transmitted to those entering science, and allows them to build "on the shoulders of giants". Night science corresponds to the time when new scientific knowledge is elaborated, when future theories and models cohabit with the most fantastic ideas, when everything is permitted. New knowledge,

whatever it is, is produced by this process of tinkering that Jacob proposed for evolution, and immediately applied to scientific activity. Tinkering corresponds to the activity deployed during night science: taking every idea, model, concept to hand and recombining them in order to generate new knowledge.

4. A modern, but non-relativist conception of science

By describing science as it is practiced, and not as philosophers of science have dreamt it ought to be, François Jacob gave scientific activity a renewed and much more attractive image than that of traditional descriptions. Imagination and metaphors have their full place in night science, and therefore in the production of new knowledge. Even if gravitation would have been discovered without Newton, and evolutionary theory without Darwin, each scientist has a specific style that gives his or her contribution its full flavour. The way scientific knowledge is produced also explains why new knowledge depends on the societal and cultural context in which it is produced. The vision of science given by Jacob is not very different from that provided by social scientists during the last four decades. He shares with them the conviction that scientific knowledge is limited, not only by the techniques available to scientists, but also by the possibility of distinguishing new phenomena and of conceiving new explanations.

But this more realistic conception of the construction of scientific knowledge does not prevent Jacob from rejecting all forms of relativism. Science constitutes the best (and perhaps unique) form of efficient knowledge because it has added a powerful sieve to the anarchically produced new pieces of knowledge: their evaluation through free and rational

discussion between scientists, and the testing of the new theories and models through experimentation. Jacob has been able to reconcile total freedom of the imagination and strict rational control in his description of the production of scientific knowledge. His conception is also consonant with the notion of scientific progress: the successive descriptions of the different levels of organization within organisms presented in *The Logic of Life* constitute progress in our understanding of the biological world (8).

The most significant lesson that I learnt from François Jacob is that reflection on science is a part of science and should not to be left to others, to philosophers, historians and sociologists. This François Jacob was able to accomplish by combining his experiences in science and in the wartime, and his personal commitment to social issues.

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