

The transformation of the biological sciences in post-war Europe

EMBO and the early days of European molecular biology research

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The European Molecular Biology Organization (EMBO) will celebrate its 40th birthday next year. This seems like a good opportunity to take a closer look at how EMBO came into being in 1964, and at the driving forces that established this first European organization to represent molecular biology. Investigating the origins of EMBO also allows us to explore the history of molecular biology in Europe and how it changed from a marginal specialty into a well-established practice in most fields of experimental biomedicine.

Like many other institutions, EMBO has its official history, and the canonical version was laid down in a sample copy of *The EMBO Journal* by John Tooze, former Executive Director of EMBO: "In December 1962, immediately following the Nobel Prize Investiture ceremony, John C. Kendrew together with James D. Watson visited the Centre Européen de Recherche Nucléaire (CERN) in Geneva on their way home from Stockholm. Leo Szilard, the nuclear physicist-turned-molecular biologist, was also in Geneva at the time. Having decided that the Cuban missile crisis [October 1962] might lead to war he had left New York and had taken refuge in Switzerland. During the course of a conversation the three visitors had with Victor Weisskopf (CERN Director General), Leo Szilard proposed that Europe's molecular biologists should attempt to emulate their colleagues in particle physics and try to persuade their governments to establish an international laboratory for molecular or fundamental biology patterned on the CERN model. [...] The upshot was a

meeting held at Ravello, Italy on 16–17 September 1963. [A group of molecular biologists] discussed the possibility of international cooperation in fundamental biology. The group decided that a European organization was a more realistic project than a global one, and then discussed a paper by Kendrew and Conrad H. Waddington entitled 'A proposal for a European Organisation of Molecular Biology'. It endorsed the proposal but opted to name the new organization the European Molecular Biology Organization (EMBO)" (Tooze, 1981).

All these events in Tooze's recollection did happen. However, this gives the impression that the establishment of EMBO was an inevitable outcome, based on the decisions made by a few determined players. But it was, in fact, not that simple, and by putting these events into their historical context, with all the uncertainties at that time, we can better appreciate their deeper significance and the achievements of these scientists. It also allows us to re-examine such apparently simple but important questions as: why did European molecular biologists feel that it was necessary to create EMBO? Why was EMBO originally funded by private foundations? And why did the European governments eventually come on board? Before answering these questions, some historical context needs to be considered.

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First, the science policy agenda of the period immediately after the Second World War was dominated by atomic physics—and atomic physicists—and to a lesser extent by space research. The creation of the CERN in 1953 and of the European Space Research Organisation (ESRO) in 1962 reflects this scientific emphasis in the years of the Cold War. Second, it was far from clear in the early 1960s that molecular biology deserved a comparable level of governmental support, over and above other areas of the biomedical sciences. Third, it was not obvious that molecular biology had to be organised at a European level. Fourth, EMBO's task was not to establish a European laboratory, equivalent to CERN, but rather had the broader objective of supporting molecular biology research in Europe by different means. Last, EMBO did not invent the concept of an international laboratory for the life sciences because many other organizations were pursuing this goal at the same time.

With these elements in mind, we can try to answer the question: why did European molecular biologists set up EMBO? This simple question has no simple answer. The creation of EMBO has often been portrayed as a means for the creation of a central European laboratory dedicated to molecular biology. But that is not quite

true. Historian of science John Krige, from the Georgia Institute of Technology (Atlanta, GA, USA), made it clear that there was more than one rationale behind the informal creation of EMBO in September 1963 (Krige, 2002). There was Kendrew's idea to create a central laboratory (Fig. 1), but there was also Waddington's concept of a federation of existing laboratories. Both agreed that EMBO should, in addition to any laboratory project, establish a European funding scheme to support research in fundamental biology. As we know, Kendrew's idea finally succeeded when the European Molecular Biology Laboratory (EMBL) was created in 1974 and he became its first Director General. However, Waddington's project was not dropped altogether, but was slowly transformed into the EMBO fellowship programme, which allows European researchers to work in other laboratories for various lengths of time. Young scientists can 'shop' for techniques, ideas and resources wherever they are to be found, which was actually the main idea behind Waddington's federation of laboratories. The programme started in 1965, under the chairmanship of Adriano Buzzati-Traverso, and was inspired by the European Atomic Energy Community (EURATOM) fellowship programme that was initiated by Raymond Appleyard, who became EMBO's Executive Director that year. Since then, the short-term and

long-term fellowship programmes have been EMBO's main activities, consuming more than 70% of its budget.

These fellowship programmes should be put into the broader historical perspective of the changing relationship between European and US science. Immediately after the Second World War, it became clear that the USA had taken the lead in science and technology, as demonstrated by their development, for example, of the atomic bomb, antibiotics and the computer. To face what was perceived in Europe as an 'American challenge', several important institutions, such as the Institut Pasteur in Paris, France, and the Medical Research Council laboratory in Cambridge, England, developed various transatlantic networks of exchange between Europe and the USA to freely circulate people, organisms, materials and ideas. These made a crucial difference in Europe, where resources were still scarce in the years immediately after the war. At first, these movements were quite unidirectional, but they became more balanced throughout the 1950s. However, some scientists started to question the sense of European researchers looking to the USA for intellectual and technical resources that could be found in Europe. Waddington's federation project therefore aimed at translating the trans-Atlantic network into an intra-European network of exchange. The goal was not to transfer

resources to modestly endowed institutions, but to allow a new mode of interdisciplinary research to emerge.

Through the establishment of the EMBC [European Molecular Biology Conference] as a permanent intergovernmental body in 1969, EMBO was able to gain the necessary political support for its long-term projects

Consequently, the EMBO fellowship committee developed an 'excellence policy', refusing to take into account an applicant's country of origin or '*juste retour*' considerations that apply in many other international funding schemes. However, they were not completely immune to political influences—indeed, Raymond Appleyard was reluctant to support fellowships in the USA. EMBO had, in part, been set up to counter the 'brain drain', not to contribute to it. The committee was also uneasy about applications from Eastern European scientists, mainly because interviews with candidates were difficult to carry out. These choices show how closely EMBO was aligned to Western Europe, except for its links with Israel. The fellowships committee accepted demands from whichever field in biology they came, and interpreted 'molecular biology' in a very broad sense, not restricted to molecular genetics, protein synthesis or structural analysis. As a result, it accepted more than 80% of short-term and 50% of long-term fellowship applications until the 1970s. This funding of scientists broadened the basis of molecular biology as a discipline underlying all experimental life sciences, synonymous to 'modern biology'. The fellowship programme, together with the courses and workshops that were also funded by EMBO, proved immensely beneficial for European researchers in the 1960s, particularly as US funds were becoming increasingly scarce, due to the escalation of the Vietnam War. The courses and workshops offered training opportunities in Europe that could previously only be found in the USA; for example, the bacteriophage course at Cold Spring Harbor Laboratory.



Fig. 1 | Sir John Kendrew with the 'forest of rods' model at the Laboratory of Molecular Biology (LMB) in Cambridge, UK. © (1960) LMB.

But the fellowship programme required significant financial means, which brings us back to the question of why EMBO was originally funded by a private organization. When EMBO was informally created in Ravello, it was just a 'club' of life scientists who wanted to promote molecular biology research in Europe. It had no funds, no legal existence, let alone political support. It was the task of the first EMBO Council to change this. Individual members of the Council approached several European governments for financial support, but they were unresponsive. After all, science policy officials argued, why should a national body fund a European initiative when even national demands could not be covered? Only Israel and the Swiss pharmaceutical industry reacted positively, with modest grants. These covered the EMBO Council's expenses, but were insufficient to fund any scientific activities. Thus, in February 1964, the Council decided to approach private foundations.

Science historian Hans-Jörg Rheinberger, and Volkswagen Foundation collaborator Indra Willms-Hoff, have highlighted the crucial role that the German Volkswagen Foundation played in EMBO's early years (Rheinberger, 2002). The Foundation was created in 1961, after the privatisation of the Volkswagen company, and was devoted to the support of scientific research and education. Its enormous financial resources immediately made it an important player in German science funding, with a budget equivalent to those of the Deutsche Forschungsgemeinschaft and the Max Planck Society. The Volkswagen Foundation supported physicists and chemists who wanted to move into biology, and believed that powerful instrumentation was crucial for the life sciences. Post-war biophysics thus represented an ideal target for their resources—among others, the foundation funded the Gesellschaft für Physikalische Biologie, several members of which soon became EMBO members. Indeed, many European molecular biologists had worked under the biophysics label before the term molecular biology became fashionable in the 1960s.

This connection between EMBO and physicists played a crucial role in the Volkswagen Foundation's decision to support it. As with many foundations financing scientific research, physicists held key positions at the Volkswagen Foundation.

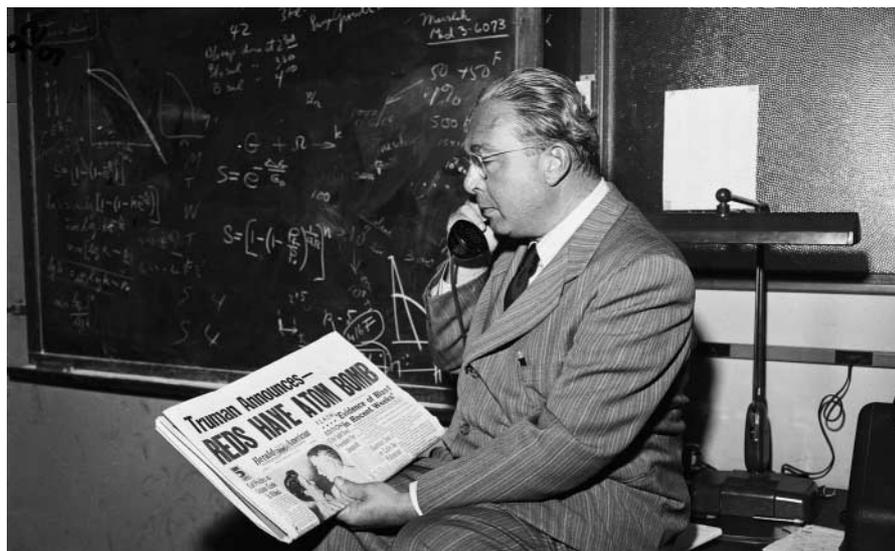


Fig. 2 | Leo Szilard with a copy of the *Herald American*, 23 September 1949. © (1949) Corbis.

Its funding department was headed by Rudolf Kerscher, a physicist by training and a friend of Leo Szilard (Fig. 2). Kerscher visited Szilard in the USA in the summer of 1962, even before he launched the idea of EMBO in December 1962 at CERN, which has become the mythical origin of EMBO. Kerscher sought advice about where the Volkswagen Foundation should invest its funds to make a difference to European science, and Szilard, who had started a new career in molecular biology, pointed to this field as a promising venture. Just before Szilard died, a meeting between him, Kerscher and Gotthard Gambke, Secretary General of the Volkswagen Foundation in 1964, proved decisive in convincing the foundation to support EMBO. In 1965, after many rounds of negotiations, the foundation awarded EMBO DM2,748,000 roughly the equivalent of €4.1 million today. This money funded the first five years of EMBO's fellowship programme and gave EMBO enough time to seek more permanent support.

We tend to forget that in the 1960s, EMBO had to face many competing projects to develop international cooperation in the life sciences at the European, Atlantic and global level. These projects were backed by well-established organizations, such as the Council of Europe, EURATOM, the North Atlantic Treaty Organisation (NATO), the Organisation for Economic Cooperation

and Development (OECD), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Health Organization (WHO). Furthermore, several of these institutions, including WHO, UNESCO and NATO, also had plans for an international laboratory for the life sciences. It was therefore difficult for the newly founded organization to establish itself and gain governmental support for its own goals. The EMBO Council manoeuvred tactfully and made sure that all these organizations were aware of its projects. Several institutions were eager to take diplomatic initiatives in favour of EMBO, others wanted to integrate EMBO's projects into their own plans. EMBO succeeded in remaining independent and, through a Swiss diplomatic initiative, convened the European Molecular Biology Conference (EMBC) in 1967, to bring together governmental representatives of most Western European nations. Through the establishment of the EMBC as a permanent intergovernmental body in 1969, EMBO was able to gain the necessary political support for its long-term projects: the training of European molecular biologists and the creation of a European molecular biology laboratory.

One might wonder how EMBO succeeded in gathering the political momentum to ensure long-term support for molecular biology, whereas many other projects, supported by well-established organizations such as the WHO, died prematurely. The answer to this question is

related to the fact that EMBO was European, more precisely Western European. All the other projects proposed different international configurations: global, Atlantic, European (including Eastern Europe) and regional. Supporting EMBO became a justification for Western European countries to cooperate according to the 'functionalist method' or 'Schuman doctrine': the creation of common interests in order to strengthen political ties, just as the Coal and Steel Community (1951) or EURATOM (1958) had done earlier. Strengthening European ties was all the more necessary in the mid-1960s, during the antagonism between France and the United Kingdom because of controversial issues such as the Common Agricultural Policy. In addition, EMBO projects were perceived as a way to bolster Europe scientifically and to address the main science policy theme of the 1960s: the scientific and technological 'gap' between Europe and the USA. The fact that EMBO proposed to support molecular biology in a Western European configuration, thus aligning itself with the changing politics of the 1960s, was certainly one of the main reasons for its success. But there were others too.

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The EMBO Council was able to play one sponsor off against another by promising support to each of them. This competition between organizations turned out to be effective in getting them to move quickly towards a solution. The EMBO projects and, more generally, cooperation in the life sciences, were particularly attractive to these international organizations, as they presented relatively simple cases, raising few delicate economic or political problems and requiring only modest investments. Another reason for EMBO's success was the fact that it accepted to leave aside, at least temporarily, its laboratory project. Indeed, it would have been very difficult to find a political consensus

in favour of an international laboratory for the life sciences in the mid-1960s. Krige argues that it was only when molecular biology stood on firmer ground nationally, in the early 1970s, that governments and scientists alike were ready to spend additional money on international projects. Timing is, to be sure, of the essence here. The scientific and political contexts of the early 1960s, when EMBO took shape, were quite different from those of the 1970s. In particular, the promise of molecular biology for biomedicine, the institutionalization of the field at the national level and the dynamics of European integration had profoundly changed. Also intriguing is the fact that the laboratory project gained new momentum after the International Laboratory for Genetics and Biophysics (LIGB) in Naples, Italy, which was envisioned as a good candidate for a European laboratory, closed in 1969. Determining which were the most important factors that finally enabled the establishment of the EMBL in 1974 still requires historical research.

EMBO took on new roles after EMBL was established, in particular its formation of a Standing Advisory Committee on Recombinant DNA in 1975 (de Chadarevian, 2002). Shortly before Paul Berg and other scientists published their famous letter in *Nature* and *Science* asking for a moratorium on recombinant DNA technologies, which eventually led to the 1975 Asilomar conference, Kendrew received a letter signed by 12 European virologists, expressing their worries about possible restrictions of this technology. EMBO first reacted by sending representatives to the Asilomar conference. Later, after the US National Institutes of Health (NIH) had set up strict safety guidelines for recombinant DNA experiments, EMBO established its own advisory committee to discuss these guidelines and how they might apply to the European situation. The committee took a liberal position on the regulation of this scientific practice and downplayed the risks of recombinant DNA experiments. But the committee had broader implications beyond policy advice, as it inaugurated EMBO's new role as an expert body, a function that has recently become increasingly important.

In 40 years, EMBO has changed from a small, self-proclaimed club of scientists to a well-established organization with firm

financial and political support that is involved in various activities, ranging from supporting researchers to publishing and science policy. This would not have been possible without the founders' significant commitment and engagement in developing molecular biology and scientific cooperation in Europe. From a broader perspective, the establishment of EMBO, EMBC and EMBL, 20 years after that of CERN, shows how the priorities of scientific research changed during that time. After the Second World War, and during the early years of the Cold War, nuclear and space research were the top priorities of European scientific collaboration. Two decades later, molecular biology became the new focus of European science policy, not only because of the science itself, but also to promote European integration and to counter the 'American challenge'. The history of EMBO represents a unique window to look into how these developments took place and how science and society influenced each other.

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