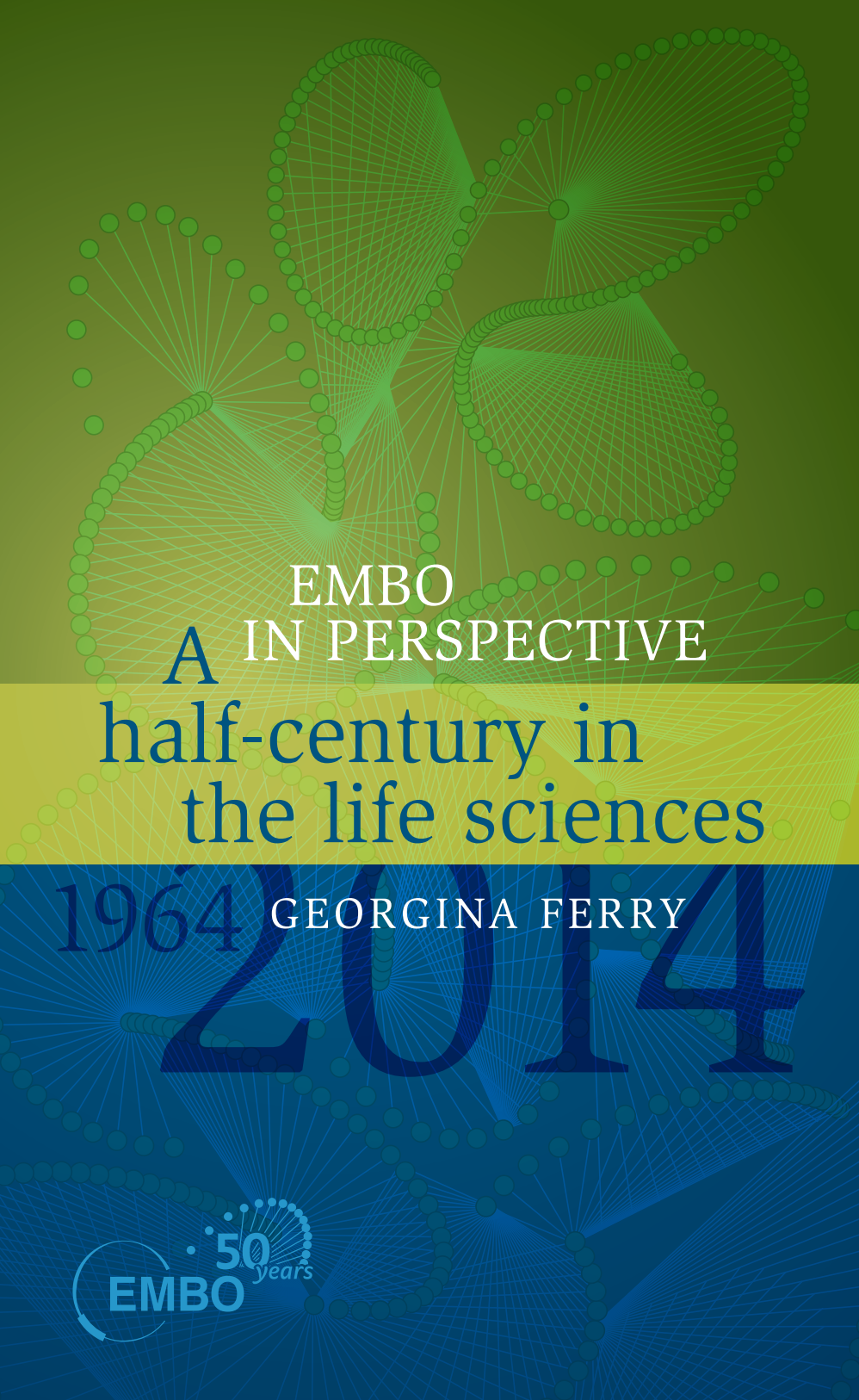
EMBO
A IN PERSPECTIVE
half-century in
the life sciences
1964 2014
GEORGINA FERRY
EMBO 50 years

EMBO in perspective
*A half-century in the life sciences*

EMBO is an organization of more than 1600 leading researchers that promotes excellence in the life sciences. Since it was founded in 1964, it has made many contributions to promote the development of research in Europe and beyond.

When EMBO officially acquired legal status on 12 July 1964, its first goal was to establish networking activities to encourage interactions between European laboratories. The provision of fellowships and the election of the first members proved extremely beneficial for life scientists in Europe. A second objective was to create a central laboratory for molecular biology, a goal that was realized in 1974 with the foundation of the European Molecular Biology Laboratory.

*EMBO in perspective* includes interviews with Sydney Brenner, L. Luca Cavalli-Sforza, Georges Cohen, James Watson and the past and present directors of EMBO. Their engaging accounts provide details of some of the profound changes that have taken place in the life sciences and document the progress of EMBO over the past 50 years. The book also provides new perspectives on some of the creation myths of the organization.

## Georgina Ferry

Georgina Ferry is a science writer based in Oxford. Her work includes articles for *New Scientist, Nature* and *The Guardian*, science broadcasts for BBC Radio, and web content projects for the Wellcome Library and the Science Museum, London.

Her book *Dorothy Hodgkin: A Life* (Granta 1998) was the first biography of the Nobel Prize-winning scientist. She has published three further books, including a biography of EMBO Council's first chairman, Max Perutz. To mark the centenary of Dorothy Hodgkin's birth, she wrote and produced a one-woman play, *Hidden Glory.*

She is a Trustee of Science Oxford and sits on a number of advisory boards including the editorial board of the Biographical Memoirs of the Fellows of the Royal Society, and the British Library's Oral History of British Science project.

EMBO IN PERSPECTIVE

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Georgina Ferry



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**The author**
Georgina Ferry is a science writer and broadcaster. Her books include the acclaimed biography *Dorothy Hodgkin: A Life* (1998); *The Common Thread* (2002, with Sir John Sulston); *A Computer Called LEO* (2003); and *Max Perutz and the Secret of Life* (2007). She lives in Oxford.

# EMBO in perspective

*A half-century in the life sciences*

GEORGINA FERRY

# Contents

# Foreword

*by Paul Nurse*

The European Molecular Biology Organization or EMBO was founded 50 years ago in 1964. On the occasion of its 50th anniversary, it is fitting to look back on how EMBO came into existence, document its influence on the life science community, and also take a glimpse of the future.

The life sciences have grown immeasurably from the early pioneering days of molecular biology; EMBO too has undergone profound changes. This book looks at the transformations by bringing together personal interviews with scientists who have made contributions to the development of molecular biology, including the past and present directors of EMBO.

Georgina Ferry has written a book that takes the reader on a journey from the study of molecules and microbes in the nuclear age through to the growth and expansion of EMBO and the life sciences. The narrative includes new details on some of the early historical events that shaped EMBO. It also provides perspective on some of the creation myths that have grown up alongside the organization.

I would like to thank Sydney Brenner, L. Luca Cavalli-Sforza, Georges Cohen, and James Watson for their contributions to this project. I would also like to thank all the directors of EMBO for their sometimes frank but always engaging accounts of the growth of the organization. These interviews and historical records reflect personal views and recollections that give a real immediacy to the accounts of each individual.

Science is unpredictable but it is clear that some of the most important scientific discoveries come from basic research. With modest resources and prudence, EMBO has supported postdoctoral fellows, young investigators and more established researchers in their quest to do the best possible discovery research.

I hope that this book helps reveal to a wider audience the many achievements of EMBO and why we should do our best to support the organization in the future. I also hope you will find it an enjoyable read.

***Paul Nurse***

EMBO Secretary General

Chapter 1

# Before the beginning

*Molecules and microbes in the Nuclear Age*

## Introduction

In the years following the end of the Second World War, there was a burst of creativity in scientific research that in many ways laid the foundations for what we accept as the practice and organization of science today. War-related research programmes, including the development of radar, secret computing projects, and the extraction, testing and medical use of penicillin, had all played decisive roles in determining the outcome of the war. While in Europe at least, society endured an age of austerity that lasted until long after the end of hostilities, there was a strong sense that government support for research could also contribute to economic productivity and general well-being.

Collaboration among the allies had shown how discovery could be accelerated through international exchange. Paradoxically perhaps, the research that led to the creation of the first atomic bombs, and the realisation of their appalling human cost, not only had consequences in the post-war years for further research in nuclear physics, but directly or indirectly led to work in biology or medicine that was to be of great significance in the foundation of EMBO. Thanks to funding from mainly American philanthropic organizations, several of the top European researchers benefited from extended visits to American labs, and brought the latest ideas and techniques back with them. Other major influences included the Phage Group centred on Max Delbrück at the California Institute of Technology in Pasadena (Caltech), and its annual gatherings at the Cold Spring Harbor Laboratory on Long Island. Not only did these foster a culture of lively debate and discussion between senior and junior researchers, but they also established microbial genetics as the arena within which it would be possible to bring together genetics and biochemistry.

## 1 Early attempts at scientific exchange and the influence of the Rockefeller Foundation

There was little tradition of international scientific exchange within Europe in the first half of the 20th century: senior figures might visit each other's laboratories or attend conferences, but there was no incentive, requirement or resource for younger scientists to do so. The 'Teutonic'

model in continental European universities saw junior researchers essentially as indentured apprentices to their professors, waiting decades until they might step into their shoes. When Max Perutz left the Department of Chemistry in Vienna to study for a PhD with J.D. Bernal at the Cavendish Laboratory in Cambridge in 1936, he was considered an oddity: his funding came from his then wealthy family. Sydney Brenner joined Perutz's Unit on Molecular Structure of Biological Systems (later to become the MRC Laboratory for Molecular Biology, or LMB) in 1957. That same year, Perutz's colleague John Kendrew became the first scientist in the world to produce a low-resolution, three-dimensional structure of a protein, myoglobin, using X-ray crystallography to collect the data.

Brenner had come to Oxford from South Africa five years previously on an 1851 scholarship (for citizens of the former British colonies), and subsequently spent the summer of 1954 at Cold Spring Harbor Laboratory on a Carnegie fellowship, where he met all the pioneers of molecular biology. There was no doubt in his mind that fostering this kind of interchange was vital.

> *[In the late 1950s or early 1960s] we got £300 from the Wellcome Trust to invite people from France to a meeting… [it was] one of the very first microbial genetics meetings that we could pay for people to come. We held two such meetings… to encourage graduate students to exchange, but there was very little of this in Europe. I went to Berlin in 1959, then still divided… There were a few conferences. The Rockefeller Foundation had four conferences on the subject in the 60s.*

As Sydney Brenner remembers of his time at the Cambridge unit, there were very few initiatives before EMBO was conceived that sought to increase the level of engagement of European scientists from different disciplines with molecular explanations of biological processes. One exceptional institution was the Rockefeller Foundation. Since the 1930s, the Director of its Division of Natural Sciences, Warren Weaver, had thrown his support behind interdisciplinary studies in biology. Weaver is himself said to have coined the phrase 'molecular biology' in a memo of 1938. His officers supported a number of European scientists, notably funding the French scientists Boris Ephrussi and Jacques Monod

to come to Caltech and learn *Drosophila* genetics in the mid-1930s. In 1938, they also provided a grant to the director of the Cavendish Laboratory, Lawrence Bragg, to pay Max Perutz as his research assistant. Rockefeller's support to Perutz, which continued after Bragg left Cambridge, was instrumental in establishing the LMB. This was the group that attracted James Watson as a place to work on the structure of DNA: his encounter there with Francis Crick was critical to the elucidation of the molecule's structure, the double helix, in 1953.

Watson remembers that Rockefeller's influence extended further into Europe:

> *Later they gave money to [Mogens] Westergaard in Denmark. In my book The Double Helix I show a picture of a tiny meeting in Copenhagen at the end of March of 1951, where Niels Bohr is there… That meeting was arranged by Westergaard who had moved into the genetics of microorganisms.*

## 2 Advancing the science: the focus on microbes

It was work in the United States on microorganisms, specifically bacteria such as *Pneumococcus* and *Escherichia coli,* that had definitively shown that the genetic material was DNA. While many advances in classical genetics had been made working with the fruit fly *Drosophila melanogaster* and the laboratory mouse, microbes such as bacteria and phage (a virus that infects bacteria) seemed to offer the fastest route to understanding how mutations in the gene might exert their effects at the level of proteins, and how in turn genetic programming was controlled.

The French biochemist and founding EMBO member Georges Cohen encountered Jacques Monod during the war in occupied Paris, and was inspired to focus on these questions. He worked in the late 1940s and early 1950s on the antagonism between different amino acids in the diet of *E. coli,* his initial interest being to understand its metabolism.

> *We didn't know that what we were going to find in microbes was useful for the understanding of*

*higher organisms – that came later. [We were investigating] the general chemical reactions by which [microbes get] the energy that is necessary for life.*

Modern genetics had not taken off in Paris until the mid-1930s, when Monod, Boris Ephrussi and André Lwoff all spent time working in genetics laboratories in America. But Cohen remembers that they were frustrated by the reactionary attitudes of the University authorities in Paris.

*They didn't even believe in Mendel's laws… The genetics of Drosophila was flourishing in the States and here the Herr Professors didn't believe all that… The professor of biology at the Sorbonne said that what Monod was doing 'did not interest the Sorbonne' … So a lot of people went to the United States and established contacts, and those contacts were very useful after the war.*

Cohen joined Jacques Monod at the Institut Pasteur in 1954. Monod's main preoccupation at that time was to understand how *E. coli* produced the enzyme β-galactosidase only when it was needed to digest lactose. Working with Howard Rickenberg, Cohen discovered the parallel role of a second enzyme, β-galactoside permease, in allowing lactose into the cell. This enzyme turned out to be controlled by the same repressor-operator system as β-galactosidase.

*Which was the beginning. I'm not responsible for the operon-operator, but without my work on permeases they wouldn't have found it.*

Working with Lwoff, François Jacob, Arthur Pardee and other early EMBO members including Cohen and Élie Wollmann, Monod went on to complete his Nobel Prize-winning work on genetic control and the synthesis of viral proteins by the end of the 1950s.

## 3 Early ideas for European institutes

Monod hoped to establish an international laboratory in Paris, and indeed wrote a proposal for such a European laboratory in 1958 (reprinted in the EMBO *'Silver Book'* of 2004). Monod was in the United States at the time, where Senator Hubert Humphrey had put forward a

proposal in Congress to provide a $50 million fund to support 'an international mobilisation for a cooperative war against disease and disability.' Georges Cohen was present when Humphrey visited the Institut Pasteur to consult with them on his project.

> *He was the Vice-President of the United States, and was a candidate to become President, and he was a pharmacist. He was very much interested in science, and we were trying to get money. We met in the library here and we explained to him what we were doing, and he was quite interested. Unfortunately he did not become president of the United States.*

The following year President Charles de Gaulle convened a meeting of the '*12 wise men*' – his Consultative Council on Scientific and Technological Research – and asked each of them, in five minutes, to make a proposal for a priority area in French research. Raymond Latarjet, founding Director of the National Institute of Nuclear Science and Technology established under the auspices of the French atomic energy commission in 1956 (and an early EMBO member) made his pitch for molecular

A meeting held at the Institut Pasteur, Paris, on 19 November 1958 between French scientists and Senator Hubert Humphrey from the United States. From left to right: François Jacob, Georges Cohen, François Gros, André Lwoff, Senator Hubert Humphrey. Photograph courtesy of Institut Pasteur/Fonds d'Archives Madeleine Brunerie.

biology, heavily influenced by a report recently written by André Lwoff on the exciting results emanating from the Pasteur. At the end of the hour, de Gaulle remarked that as a General he might be expected to favour grand projects such as the conquest of space or exploration of the oceans. But, he went on, *'au fond de moi-même, je me demande si cette mystérieuse biologie moléculaire à laquelle d'ailleurs je ne comprends rien, n'est pas plus riche de développements futurs.'* [In my heart of hearts, I wonder if this mysterious molecular biology, of which I previously understood nothing, is not richer in future developments.[1]]

In consequence, funding for molecular biology increased within France, particularly in support of the Strasbourg laboratory of Charles Sadron and the Institut Pasteur, and the necessity to obtain international funds receded.

Meanwhile in Italy another European who benefited from contact with American research was Adriano Buzzati-Traverso from the University of Pavia, who would later be one of the most active members of EMBO's first council. The historian Mauro Capocci describes him as exceptional in the Italian context: *'[H]e demonstrated a unique synthesis of scientific creativity, managerial attitudes, political independence, strong morality, broad cultural views of scientific knowledge and a competent and genuine interest in improving the educational and scientific standards of the Italian academic system.'*[2] He had spent a year as an undergraduate at the University of Iowa in the 1930s, and in the early 1950s headed the Division of Marine Genetics at the Scripps Institute of Oceanography in La Jolla, California. On returning to Italy he devoted his efforts to establishing experimental genetics in Italy, ably supported by his former student, L. Luca Cavalli-Sforza. Cavalli-Sforza had started experimenting with bacteria as an undergraduate in Pavia, and in the late 1940s worked in Cambridge with the statistician and geneticist R.A. Fisher:

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1 Frank Gannon, personal communication, recalling a letter sent by Raymond Latarjet in response to a request for memories for the 40th anniversary of EMBO. The story is also related by François Jacob in his book *La Souris, la Mouche et l'Homme* (Editions Odile Jacob 1997), p. 29.

2 Capocci M., Corbellini G. (2002) Adriano Buzzati-Traverso and the foundation of the International Laboratory of Genetics and Biophysics in Naples (1962–1969), *Stud. Hist. Phil. Biol. & Biomed. Sci.* 33, 489–513.

> *I was one of the first bacterial geneticists, and I developed it independently before going to England. The selection of resistance to drugs was one of the ideas I was working with… The real beginning of genetics in Italy was in Pavia. Adriano Buzzati-Traverso started the genetics institute there.*

Cavalli-Sforza retained a lifelong loyalty to Buzzati-Traverso, who had fostered his earliest researches in genetics during the war years – and who introduced him to his niece, whom Cavalli-Sforza married in 1946. Buzzati-Traverso dreamed of founding a research laboratory in Italy of international standing, and in 1962 succeeded in launching the International Laboratory of Genetics and Biophysics (ILGB), on the seashore near Naples. Rockefeller funding had been once again available when in the late 1950s he had launched first a series of intensive courses on the biological action of radiation, and subsequently a research program on mutation rates headed by Cavalli-Sforza. But the main supporter of these initiatives was Italy's National Council for Nuclear Research (CNRN). It was the CNRN (later renamed the CNEN), then led by the engineer Felice Ippolito, that backed Buzzati-Traverso's laboratory plan: since 1957 Buzzati-Traverso had directed the CNRN's biological division. Critical to the success of the project was the ability to pay internationally competitive salaries as Cavalli-Sforza remembers:

> *It was possible to hire people from overseas and to organise workshops to teach students to use the latest instrumentation and to reproduce the principal experiments that were in the process of giving birth to molecular biology. That type of course was born a few years before in the famous laboratory of Cold Spring Harbor on Long Island.*

Senior researchers in Belgium, including the nucleic acid biochemist Jean Brachet and the cytologist Christian de Duve (who later won a Nobel Prize for his work on the structural and functional organization of the cell, including organelles such as lysosomes) were also hoping to obtain funds to found an international laboratory for the life sciences in Brussels. However, the project did not materialise and by 1964 Brachet was running a group at Buzzati-Traverso's ILGB on molecular embryology.

## 4 Biology and the bomb

During the 1950s all the countries that had developed nuclear weapons capability also launched research programmes into the peaceful uses of nuclear technology, such as nuclear energy. On the biological side, one aim was to elucidate the impact of nuclear fallout on human health; however, there were also advances in the use of radiation and radionuclides as tools to study biological processes. As mentioned earlier, influential figures in France (Latarjet) and Italy (Buzzati-Traverso) obtained substantial support for molecular biology from funds set aside for this purpose. Sydney Brenner acknowledges that a good proportion of the generous funding afforded to national nuclear research agencies made its way into biology.

> *I think there was this whole thing on atomic energy and atomic physics… there was also a lot of use of isotopes in biology, that had become important. I think the atomic energy had a lot of money… And a lot of this new science got supported through this interest in atomic energy, so there's no doubt that that was important.*

Perhaps the major influence of the Nuclear Age on molecular biology was in the number of physicists who decided to turn their attention to biological problems. The best known are Francis Crick and Maurice Wilkins, who shared the Nobel Prize with Watson for the elucidation of the structure of DNA. But for EMBO's story two other names are just as significant: Leo Szilard, the co-discoverer (with Enrico Fermi) of the chain reaction, and Raymond Appleyard, who was to become EMBO's first Executive Secretary.

James Watson first met Szilard in 1948, at a summer meeting at Cold Spring Harbor.

> *I liked Szilard because… he could get very interested or worried about something which was not likely to happen, but if it happened would have devastating consequences. If you look at famous pairs in science, probably Szilard and Fermi almost rank with Watson and Crick. Because they brought in the nuclear age. I'd say Szilard was*

*the driving force. Fermi was one step at a time… but Szilard was always jumping two or three steps ahead.*

By the late 1940s, Szilard had jumped into the question of the physical nature of life, and was holding regular meetings on phage genetics in Chicago (funded, inevitably, by Rockefeller). A theoretician rather than a practical bench scientist, his role was to challenge the ideas of others, to stimulate and provoke. Victor Weisskopf, director of CERN, called him 'an intellectual bumblebee'. And it was he, fleeing to Geneva during the Cuban Missile Crisis of October 1962, who first planted the idea that a European centre for molecular biology ought to be created next to CERN.

Appleyard, meanwhile, had studied physics at Cambridge before going to Yale for two years as a biophysicist and then to Caltech to work on phage under Max Delbrück. His next move was to the Chalk River Nuclear Research Laboratories in Canada.

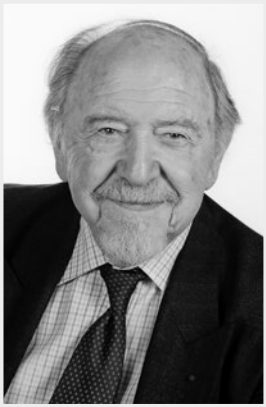
*I worked away on lambda phage. It seemed obvious that lambda being a temperate phage when it entered into the bacterium became part of the bacterial chromosome. It seemed obvious, but it wasn't. There were half a dozen other things it might have been. It needed demonstrating, and I demonstrated it – three months after Watson and Crick published the double helix.*

Appleyard left Chalk River in 1956 and worked in New York for the next four years as secretary of the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). In 1961, this led back to Europe, and to the post of Director of the Biology Division of the directorate general for research and training of Euratom, the body set up by the six signatories of the Treaty of Rome to promote the peaceful uses of nuclear energy. Appleyard used his networking skills to encourage the sharing of expertise across the member states. As he wrote in his first five-year report, published in 1964:

*Real coherence needs to start from the roots. In a Europe in which, because of linguistic, national, institutional or other boundaries far too few people talk to each other, this means a continuous series of discussions, at the level of the*

*individual research worker, between those who, whatever their affiliations, face the same technical problems.*

When the newly formed EMBO Council was seeking to appoint an Executive Secretary, Appleyard could not be better qualified for the role.



# Georges Cohen

*Pioneer of microbiology in France*

At the age of 93, Georges Cohen still comes into his office at the Institut Pasteur every day to annotate bacterial genomes. *'I'm afraid I'll be bored if I stay home,'* he says.

Cohen was one of a group of outstanding geneticists and biochemists working in Paris during the late 1950s and early 1960s, when scientists began to understand how gene expression was controlled. His colleagues included François Jacob, Jacques Monod and André Lwoff, who shared the Nobel Prize in 1965 for discoveries including the lac operon, a cluster of bacterial genes controlled by levels of lactose in the environment.

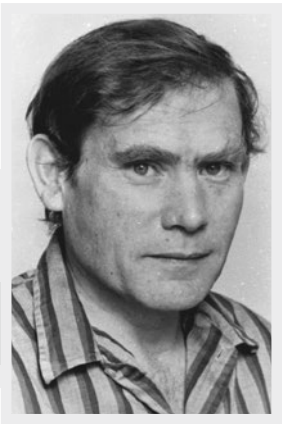
Remarkably Cohen, who was born to Jewish Greek parents in Constantinople before his family moved to Paris, began his research career under the noses of the Nazis in the occupied city. He spent the first years of the war in the unoccupied south of France, where he met and married his wife. When German forces occupied the whole of France he returned to Paris: *'it was less dangerous to hide in a big city than in a small place in the country.'* There he worked under Professor Michel Macheboeuf, who ran the biological chemistry service at the Pasteur. *'He took me in his lab and he said 'If the Germans come in, you have to say that you're the plumber,''* recalls Cohen. Under an assumed name, he went undetected by the Gestapo until Paris was liberated.

Cohen met Jacques Monod for the first time at a Communist Party meeting in 1944, and was immediately struck by his personality and intelligence. *'This encounter was for me the beginning of a great*

*intellectual adventure,'* he says.[3] Cohen began working on microbes at a laboratory in Garches, near Paris, and also spent time in Oxford learning from the taciturn microbiologist Donald Woods. In 1954, Monod finally found room for Cohen in his lab at the Pasteur. *'I had wanted to join his lab for years,'* he says, *'because I was exiled in Garches. We had meetings every month – I never stopped having discussions with him.'*

At the time of EMBO's foundation, Cohen had recently become director of a new CNRS enzymology laboratory at Gif-sur-Yvette, near Paris. In the early 1970s, he returned to the Institut Pasteur, succeeding first André Lwoff as head of department, and subsequently Monod himself as director of the cellular biochemistry service. Elected a founding member of EMBO, he personally took no part in its administration. *'At that time we did not think that things would develop as they did,'* he says. '*Now EMBO is a real institution.*' But later, as Executive Secretary of the International Cell Research Organisation from 1989, he came to adopt many aspects of its mission to foster training and international collaboration. *'I visited all over the world. I enjoy it,'* he says.

3 Cohen GN (2005) Looking Back *Annu. Rev. Microbiol.* 59, 1–17.



# Sydney Brenner

*Restless innovator and éminence grise*

Sydney Brenner has spent his career starting new things. It is not surprising that he should have been a founder member of EMBO, and one who, without ever taking a seat on EMBO Council, played a key role from the start. *'Of course in the early days we knew everybody already,'* he says. *'Because the whole of molecular biology began as a very tiny, worldwide group.'*

Brenner was born in 1927 of illiterate immigrant parents in South Africa, but he showed such exceptional intellectual gifts that he was admitted to the University of Witwatersrand in Johannesburg aged only 15. Within a year of his arrival in the United Kingdom in 1952 to begin a research career, he was one of the first to see James Watson and Francis Crick's model of the double helix.

From 1956 he joined the team that grew into the MRC Laboratory of Molecular Biology in Cambridge, working with Crick to unravel the genetic code and mechanisms of gene expression. Another colleague was John Kendrew, EMBO and EMBL's principal founder, who shared his mission to deploy the advanced tools that were emerging from the physical sciences, such as high-speed computing, to decipher the molecular basis of life.

*'In the early 1960s there were very few places which had the strange people doing genetics and X-ray crystallography,'* he says. *'And what we had learned from LMB was that the development of new instruments was damn important and you should not wait around for them to be developed… The perception that the computer would be the real workhorse for biology took quite a long time to sink in. Most experimental biologists*

*thought that 'people who have failed at everything else play around with computing.''*

Needing a simpler model to explore the function of a whole organism in his lab at LMB, Brenner chose the tiny roundworm *Caenorhabditis elegans*. A global community of scholars now studies *'the worm,'* and the wealth of new knowledge it has produced earned him a Nobel Prize in 2002.

In recent years, Brenner has shuttled between the Salk Institute for Biological Studies and the Molecular Sciences Institute in California as well as the Singapore Institute of Molecular and Cellular Biology, constantly provoking his young colleagues to try new things. *'Most of what I say is rubbish, but amidst the kind of stream of unconsciousness, if I can coin a phrase, there is the odd idea that can be developed into something,'* he wrote in his autobiography.

He derides many graduate schools as *'a kind of slavery,'* and sees keeping research labs bubbling with new ideas as critical to maintaining the health of the discipline. *'Young people go where there's a challenge,'* he says. *'And they're the ones you really want to have, the ones that go where you can do something new and get excited.'*

# L. Luca Cavalli-Sforza

*Geographer of human genetics*

Luca Cavalli-Sforza is one of only three surviving participants in the Ravello meeting of September 1963. An internationally respected geneticist from Pavia, who had worked in Berlin and Cambridge and attended meetings at Cold Spring Harbor, he was an obvious choice to help his professor and uncle-in-law, Adriano Buzzati-Traverso, represent the interests of Italian molecular biology.

Cavalli-Sforza himself, however, insists that he always made it his priority to manage his own research. At Ravello, he was appointed a founder member of the Laboratory Sub-Committee, but he was not an active participant. From 1969, frustrated with the amount of administration he had to do in Italy, he spent the rest of his research career at the University of Stanford in California.

Although he will be remembered for his work in human genetics, Cavalli-Sforza began as one of the first bacterial geneticists. In 1948, he was hired by Ronald Fisher, one of the fathers of statistical genetics, to work on bacterial colonies in Cambridge. *'Mouse genetics required big [infrastructure], but with bacteria I could just do it in a room,'* he says. *'But you have to develop special tricks in order to do the kind of genetics in bacteria that you can do in higher organisms.'*

On his return to Italy, he taught statistics and genetics at the University of Parma, where he began his first study on human genetics. *'Being in Parma I could work on the Apennines, and I started to make a thorough study of genetic markers,'* he says. To do this work he enlisted the help of a priest and former student of his, Alberto Moroni. Moroni persuaded local priests to recruit study participants from their villages.

He also obtained access to birth and marriage records going back generations. With Anthony Edwards, who came from Cambridge to write the first computer programs to analyse the genetic data, Cavalli-Sforza was able to model patterns of inheritance, including genetic drift, that closely matched the church records.

Moving back to the University of Pavia, and subsequently to Stanford, he extended this research worldwide. Recognising that existing work on human migration drew on archaeological, linguistic and anthropological approaches, he incorporated findings from these areas into his genetic studies, creating a field that he called *'genetic geography'.* He was instrumental in setting up the Human Genome Diversity Project, a collection of over 1000 cell lines from 52 populations across the world, that many others have used to ask questions about human history.

His studies led him to the conclusion that apparently diverse human populations have much greater similarities than differences, and that, scientifically speaking, the concept of *'race'* is without meaning. Despite the controversy that this view has attracted over the years, he is optimistic about the impact his findings will have on world development. *'People are willing to realise that there is a lot of history that is the real determinant of where you are, whether you are rich or poor,'* he says. *'I think education is the only route to progress.'*

# 2

Chapter 2

# The birth of EMBO

*Some creation myths and the growth of an organization*

## Introduction

The story of the origins of EMBO has been told many times. However, none of those who have previously tackled the subject have both made use of all the archival documents, and sought to track down those involved to give their own recollections. While some key figures, such as John Kendrew and Adriano Buzzati-Traverso, can no longer be heard, it has been possible to collect perspectives from others who lived through this significant episode in the history of molecular biology. Augmented by reference to the meticulous archive kept by John Kendrew, now part of Special Collections and Western Manuscripts at the Bodleian Library in Oxford, these can begin to add intriguing details to the previous accounts.

## 1 The meeting at CERN

The founding myth of EMBO, set out in John Tooze's 1981 history of the organization for the launch issue of *The EMBO Journal*,[4] is that:

> *In December 1962, immediately following the Nobel Prize investiture ceremony, John C. Kendrew together with James D. Watson visited [CERN] in Geneva. Leo Szilard… was also in Geneva at the time… During the course of a conversation the three visitors had with Victor Weisskopf… Leo Szilard proposed that Europe's molecular biologists should… 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.*

4 Tooze, J. (1981) A brief history of the European Molecular Biology Organization. *EMBO J.* sample copy, 1–6.

Szilard, famously, had arrived in Geneva during the Cuban Missile Crisis of October 1962, bearing 15 suitcases and announcing himself to the CERN director Victor Weisskopf as *'the first refugee from the Third World War.'* But other aspects of this myth require clarification. James Watson is the only participant in the meeting still alive, and he reveals that the motives of the three visitors were very different. Furthermore, as is clearly documented elsewhere,[5] Szilard had returned to Washington DC by the time Watson and Kendrew arrived in Geneva.

> *After the Nobel Prize I went first to Berlin and then Cologne and then I went to Geneva… I was going to spend part of the Christmas holidays with Alfred Tissières [skiing] at Verbier… The driving force for the meeting [with Weisskopf] was John Kendrew… [he and I] met in Geneva. I am sure [his motive] must have been that EMBO, or EMBL, would possibly provide a position for him so he could not be condemned to live solely in Cambridge. Because John had a very mixed feeling about the life of the Cambridge don. I was disappointed that Szilard was no longer there… I can imagine what we would have said, which was that molecular biology in Europe lacked a Cold Spring Harbor, which was a site where they could get together to talk.*

Although not present at the meeting, Sydney Brenner offers an interesting sidelight on what had happened previously.

> *Szilard and Weisskopf wanted to found CERB, Centre Européenne de Recherche Biologique. The idea was that nuclear physics and molecular biology would go together. So the job was offered to Francis Crick, because Francis received a telegram from Szilard… and he showed it to me… and he showed me his answer, and his answer was typical Francis. He said 'Not my glass of champagne.' Then Leo Szilard telephoned me here in Cambridge and told me that… Francis Crick had turned him down, and could*

5 Lanouette, W. (1992) *Genius in the shadows: A biography of Leo Szilard,* Macmillan, chapter 25.

*I persuade him… And so I then told him that Francis wasn't the person, and he should talk to John Kendrew. And he said who is John Kendrew? And of course they quickly found out who John Kendrew was. John was very interested... I think he saw himself as someone who could really do this. I think he was frustrated in Cambridge.*

Other evidence (see Buzzati-Traverso's letter of 13 December 1962 to Victor Weisskopf, reproduced in the EMBO *'Silver Book'* of 2004) suggests that Weisskopf had been thinking about a biology laboratory next to CERN before Szilard even arrived. But from this point on, it was John Kendrew who took the initiative in driving forward the proposal. At this stage, he clearly envisaged a European laboratory, with a working title of CERB, based in Geneva and working very closely with CERN. By the time of the Ravello meeting, less than a year later, the proposal had developed into something more complex.

## 2 The Ravello meeting

The Ravello meeting took place in September 1963. The intervening year was critical in the development of what was to become EMBO. Meetings had taken place on 28 March and 28 June in Geneva, hosted by Weisskopf who invited the great and the good from several European countries, working from a list drawn up by Kendrew. By the time of the March meeting Kendrew, advised by Szilard that it would be *'very awkward… to be a frank candidate for the directorship and to be also the prime mover in England,'* [6] had recruited the respected Edinburgh geneticist C.H. Waddington as a British advocate for the cause. Waddington, however, quickly came to believe that if the task was to promote European molecular biology then a lab was unnecessary, and that a federation of European institutes (initially called EBO or EFBO, the European Fundamental Biology Organisation) would be much more useful. His paper on EBO was presented for discussion at the June meeting, along with Kendrew's on CERB. In a letter to Arne Engström of the Karolinska Institute in Sweden, Kendrew confided that he was not very enthusiastic about Waddington's proposal, but that Waddington, the Swiss electron

6 Szilard, L. to Weisskopf, V., 21 January 1963, copy in Kendrew papers, Bodleian Library MS. Eng. c. 2418, NCUACS F.1.

microscopist Eduard Kellenberger and Buzzati-Traverso preferred it to CERB, which they would *'not be sorry to see… dropped altogether.'*[7]

All participants agreed on the problems that were inhibiting the development of molecular biology in Europe: that young, ambitious scientists left for the United States to further their careers; that disciplines such as zoology and botany were rigidly separated in University departments; that there was no European integration of research; and that it was harder, for entirely bureaucratic reasons, for a European biologist to make a career move from one European country to another than for the same person to go to the United States. Waddington suggested that the purpose of EBO, which could be an adjunct rather than an alternative to CERB, would be *'to build up the resources (equipment, jobs) of a number of selected labs in the various nations of Europe, and to make communication between them really easy.'*[8] In the same paper, he proposed the election of 100–150 Fellows, who would be funded to make short visits to one another, as well as postdoctoral posts and courses.

Szilard also made an appearance at the July meeting. He argued that the new European organization should be jointly funded by the United States and Soviet Academies of Science. Szilard's biographer described this proposal as *'a typically freewheeling idea that was perfectly logical but politically zany.'*

Few personal recollections are still available of the Ravello meeting itself. Held on 16 and 17 September, it was tacked on to the end of a ten-day international summer school on molecular biology on which James Watson was a member of the faculty. The official aim of the meeting was to discuss the content of another summer school at Varenna to be held the following year. Watson remembers teaching at the summer school, but has no recollection of the sessions billed as *'Informal discussions concerning the present status and future developments of molecular biology in Europe… under auspices of the Italian Physical Society.'*

7 Kendrew, J.C. to Engström, A., 30 August 1963, Bodleian Library MS. Eng. c. 2418, NCUACS F.4.

8 Waddington C.R., unpublished paper, Bodleian Library MS. Eng. c. 2418, NCUACS F.3.

Luca Cavalli-Sforza is listed as having attended the Ravello discussions, but like Watson he does not recall them today. At the time, he was head of the Institute of Genetics at the University of Pavia and in the process of setting up a second lab there for the National Research Council, and he was reluctant to get involved in any more politics or administration.

> *I was interested in doing research. I tried not to be too much distracted. I was doing some teaching, but I tried to use most of my time for research. I did develop a lab in Pavia, and that was supported by a number of friends.*

He had no taste for the endless funding negotiations that went into research administration in Italy, and by the end of the 1960s would leave permanently to work in the United States. In the year immediately following the Ravello meeting, a political crisis in Italian academe led to the imprisonment of Felice Ippolito for supposed embezzlement. It also triggered a cut in ILGB salaries, and Buzzati-Traverso resigned in protest. Although by then he was running two genetics institutes at the University of Pavia, Cavalli-Sforza agreed to step in as Director in Naples until Buzzati-Traverso felt able to return to his post later that year. With all this to occupy him, it is not surprising that the embryonic EMBO failed to register with Cavalli-Sforza as a priority.

The only remaining delegate who played an active role in the Ravello meeting is Sydney Brenner. By the time Kendrew and Waddington presented revised versions of their proposals, the participants had divided into two camps: those who favoured a European laboratory and those who preferred Waddington's model of fellowships, courses and workshops. Brenner was from the first an ally of Kendrew in his plans for the laboratory.

> *There were a lot of us who thought the lab was more important. I was definitely in the lab camp, and worked for it very hard until the end. There was this group in which Waddington was very important… they wanted to have fellowships, meetings, the whole thing. We agreed to all of that, but still a group of us went on and thought… we would grow the lab. But*

*what was interesting was that it was decided that it would be like an academy – you had to be elected.*

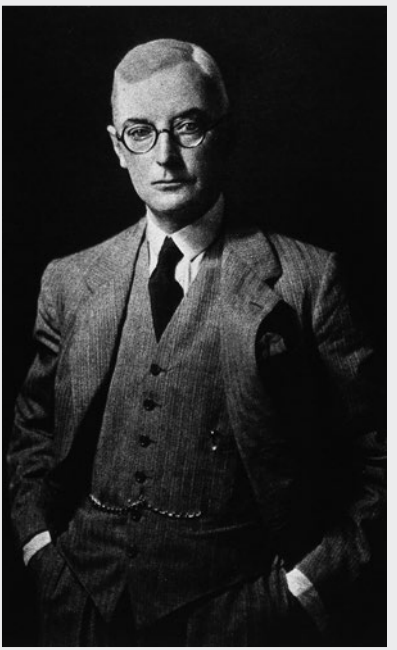
While Kendrew managed to secure majority votes in favour of both proposals, some of those who met at Ravello were actively opposed to the idea of a laboratory in Geneva. Chief among these was Adriano Buzzati-Traverso, and he had good reason. He was one of the earliest to get wind of the plans. As mentioned earlier, Weisskopf had written to him in September 1962, before Szilard, Kendrew or Watson had visited, to say he was *'dreaming'* of a biology lab at CERN. Buzzati-Traverso's reply (reproduced in full in the EMBO *'Silver Book'*[9]) set out in detail how he had managed to establish the ILGB at Naples with international support (though mostly national funding), and arguing that it would not be in either's interest to develop a second international laboratory elsewhere. Instead, he welcomed CERN scientists to pursue their biological interests in Naples.

The Ravello meeting convened an executive committee (later called the Council). Max Perutz, who had until the Ravello meeting taken very little interest in EMBO's development, found himself (probably to his own surprise) shouldering a major administrative load when he accepted the position of its chairman. *'He was a bit cornered,'* says Brenner, *'but he accepted with good grace.'* Jeffries Wyman, an American scientist, formerly at Harvard, who worked on haemoglobin in Rome, was appointed Secretary General. He was one of the five-strong contingent from Italy on the Executive Committee. This Committee's task was to invite 100–200 leading biologists to become members, and to draw up a Constitution for the new organization. It also set up two subcommittees: a Federal Organization subcommittee chaired by Buzzati-Traverso, and a Laboratory subcommittee chaired by John Kendrew.

Buzzati-Traverso had involved Euratom in his plans for the ILGB, and so was well acquainted with the director of its biology programme, Raymond Appleyard. It is not clear exactly when Appleyard first heard about the plans for EMBO, but his involvement certainly predated the Ravello meeting: he received a copy of Kendrew and Waddington's

9 Buzzati-Traverso, A. to Weisskopf, V. and Bernardini, G., 13 December 1962, reproduced in *EMBO: 40 years of success*, 2004, pp. 52–56.

position paper and was invited to attend the meeting. He had begun his own efforts to integrate leading radiobiology research labs across the six Euratom countries, and to introduce training programmes, a plan that clearly chimed with Waddington's vision.



Jeffries Wyman (1901–1995), one of the founder members of EMBO, played an influential role in the early days of the organization. He served as Secretary General from 1963–1969. Photograph courtesy of Wellcome Library, London.

To his regret, Appleyard was unable to go to Ravello. His response to the proposals, a confidential memorandum written in the summer of 1963 and preserved among John Kendrew's papers, was fairly negative about the laboratory, but enthusiastic about the federal and training initiative *('Waddington's EBO is much more practical')*. He indicated that he was open to closer cooperation between the two organizations. After EMBO was officially created at Ravello, the first meeting of Buzzati-Traverso's Federal Organisation Subcommittee took place in December 1963 at Euratom's offices in Brussels, at Appleyard's invitation and at no cost to EMBO (which at the time had no funds of its own). Jeffries Wyman reported to Perutz that despite what he called Appleyard's *'rather acid'* memo at the time of the Ravello meeting, he was *'an extremely nice person whom I believe we can count on to help us in any way he can through Euratom.'*[10]

10 Wyman, J. to Perutz, M., 18 December 1963, Bodleian Library MS. Eng. c. 2418, NCUACS F.9.

## 3 Support and a secretariat

EMBO acquired legal status as a non-profit organization registered in Switzerland in 1964, and it is this official start date that is commemorated in 2014. Apart from the constitution and the election of members, the most urgent problem then facing the EMBO Council was raising funds to support a secretariat and a programme of fellowships. Early attempts to raise money from governments were largely unsuccessful, particularly if the building of an international laboratory was to be part of the deal. The only positive response came from Israel. Ephraim Katchalski from the Weizmann Institute, who was a good friend of John Kendrew, had attended the Ravello meeting in 1963: both were keen to see Israel included in the EMBO family. As tension mounted between Israel and its neighbours, Katchalski approached the Foreign Minister, Golda Meir, to ask for support. She gave him little reason to hope. But a short time afterwards he learned to his surprise that Israel would make a grant sufficient to cover the expenses of the EMBO Council, though not to fund its programmes. Another small grant came from the Swiss pharmaceutical company Interpharma. To launch its programme of activities, EMBO would need something much more substantial.

In his capacity as Chairman, Perutz set about pursuing a link with the Volkswagen Foundation that had initially been forged by a phone call from Leo Szilard to Rudolf Kerscher (head of the grants department) immediately after the Ravello meeting. The Foundation was only recently established, set up with funds raised by the German government from the sale of shares in the Volkswagen company during the 1950s. It immediately became one of the most influential sources of science funding in Europe. Important intermediaries who made initial approaches to the Foundation included Executive Committee member Hans Friedrich-Freksa, and the scientific attaché at the British Embassy in Bonn, Ronald Ashton. Friedrich-Freksa had established by the end of February 1964 that the Foundation might provide start-up funds, but would not commit itself to fund EMBO in perpetuity. Perutz and Szilard both visited the Foundation's officers in the spring of 1964, only weeks before Szilard died. They came away with an invitation to apply for a three-year grant. The deal was finally clinched, after many rounds of negotiation, in December 1965, with almost 2,748,000 Deutschmarks provided to cover the first three years of EMBO's operation.

Once the money was certain, they could appoint an Executive Secretary, and they approached the obvious person: Raymond Appleyard.

> *Somebody told me that the Council of EMBO was looking for an executive secretary to run it, and had decided that they would ask me before they advertised. Which was a complete embarrassment… What do you do? The top brass in your field, a council with four to six Nobel Prize winners, asks you. You cannot say no. But you can't leave the kind of job I had, with reasonably good responsibilities, an extremely good salary and pension, and a permanent high level job that was going to get higher.*

While he thought about what to do, Appleyard was summoned to Cambridge for his first meeting with Max Perutz, the Chairman of EMBO's Council.

> *All I could say was 'I have read your haemoglobin papers, I've listened to your lectures, and I've been going around with girlfriends who have been reading your haemoglobin spots. There's nothing more I can say.' To which I got quite a nice grin from Max.*

Eventually Appleyard himself came up with a solution to his predicament.

> *I thought for a long time and decided that the only way to do it was as a spare time job. I got the Commission's permission and told Max that I would do it for a while as a spare time job until they got settled… I called my key staff together and said 'This is coming, I would like to take it, but it means you all doing a bit more work, are you willing?' And they all said yes. It fitted very well. The difficulty with Euratom was that for top scientists, particularly pure scientists, it was totally disreputable. But EMBO was totally reputable. If I couldn't talk to them as Euratom I could talk to them as EMBO. I had a background in the area – it fitted beautifully.*

In 1965, Appleyard was formally appointed part-time Executive Secretary of EMBO, while still retaining his Euratom post. He immediately found that EMBO was to be administered according to a philosophy unlike

anything he had experienced in his career to that point. This philosophy was set out in the founding document that had been developed from Kendrew and Waddington's original proposals, and finally given an extensive revision by Jeffries Wyman in 1965. It was published as a small grey booklet the following year.[11]

> *The key to running EMBO was in the remarkable constitutive document… I think you will find in it somewhere a sentence that says the Executive Secretary has authority to do anything up to a level of £100,000, and then he needs one member of council to agree [SF 300,000 with the approval of one member of the Fund Committee; larger amounts need the Chairman's approval]. I had absolutely a free hand. It was totally unbureaucratic, but as I discovered to my horror, totally responsible. I'd never been responsible for anything. There's always been a finance director or something like that… The actual amount of work to do was quite small… I had a first class secretariat to which we added one more member. There were resources there that you wouldn't get normally, just lying around. The Commission let me have extra offices and furniture without a word being spoken. My administrator was a first class Frenchman, Marc Delauche, the senior secretary was Fräulein H. Schwappach, they all shared the work… It was pure administration, to be done by other people with an eye kept on it, with another eye kept on the EMBO Council.*

Appleyard reported only to Council, under its Chairman Perutz and its Secretary General Jeffries Wyman. Appleyard remembers Wyman as a *'tower of strength'* who *'could keep Max on the road when Max would otherwise have drifted off.'* Despite his Nobel Prize and role as Chairman of the LMB at Cambridge, Perutz was a hands-on bench scientist still immersed in solving the finer points of the structure of haemoglobin. He did not wish to be troubled by administrative matters, though to this day his rare interventions are burned into Appleyard's memory.

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11 *The European Molecular Biology Organization EMBO.* Booklet published in 1966; introduction, taken from the final 1965 draft, reproduced in *EMBO: 40 Years of Success*, pp. 61–64.

*The only time I bothered him, I discovered how waspish he could be. He said 'Ray, I've been getting complaints from Germany that letters are not being answered for 3 weeks. A letter gets an answer in 3 days even if it's only to acknowledge receipt.'… I tried to put up a proposal once in Council and I got snapped at. I didn't try again – it was quite frightening, as other people had found. But if you did your job he was fine and supportive… He was also very clear-thinking in what we were doing and where we should go.*

Appleyard's own experience in America meant that he immediately understood what the founder members of EMBO were trying to achieve in improving opportunities for young European scientists to interact.

*I was sure it was important for Europe. Max Delbrück… had started the whole business with the Phage Group, and he kept hold of it right to the end because anything new he heard about he immediately invited the person to Caltech to give a talk. This was how it worked, by inter-laboratory visits.*

EMBO did not have its own offices at that stage: Appleyard worked from his Euratom office in Brussels with his own secretarial and administrative staff. But he was reluctant to put the Euratom address in Avenue de la Jouissance on the EMBO letterhead, believing that it did not have sufficient kudos with the research community.

*I had long contacts with [Jean] Brachet's lab at the ULB [Université Libre de Bruxelles] … I said 'Could I use it as a postal address?' So the postal address was always the ULB laboratory… I used to go and collect the mail… So yes, the location is the laboratory to avoid using Euratom, although the work was actually done in the Euratom offices that they put at our disposal.*

Appleyard successfully ran EMBO for eight years while retaining his post at Euratom, and played a formative role in its development.

## 4 Membership, fellowships and workshops

From the first, EMBO was conceived as a dispersed academy, representing all that was best in European molecular biology. Following the Ravello meeting, the newly elected Council members each drew up a list of those they would like to propose for membership, and an initial cohort of around 150 members was established. Since then, members have been invited to nominate candidates each year, and the membership votes on their election.

Based on his own experience of winning a Rockefeller grant during his early days in America, Appleyard designed the very simple application procedure for short-term fellowships.

> *[I thought] these young people, they're only going to get small sums, little travel grants: they can't fill in forms asking the colour of their mothers' eyes… I spent the whole of a very hot summer's day in my attic, getting the application form for the short-term fellowship down to one side of paper, and did it… Of course it looks very easy to defraud. But when you come down to it, it isn't. It needed the permission of the director to go, it needed the permission of the director to receive, it needed a report to go to both directors. You could fake some of that, but not all of it. And of course if it became known, the fellow would be a dead duck who never gets another job. It worked. As far as I know nobody ever defrauded us... We funded them so that they could travel any way they liked. They could walk if they wanted, or they could take father's private plane, I didn't care, we paid them the train fare and that's it… And I owe a debt, and so do the EMBO, to the Rockefeller Foundation for demonstrating to one junior fellow how a foundation should work.*

Applications for the short-term fellowships, which were really innovative and not available from any other source, had a high probability of being funded, and Appleyard himself made the selection.

> *If it's a yeast lab you'd go to one of the top people and find out about the lab, and if possible about the chap.*

*I did a lot of telephoning – that's the bit I could do as I knew the people. The short-term fellowships were a week to ten days. You went to do a job on a piece of equipment, or with a chap… If I had any doubt I asked questions, but if they came from a reputable lab, the problem was a sensible one, and they were going to the right place it was straightforward – and that applied to 95 per cent of cases… We did long term fellowships as well, one year at a time, usually reviewed for a second year.*

EMBO's long-term fellowships funded postdoctoral researchers to spend one or two years in another laboratory. These were more competitive, and the merit of the applications was assessed by a Fellowship Committee of EMBO members. And there were other ways, says Appleyard, in which EMBO increased the opportunities for European scientists to interact.

*We had also what I now have to call discussion groups [workshops], not only courses, but various meetings, because this also was the way the Americans circulated information. The Cold Spring Harbor Laboratory meetings were a model, although they were much bigger. We'd have six or a dozen people who would sit down for a couple of days and thrash things out. And the courses were a very big part.*

Sydney Brenner never held a committee position within EMBO – from choice – but he was elected a founder member and was actively engaged as a close associate and confidant of John Kendrew. Much of his effort went into advocating the creation of CERB/EMBL, but he was also an enthusiastic organiser of workshops and supporter of the fellowship programme.

*I organised two [workshops] in Cambridge, I did them with the Royal Society. And the workshops were quite interesting because we had to break the business in Europe that only the professor went to meetings. We had to extract the younger people… I think in the early days [EMBO] was very important for getting its workshops going and ensuring that the active, the young people were there, and I think that… opened up continental Europe, to*

*real scientific exchange, not just between the professors. I think the Fellowship scheme and the short term scheme were really important for moving technology ideas around.*

As long as the organization remained small, says Raymond Appleyard, it functioned very much on a person-to-person basis, relying on existing networks of friendship and collaboration in order to build up a more extensive community.

*I was invited to Hungary by a youngish chap who'd been at the Pasteur. The Russians were still in charge. I was very dubious about this as a Euratom official. I rang up François Jacob who said 'Yes, he's OK, you can trust him with anything including your life, don't worry. Just go.' I had a lovely time.*

## 5 The creation of the EMBC

While the funding from the Volkswagen Foundation and other initial funders enabled EMBO to recruit a secretariat, elect members, provide the first fellowships and run courses and workshops, it would ultimately need a more permanent funding source. That meant obtaining support from national governments, on the model that funded CERN and other international laboratories. EMBO Council members and others went to work on their national ministries. Possibly due to EMBO's historic associations with CERN, and the shared desire of Victor Weisskopf and John Kendrew to see a European molecular biology laboratory established in Geneva, the Swiss government was the first to respond favourably. Its diplomatic initiative, referred to since as 'the Swiss initiative,' opened discussions initially with 13 other national governments: Austria, Belgium, Denmark, the Federal Republic of Germany, France, Greece, Israel, Italy, the Netherlands, Norway, Spain, Sweden, and the United Kingdom.

The European Molecular Biology Conference (EMBC), as it became known, had to be legally distinct from EMBO. It met formally for the first time at CERN on 13 February 1969, and representatives of 12 of the 14 member countries signed the agreement bringing it into being. Belgium delayed signing, and although Israel was keen to sign, other countries

disputed whether it was *'European'* enough to be eligible. As Israel had contributed to EMBO's funds before the EMBC had been created, and John Kendrew had close links with Israeli scientists, there were strenuous efforts behind the scenes to add Israel to the signatories. The final wording of the EMBC's founding document stated that membership was open to *'European States, as well as States which have made an important contribution to the work of EMBO from its foundation.'* Israel's alacrity in being the first to give a grant to EMBO in 1963 clearly qualified the country to belong. But other events, far beyond the control of EMBO, nearly drove its application off course. On 24 December 1969 Israeli crews sailed five naval ships out of Cherbourg at dead of night and took them to Israel. The ships had been commissioned by Israel but had been held in Cherbourg under a French arms embargo. Appleyard remembers what happened next.

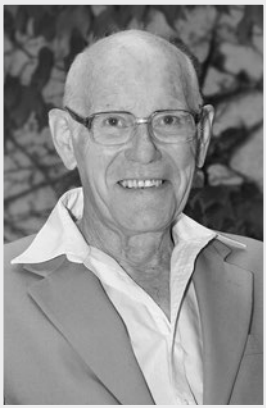
> *Israel was not very popular in France. But François Jacob was a close friend of the French foreign minister. France simply agreed [to Israel's membership] without any explanation, so Israel got in.*

EMBC's founding document gave it a dual aim: to provide a secure source of funds for a generic programme that included initially the EMBO fellowships, courses, workshops and administration; and to provide a framework to establish the European Molecular Biology Laboratory (EMBL). The first aim was achieved at once, and when the Volkswagen grant was exhausted the programme continued without interruption. For EMBO, the establishment of EMBC was absolutely critical: John Tooze, EMBO's second Executive Secretary, points out that at least 80 per cent of the funds spent by EMBO came from EMBC. Much of the credit for EMBC's successful establishment must go to John Kendrew, whose diplomatic skills were legendary. However, as Raymond Appleyard remembers, he was playing a long game in which establishing EMBO was only the opening gambit.

> *Kendrew had to have [EMBC] to have the laboratory. It gave the Conference a target from the start.*

EMBL would clearly never have happened without EMBO: the circumstances in the early 1960s were simply not conducive to the sudden creation of a large international laboratory. But it is also true to say that

without John Kendrew's ambition to head such a laboratory, he would never have brought together the extraordinary network of influence that created EMBO and EMBC.



# Raymond Appleyard

*International official and first Executive Secretary*

Had Raymond Appleyard deliberately set out to prepare himself for the role of EMBO's first Executive Secretary, he could not have done a better job. Having participated in the formative years of molecular biology, he joined first the United Nations and then the European Commission in senior administrative roles. *'I had a bit of physics, a bit of biology, a bit of governmental – I had it all,'* he says now.

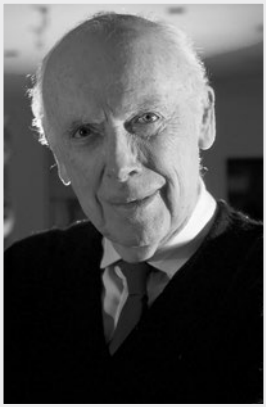
As a young man with a Cambridge physics degree under his belt, he immediately began to try to *'shift into biology,'* convinced that a successful career in science would depend on competence in more than one discipline. The shift took him to the United States, where he spent two years in biophysics at Yale. Thanks to a Rockefeller fellowship, he then joined the laboratory of Max Delbrück at Caltech, where he worked with the Swiss molecular biologist Jean Weigle on the interactions of lambda phage with its bacterial host. *'This was the start, because this was real proper biology,'* says Appleyard. He presented his findings at the historic 1953 Cold Spring Harbor symposium, where Watson and Crick first spoke in public on the double helix. Twelve of those present would go on to win Nobel Prizes.

By this time, Appleyard had moved to the Chalk River Laboratories, a research institute of the Canadian atomic energy authority. In 1956, the United Nations convened the first meeting of its Scientific Committee on the effects of atomic radiation [UNSCEAR]. *'They sent [as Canadian representative] a senior public health man [Ernest Watkinson], accompanied by somebody much younger who knew a bit about radiation and biology and physics,'* says Appleyard. *'So I went and we had a great time.'*

He became secretary to the Committee, and spent the next four years in New York. *'The UN was wonderful,'* he says. *'So having moved from physics to biology, I found myself moving into the semi-governmental.'*

Appleyard returned to Europe in 1960 to lead the biological research and training activities of Euratom. As described in this chapter, he took on the administration of EMBO concurrently, from 1965 until 1973. With Britain's accession to the European Economic Community (EEC), he joined the top brass at the European Commission as Director General, Scientific and Technical Information and Information Management. In that role he was able to oversee another revolution, helping to harmonise data networks across Europe as the age of the internet dawned.

Appleyard has retired to East Sussex, where he lives with his wife Joan, also a trained scientist. Asked if he saw his move to administration as a step down from science, he replies *'At the time I regarded it as a step down. Today I don't know. Today I would say the administration actually needs people who have a bit of experience of working at the laboratory bench… I take great pride in EMBO, I have to admit.'*



# James Watson

*Doyen of DNA*

A potted biography is really not called for where the most celebrated name in molecular biology is concerned, especially as James Watson is almost as famous for his autobiographical account of the discovery of the double helix as he is for the discovery itself.

Watson earns his place in this account of EMBO's history partly through having been present at the Ravello and Constance meetings, and partly through the years he spent at Cambridge in the early 1950s, when he joined the circle that included two of EMBO's founding fathers, John Kendrew and Sydney Brenner. *'In the first year in Cambridge,'* he says, *'I lived in this unheated room at the back of the Kendrew servant house in Tennis Court Road, with a little electric heater.'*

As has now passed into legend, the key relationship he formed at Cambridge was with Francis Crick. *'We saved each other,'* he says, *'because until I met Francis I had no one to talk to who knew that the problem was DNA and nothing else. The key thing in science is having someone to talk to.'*

Like Kendrew, once he had won his Nobel Prize Watson essentially gave up laboratory work in favour of scientific administration. *'I thought I can never do anything better,'* he says. Though he ran a research group at Harvard for 20 years, he followed the example of his mentors in never putting his name on papers for which others had done most of the work. *'Luria or Delbrück would never have put their names on my papers,'* he says. *'You were young, but we didn't see science as teamwork.'*

Instead his motivation has been to create structures that foster scientific creativity: his long tenure of the directorship of the Cold Spring

Harbor Laboratory (CSHL) was the second defining period of his life (the third perhaps being his leading role in the Human Genome Project). Soon after he took over as Director at CSHL in 1968 he began a research programme on tumour viruses: that has now grown into an NIH-funded Cancer Center. *'When I was in Luria's lab my uncle was dying [of cancer],'* he says. *'So I've had the motivation to cure cancer longer than I've had the motivation to solve the structure of DNA. DNA was much easier.'* Apart from cancer, human disease research at CSHL is focused on neurological conditions such as Alzheimer's disease, autism and schizophrenia.

More than almost any other Nobel laureate, he has contributed to training the next generation of scientists through writing textbooks. *'As late as 1975 I wrote all the 3rd edition of Molecular Biology of the Gene without any help,'* he says. *'Then I started Molecular Biology of the Cell with Martin Raff. Writing a textbook requires you to think and to learn new things. So probably I'm a better scientist because I write books than if I were doing experiments.'*

# 3

Chapter 3

# Engineering success

*Responding to the challenge of new technologies*

## Introduction

From the beginning, Kendrew and his colleagues engaged in discussions about the state of play in molecular biology, and how a European laboratory might help to push the subject forward. There was a desire for a grand, centralising project that would provide a focus for the lab, as the structure of elementary particles did for CERN. Rather to everyone's surprise, the lab proposal that eventually emerged sold itself on the acquisition and development of the best in modern instrumentation. By the time it was built, however, the technology wheel had turned once more: recombinant DNA was transforming molecular biology, with profound implications for science and society.

## 1 The Constance meeting

The Laboratory subcommittee met two or three times a year throughout the 1960s to formulate proposals that they hoped would persuade governments to fund what was still being called CERB. Central to these was the idea of a single, blockbuster project that would use the techniques of molecular biology to solve the problems of a complete biological model. Sydney Brenner was a key participant in these discussions.

> *We asked ourselves, if you want to do complete information, to get the whole thing, what would you do? We talked about four things and they were labelled K, L, M and N. There was Project K, which was E. coli K12. L was lambda, which was almost doable, and M was the mouse… But that was just too big. The idea was that you would make mutations, treat them like bacteria. And N was of course C. elegans, the nematode. Different people had different views. I remember discussing this with Szilard, and he said we should do the mink and*

*the mouse together. You could feed the minks on the mice, and sell their coats to make money for the lab.*

Inevitably, in the eyes of the Cambridge contingent, the model for the projected laboratory was the MRC Laboratory of Molecular Biology. As Brenner recalls, the founders of the LMB, which had its origins in a department of physics, had set great store by the development of new instrumentation.

*In the early 1960s there were very few places – in fact only one place, the LMB – which had the strange people doing genetics and X-ray crystallography. And what we had learned from LMB was that the development of new instruments was damn important and you should not wait around for them to be developed. So a very early interest right from the 1950s was to get new technology, new X-ray tubes, new computers, we pioneered all of that. And then of course with Fred Sanger's work we developed not only all the science but also all the technology which enabled [nucleic acid sequencing] … Molecular biology had just blown open most of biology at the time. But in the late 60s many European countries were far behind.*

Much of the resistance to the idea of a European lab was coming from individual countries who would have preferred to see national centres of excellence developing in their own countries – and the United Kingdom, which already had a centre of excellence and did not see the need for another one. But Brenner, and even some of Kendrew's supporters in continental Europe, were sceptical that scientists in such countries could develop the necessary level of collaboration.

*They couldn't develop it, and what was happening was that the field was changing at an enormous rate. Of course you could buy the instruments, you could hire programmers, but [what was important was] the culture of doing things in an integrated way.*

Brenner recognises now that proposals, for example, to map the complete nervous system of an animal in order to understand its function,

were far too ambitious at the time (and may still be in the case of mammalian brains).

> *We could do it for C. elegans: it took us 20 years. But it's tiny and it's only got 300 neurons. We still don't know in detail how it works, but at least you can start modelling it… We had the concept of starting to work on nervous systems and brains right from the 60s and 70s, just at the time when most people thought all you do in a brain is measure the electrical properties of the neurons.*

In 1969, EMBC was successfully inaugurated, with one of its aims to pursue the laboratory project. It became more urgent than ever that its proponents clarify what the point of the lab was to be. Why should national governments put money into it, when they might just as well put more money into their national research programmes? EMBO convened a conference, held at the Hotel Insel on Lake Constance from 27–29 November 1969, with the aim of deciding the focus of the projected laboratory. The meeting was the brainchild of Sydney Brenner, who wrote to the members of the Laboratory subcommittee in May 1969:

> *What is required is a discussion of the next 25 years of molecular biology strictly from a scientific and not from the administrative point of view… I would propose that parallel with the submission of the document to the Conference… EMBO should convene a working scientific panel/seminar to meet and ultimately to produce a more detailed scientific appraisal of the content of the research.*[12]

For the small number of people who attended the Constance meeting, it was an astonishing review of where the field might be going. Raymond Appleyard remembers it as the highlight of his tenure of the post of Executive Secretary:

> *One of the most interesting things that happened, which nobody seems to talk about, and is certainly unpublished, is the Lake Constance meeting. That was extraordinary… The purpose of it was to look 10 or 20 years ahead and*

12 Sydney Brenner to Laboratory committee members, 27 May 1969, Kendrew papers, Bodleian Library MS. Eng. c. 2435, NCUACS F.186.

> *see where molecular biology might be going with the top brass in the subject … It was the most extraordinary meeting I've ever been to, for the quality of the people and quality of the discussion. Crick brought along a young chap on the neural system [David Marr] who was almost a genius. He gave an incomprehensible talk, at the end of which Francis said 'I don't think many of us understood that – I'll repeat that in the morning.'*

Sydney Brenner, of course, was there, and instrumental in selecting some very young and very bright speakers.

> *The future of the subject was what we wanted to discuss. So there were talks, and I remember getting [visual neuroscientist] David Marr to go, and [developmental biologist] Peter Lawrence… We could talk about all the new things that were happening. We had talks on NMR, electron microscopy, all the places where molecular biology was going…*

One of the four session themes was neuroscience: the hands of both Brenner and Francis Crick seem detectable in this bias. As it seems to be recorded nowhere else, it is worth listing in full those who attended. They were Raymond Appleyard, Sydney Brenner, Arnold Burgen, Jean-Pierre Changeux, Hubert Chantrenne, Francis Crick, John Eccles, Boris Ephrussi, Manfred Eigen, Arne Engström, Paolo Fasella, David Hubel, François Jacob, Nils Jerne, Michel Jouvet, Thomas Jovin, Ephraim Katchalski, John Kendrew, George Klein, Aaron Klug, Peter Lawrence, Cyrus Levinthal, Vittorio Luzzati, Ole Maaløe, Werner Maas, David Marr, Ricardo Miledi, Roger Monier, John Paul, Max Perutz, David Phillips, Martin Pollock, Werner Reichardt, Michael Stoker, Alfred Tissières, Adriano Buzzati-Traverso, Hans Tuppy, James Watson, Victor Weisskopf, Heinz-Günter Wittmann, Jeffries Wyman and Hans Zachau.[13]

Of the 42 who showed up, 10 either already had Nobel Prizes or would go on to win them. Yet others, such as Lawrence and Marr, were still in their 20s, picked out by Crick and Brenner as likely to go far. The

13 See Kendrew papers, Bodleian MS. Eng. c. 2435, F.190.

intimate scale of the meeting, and what was at stake, guaranteed vigorous discussion. The whole of 27 November was devoted to presentations on plans for the laboratory, given by Ole Maaløe (who had, at Jeffries Wyman's urging, taken over from John Kendrew as chair of the laboratory committee), Manfred Eigen (just elected Chair of EMBO Council to succeed Perutz), Kendrew himself and Weisskopf (presumably in the role of godfather to the whole project). In the succeeding two days, there were talks under the headings genetics and protein synthesis; development, differentiation and control; structure and function of biological macromolecules; and neurobiology. Jacques Monod particularly held out for the most ambitious of the four putative projects: Project M, which Crick had previously dubbed the *'Megamouse'* project. But it was a completely different focus that emerged from the discussion – championed particularly by the electron microscopist Aaron Klug from the LMB and the crystallographer David Phillips who was just setting up a new lab at Oxford. This was that the lab should focus on instrumentation: it should both provide the best of what was then available, and develop new instrumentation in its own workshops. This, says Brenner,

Researchers discuss the future of the European Molecular Biology Laboratory. The meeting was held in Constance, Germany, on 27–29 November, 1969. Francis Crick is seated second from the left at the table. Photograph courtesy of Wellcome Library, London.

was a surprising outcome. But he could immediately see the sense of it *'because we could show that the capability for building and operating new instruments [in most European labs] was very small.'*

It was another five years before EMBC formally accepted the establishment of the laboratory, and nine before the new buildings opened in Heidelberg, but the Lake Constance meeting was a crucial turning point in the realisation of John Kendrew's vision.

## 2 The choice of a site for EMBO and EMBL

The siting of the laboratory in Geneva was by no means a done deal. As Raymond Appleyard remembers, from the start there were many discussions among EMBO members and representatives of their governments about where it should go, though nothing could be decided until EMBC was established and governments were committed to providing funding.

> *Germany made it clear from the start they were going to have it. The French offered a lovely site on a little plateau just above Nice, it was absolutely superb, and no distance from my apartment at Villefranche … But Germany, as I had discovered in the Euratom context, was determined on Munich. That was to be the great technology centre. And if you looked into the Ministry [of Education and Science's] chain of command, there was a Bavarian at every level.*

Buzzati-Traverso's wish to host EMBO at his own ILGB, which never had much support, became even less likely as political troubles mounted in Italy. In 1969, the lab closed for a period after being taken over by Maoist activists who insisted that everyone should do the same work for the same pay.

In April 1970, at its first formal meeting, the EMBC received the latest revision of the lab proposal (scaled down since the Constance meeting from 250 to 60 principal investigators) favourably. But Brenner remembers that even at such a late stage there was uncertainty about where the laboratory might be located:

*The CERN concept of building a lab at Geneva seemed just ideal… Viki Weisskopf was always keen to have a postgraduate university… for science in Europe, and we said it's got to be done to international standards, because we'd noticed that the way people were being judged throughout Europe was only on local standards… Germany was very keen to have an international lab, it would endorse its position… Our view was, well, we'll go to Germany, we'll see what happens… Their favourite [site] was in Munich.*

The story of how Heidelberg came to be selected over Munich, which had the blessing of the German Ministry of Education and Science, is something that is remembered vividly by Hermann Bujard. Bujard served as EMBO Director from 2007–2010, but in 1970 had just taken up a professorship in molecular genetics at the University of Heidelberg after several productive years at the University of Wisconsin at Madison and the Southwest Center for Advanced Studies at the University of Texas, Dallas. There were very few molecular biologists in Heidelberg at the time, but one of the most influential was Ken Holmes, formerly of the LMB in Cambridge, who had recently arrived to direct the Department of Biophysics at the Max Planck Institute for Medical Research.

Holmes was a member of the sites subcommittee set up by EMBO at a meeting in The Hague on 26 September 1970. (The other members were Ole Maaløe, Hugh Huxley and Charles Weissman, plus David Phillips [Oxford], Hans Zachau [Munich] and Alfred Tissières [Geneva] as 'consultants.')[14] The task of the sites subcommittee was straightforward: to choose between Munich (Martinsried or Garching), the Harwell area near Oxford, or somewhere near to CERN in Geneva. It quickly became apparent that Munich was the only serious candidate.

Only Germany had formally made an offer to host the laboratory. Realistically the European countries would never have supported another international laboratory in Geneva once Switzerland had been granted a new collider, the Intersecting Storage Rings at CERN. France, meanwhile,

14 Committee paper, Kendrew Papers, Bodleian Library MS. Eng. 2436, NCUACS F. 198.

had briefly entertained the idea of hosting EMBL near Nice, but once it had agreed with Germany to build a European neutron source at the Institut Laue-Langevin in Grenoble in the late 1960s, it was out of the running. Majority biological opinion in the United Kingdom was against having an international lab at all: at a Royal Society meeting held to discuss the issue in October 1969, the biochemist Hans Kornberg had called it *'the thin end of a white elephant*.'[15]

The group wasted no time, setting out on a visit to Munich at the end of October 1970, and Geneva (where they finally realised they could expect no support) at the end of November. By this time, Bujard was a frequent visitor to Holmes's lab.

> *In Ken Holmes's lab there was this interesting and visionary fellow, the late Peter von Sengbusch, a botanist, who had just returned from California, and I had just come from the States. We both were pretty young and had this American education that made you think 'if somebody can do it, we can do it.' So we got together and we talked to Ken, and decided 'why not Heidelberg?' It was totally crazy but Ken was very supportive and encouraging.*

Working flat out, they put together an application, copying the papers on an ancient Roneo machine and binding them in cardboard folders bought from the local stationery supplier. The packages presented Heidelberg's strong credentials in physics (seen as more important than biology for an instrumentation-oriented research centre), the availability of both a site for a new building and temporary accommodation until it was ready, its neighbouring industry and technology, its good transport links and, above all, its attractive location on a wooded hillside above the Neckar. And then they went looking for support.

> *The mayor of the town was enthusiastic… in contrast to the State's Minister of Science. There was also great support by the physicists, notably Nobel laureate Hans Jensen and by Wolfgang Gentner, Director of the Max Planck Institute for Nuclear Physics…We visited Gentner, a scientist with*

15 'Anonymous, 'The EMBO Question Debated', 1 November 1969, *Nature*, vol. 224, p. 406.

*broad interests and a potential neighbour of the EMBL… He was all for it. We put together 18 packages ready to send off, and the next morning it was in the paper that it was decided that EMBO would go to Munich. And I said 'OK Peter, let's throw it out,' but Peter said 'No. We send it off anyway.' So we sent it off, and a week later I was sitting in my office and the phone rang. John Kendrew. I was scared stiff. I had never met him before, I just knew his great name and work. He said 'Listen, this sounds really good, we'd like to visit you next week.'*

Both the Geneva and the Oxford options had faded away. It was going to be Germany or nothing. A small EMBO group, again including Holmes, visited Heidelberg, Garching, Martinsried, Karlsruhe and Hamburg between 29 January and 3 February 1971. Bujard and von Sengbusch did their best to make them welcome.

*In those days we could not get anyone behind our proposal except Ken Holmes, the physicists and the mayor… It looked like they [the EMBO visitors] were quite impressed. In the evening we took them out for a beer in one of our student pubs. We learned later on that the next evening they were in the Staatsoper in Munich with the governor and the university president and further illustrious locals…*

Unimpressed by Munich's wining and dining, the working group recommended Heidelberg. However, there was a snag. EMBC could not entertain Heidelberg as an option because it had not been officially offered by the German government. Indeed, the Ministers of Culture of the German Länder had previously agreed that the lab would be in Bavaria, a decision that could be reversed only if *'a very weighty opinion was given by the EMBO Council in favour of a different site.'*[16]

Accordingly on 1 April 1971, EMBO descended on Heidelberg once again, a larger group including the President of Council, Nils Jerne. Kendrew assured Bujard that this time there would be help with the logistics.

16 Anonymous, 'The EMBO Question Debated', 1 November 1969, *Nature*, vol. 224, p. 406.

*He realised that [on the first visit] we had paid for everything from our pockets. The next visit was more official, more people were there, and people who previously were extremely sceptical and considered us to be crazy, suddenly were among the believers.*

At the end of April, EMBO Council and the Laboratory committee met in Geneva and endorsed the decision in favour of Heidelberg. John Kendrew then wrote to Claus Zelle of the German delegation to EMBC, asking if the ministry could be persuaded to make the offer of Heidelberg official. As he tells it, Appleyard worked with the one official in the German ministry who was a Prussian and not a Bavarian to write the recommendation.

*I knew him pretty well. When the question of location came up it came down to Heidelberg or Munich. You could argue for both: Munich was clearly the great technology centre, but it's pure science and Heidelberg had its place there… Hans and I sat up half the night drafting this wretched thing, but we weren't going to draft it for Munich. It went to Heidelberg.*

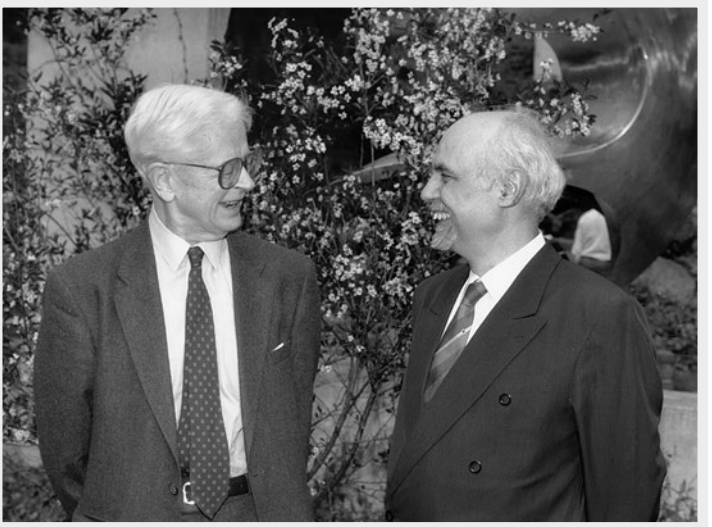
In June 1971, the German delegation formally offered Heidelberg, making it possible for the EMBC member states to vote in its favour.[17] Despite all his hard work, Bujard did not expect this outcome.

*Peter and I were extremely surprised that it was decided for Heidelberg, and some of our colleagues in Munich would hardly talk to us for a while. On paper Munich was much stronger – they had [Feodor] Lynen, a Nobel laureate, [Adolf] Butenandt, a Nobel laureate, many renowned colleagues in biochemistry and biology, and also very good physics. But what made Heidelberg attractive? Well, physics was excellent, both at the University and the Max Planck Institute, molecular biology was developing, the town was rather small but with a good tradition in science, the site proposed was attractive… a place where young scientists like to go with their families.*

17 Committee paper, Kendrew Papers, Bodleian Library MS. Eng. 2446, NCUACS G. 81.

*Finally, it was unlikely that "little EMBL" with 60 or so scientists as originally conceived would be overwhelmed by local institutions. All this fitted Heidelberg.*

It seems difficult to avoid the conclusion that the choice of Heidelberg was driven to a large extent by people who had personal experience of the LMB: a top-class laboratory close to an ancient but very distinguished university, in a small town with beautiful surroundings. The plan was for the laboratory to have its own intergovernmental funding body, formed from a subset of the EMBC members. But getting their signatures took a long and delicate process of negotiation: none was prepared to sign unless they knew that enough of the others were signing which would mean that the costs would be shared at least ten ways as originally envisaged. For a long time, Italy could not even say whether it would sign or not: but finally, on 10 May 1973, ten countries (Austria, Denmark, France, Germany, Israel, Italy, the Netherlands, Sweden, Switzerland and the United Kingdom) signed the agreement to become member states of EMBL. EMBC formally established EMBL the



John Kendrew and Fotis Kafatos at a 1997 symposium at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany. Kendrew was the first Director General of EMBL from 1974–1982 and helped persuade governments to establish the laboratory in Heidelberg. Fotis Kafatos was Director of EMBL from 1993–2005. Photograph by Maj Britt Hansen, EMBL PhotoLab.

following year. Now the building could finally begin. And there never seems to have been any question about who would manage the project: John Kendrew.

## 3 Ray Appleyard hands over to John Tooze

The admission of the United Kingdom into the EEC in 1973 was a watershed moment for EMBO. United Kingdom citizens were to be appointed to head three directorates-general of the European Commission, and such a post was the logical culmination of Ray Appleyard's career. He was to step up to the position of Director-General, Scientific and Technical Information and Information Management (DGXIII).

> *At that point I could no longer continue to do EMBO's administration. That was why it changed… I was then busy trying to sort out a directorate general…, and didn't think about EMBO until suddenly the summons arrived to go to the annual meeting of the finance committee of the Conference. I hadn't even thought about EMBO's money. I really was quite worried. I had stood down yes, but the year concerned was still my responsibility, I had to go and defend it. I didn't know what was going on, for the first time I didn't feel master of the finance at all. The Chairman opened the proceedings, saying 'Here are the documents, are there any questions?' Dead silence. Which never happened with a finance committee meeting. Then he turned round and said 'Mr Appleyard, this is our way of saying 'thank you'.'*

Into Appleyard's shoes stepped John Tooze, who had done a PhD in biophysics at King's College London, where Maurice Wilkins worked, and subsequently did postdoctoral research with Jim Watson at Harvard. More recently he had been deputy editor of the journal *Nature,* and then managed the research laboratories of the Imperial Cancer Research Fund in London. His wide experience meant that he was not in the least fazed by the task of organising Europe's leading molecular biologists:

> *When I was at King's I would sometimes – because Maurice Wilkins wanted a companion in his car – drive*

*with him to Cambridge… And he wanted to go and talk to Francis Crick and Sydney Brenner… And we would meet in Francis's or Sydney's office and they would talk. And I got the feeling I was truly in the presence of gods, that never ever would I meet anyone as fundamentally smart and witty and on top of everything as those two. And immediately after that I went to Jim Watson's lab and there was another chap who felt he was pretty good. And having had that experience early on… all these egos around Europe were… I mean if you've been in the presence of gods, then being in the presence of mortals no matter how fancy they feel is no problem.*

He inherited, and greatly appreciated, the bureaucracy-free way of working that had been established by the original EMBO Council and implemented by Appleyard. This had not changed after the introduction of the multi-government funding model through EMBC. While there was a risk that national representatives might try to steer fellowship decisions according to their national interests, Tooze found that other members were alert to any such attempt and it did not prove a problem.

*I think one of the reasons that EMBO could run in a relatively unbureaucratic sense is because the amounts of money are so small. When you're dealing with huge sums of money then the 'just return,' 'Buggins's turn next' and 'we need our fair share' comes into it much more often. When you're dealing with, by national standards, tiny amounts of money, it's easier to insist on decision by scientific merit without any worry about the national distribution of the proceeds among the different member states.*

## 4 The move to Heidelberg and EMBL

Throughout Appleyard's tenure EMBO had been run from his office at Euratom, mostly by his staff. Clearly after he stepped down that could not continue. Although EMBO was not responsible for delivering the laboratory, the overlap in its governance with the embryonic EMBL – John

Kendrew had succeeded Jeffries Wyman as Secretary General of EMBO, was also Secretary General of EMBC, and was project leader for EMBL – meant that the only sensible solution was to put the EMBO secretariat in the same place as the lab. So when John Tooze arrived in Brussels in June 1973 to learn the ropes from Ray Appleyard, he knew that moving to Heidelberg would be part of the deal. In the meantime, he hired a new secretary, Catherine Lagasse, who unlike Appleyard's staff was prepared to move to Germany, and took a crash course in EMBO's administration.

> *I learned what the scope of the job was in more detail, which was in those days courses and workshops; there were committees – all the committees of 1973 were held at the Free University in Brussels. And I watched and learned how Appleyard's secretaries and Catherine dealt with short- and long-term fellowship applications. I learned the financial side of it, [the auditor] gave me all the files. I read all the minutes of EMBO Councils to that date, the brochures that they'd produced following their Volkswagen grant when they were trying to set up the EMBC. I talked to Appleyard about the establishment of the EMBC, I talked to him about John Kendrew, about Jack Embling who was Kendrew's right-hand man and adviser and part of the British delegation [to EMBC]. I learned basically what the thing was about.*

Five months later, with winter coming on, he and Catherine squeezed into her Citroën 2cv with boxes of documents that would be needed immediately, and set off to drive to Heidelberg.

> *We stopped at her mother's [in the Ardennes mountains] on the way and were presented with a recently plucked chicken to eat when we got to Heidelberg. As it was a very long journey to Heidelberg in a very small car on a very snowy day, the chicken never got cooked. It was a long and arduous journey… We had rented offices in Deutsches Krebsforschungzentrum [the German Cancer Research Center in Heidelberg], as had the lab project – we were all on the same floor.*

Just as had been the case with the establishment of EMBC, there were anxious moments up to the last minute as EMBC member states hesitated over confirming their commitment to EMBL. As described above, ten member states had agreed to establish EMBL in 1973: getting them to ratify the agreement was another exercise in brinkmanship, and Tooze clearly remembers a crucial EMBC meeting in the summer of 1974.

> *We were in Heidelberg, and the meeting was in the Max Planck building in Berlinerstrasse. In the middle of the coffee break of the session of the EMBC, the French delegate was called off to the telephone and came back and announced that France had ratified the EMBL agreement. At that point it came into force because sufficient countries had ratified to ensure 70 per cent of its budget. That was a great festive day: EMBL had legal existence at that EMBC meeting, because it had reached the extent of ratification required for it to be legally established.*

The same year another dramatic meeting took place. In 1974, John Kendrew was the prospective Director of EMBL: he was also Secretary General of both EMBO and EMBC, posts he had held since 1969. This was not the first time a tendency to pluralism on his part caused anxiety on the EMBO Council: documents in Kendrew's archive show that in 1969 Jeffries Wyman had pointed out to him that perhaps he had better give up chairing the EMBO Laboratory Committee, which would ultimately appoint the Director, if he expected to be a candidate for that post himself. In 1974, with his appointment as Director General of EMBL confirmed (it does not seem that any other candidate was considered), Council felt the need to act. John Tooze, still in his first year as EMBO Executive Secretary, was present at the meeting, which was chaired by Hans Kornberg.

> *What Kornberg did was say that there was a feeling that there should be rotation of offices, because the Secretary Generalship was renewable every three years… Kornberg, unusually, decided to take a paper vote. And by a majority of 8 to 6 or 8 to 7, they voted in favour of rotation of the office. So then Kendrew was succeeded as Secretary General of EMBO by Niels Kjeldgaard of Denmark, and as Secretary*

*General of EMBC by Arthur Rörsch of the Netherlands. So then John was left with the EMBL, which is what he had wanted from the very beginning. And without him it would simply not have been. It was he that gave a great chunk of his time and life to establish EMBL, no question. But he didn't want at the same time to give up the other things.*

Hermann Bujard, then a professor at the University of Heidelberg who had been a key player in making the case for EMBL and EMBO to come to the city, worked with Tooze to help establish EMBO's presence there. During this period EMBO worked first out of rented space in the Cancer Research Centre, and later from a Portakabin above a building site as EMBL made its way into being. For Bujard, the presence of EMBO/EMBL created an academic environment for molecular biology that would never have been possible within the normal constraints of a German university.

*When John Kendrew hired the first people – Ari Helenius, Kai Simons, Thomas Graf and others – they would still have labs on the campus in the Cancer Research Center. We quickly got to know each other. At the same time, Heinz Schaller, Werner Franke, Günter Schütz, Klaus Eichmann and others moved to Heidelberg… it changed the whole atmosphere. A new generation took over, younger people with this Anglo-Saxon, easy-going attitude. You could send a student over there to ask, for example, for some enzymes – not common at all in [the usual German academic] hierarchical structure. So we created what we called Heidelberg molecular biology seminars, which were held in the Academy Building in the old town. People from the University, the EMBL, the Max Planck Institute, and the Cancer Research Center would participate. Once a month in the evening, there would be two lectures about your own work and after that we would go for a beer in the old town. We created something, which in Cambridge probably has a long tradition, but here it was new. John Kendrew, and later Lennart Philipson, would sit on our advisory board – indeed the advent of EMBO and EMBL catalysed the development of biosciences in Heidelberg in decisive ways.*

There were still many details to be worked out about the research programme of the laboratory: since the Constance meeting it had been envisaged as a place dominated by instrumentation. Nevertheless, the plan was to start recruiting and working straight away, rather than waiting for the completion of the planned new building. For Sydney Brenner, this was a key factor in the eventual success of the laboratory.

> *I did learn one interesting thing. If you're going to start a new institute, start by doing research, even if you have to do it in a tent. And that's how we started. We rented space in the Cancer Institute, we also rented some old buildings in the old biochemistry department, and we put people in there and started research. And if you don't do that, and you start discussing byelaws and protocols, and so on – the best thing is for the action to take place immediately.*

One of Brenner's early responsibilities was to buy a computer for the lab. He had foreseen the potential of computers at the LMB during the 1960s, when he was setting up major projects on electron microscopy and genetics with *C. elegans.* It was a matter of teaching yourself and writing your own programs, as there was no proprietary software.

> *I managed to get the MRC to buy me a computer. It was the same vintage as the PDP60 so it was very early days. We put it on a floor in the LMB, we had a lot of interesting people: John White started there. We learned, between John and David Marr and myself: we started to write operating systems. It became clear to us that this was going to become necessary. The perception that the computer would be the real workhorse for biology took quite a long time to sink in. Most experimental biologists thought it was a waste of time: 'people who have failed at everything else play around with computing.' And [what we did then] would have served to unify a lot of the later technology.*

Needless to say, Brenner encountered numerous different opinions about the type of computer he should buy: the first IBMs came with their own transferable software, but more sophisticated machines allowed users to be more creative in writing their own.

*I was the chairman of the computing committee… I bought the first computer for the lab against what everybody said. The Germans said no, no, no, just buy IBMs. But we had already seen from our experience that you need hands-on computing to do all the things that we were wanting to do. Doing things now that are trivial! But our views were so ridiculous in the 60s. To start thinking about automating image processing with the computers that were available at the time was… it couldn't be done. It was only 30 years later that the stuff became available. I bought a VAX for EMBL. People were scared to change systems. Ken Holmes had a NORD and he wanted to buy a NORD for the crystallography part of EMBL – they had the software and were scared to change. But I said the NORD was outmoded… Cheap computing made a lot of biology.*

While EMBL was indeed equipped with top quality instrumentation, inevitably not all of the early research programmes worked out. And as Hermann Bujard points out, the early plans were overtaken by the completely unforeseen advent of recombinant DNA technology and cloning, which began to develop in the United States at almost exactly the same time that EMBL was founded.

*Molecular biology, which has brought about so many insights like DNA structure, the genetic code, the mRNA concept… All these basics were worked out in prokaryotes. And in 1969, 1970 some of the people from the Delbrück school thought 'everything is solved except the brain, and we don't have the methods to go any further.' By contrast, the British gang from Cambridge, the physicists were among the optimists. They felt 'we just need better instruments to tackle more complex systems.' The documents of EMBO show that the new lab would be one where you build, for example, new types of electron microscopes, develop further X-ray analysis, build novel pattern recognition facilities. It was expected that such approaches would bring the next fundamental advance… What couldn't be foreseen at that time was cloning of DNA, DNA sequencing, novel electrophoretic systems, the ease by*

*which prokaryotic and eukaryotic cells can be transfected. This opened up molecular genetics of eukaryotic systems: even though some of the first scientists hired were instrument people, a few years afterwards everybody seemed to be pipetting. They cloned DNA and made transgenic cell and mouse lines just like everyone else. The idea of what EMBL should be did not immediately materialize. It was a lab like many other labs but a very good one with an excellent infrastructure and a superb concept for furthering young, gifted scientists. Interestingly, EMBL today is much closer to the original concept…*

John Tooze had little to do with EMBL under John Kendrew, who had organised his own secretariat and project management to supervise the building of the lab. However, by 1981 Kendrew had held the post of Director General for two three-year terms: the principle of rotation of offices after two terms still held, and despite his great reluctance to relinquish control of the project that had been his obsession for so long, he was replaced by the Swedish virologist Lennart Philipson. At this point Tooze became much more closely associated with the laboratory.

*Lennart had been chairman of the Fund Committee that gave out long-term fellowships – prior to the changeover – so I knew him very well. And he was also on the recombinant DNA committee. I got on very well with him. I certainly spoke in favour of him to any EMBL Council delegates who asked me if he was a suitable chap to take over the lab. And then I spent some time when he was elected editing and going through a strategic plan that he produced. I spent a lot of time writing chunks of that and editing it. I was his adjutant for a while.*

When the time came for Philipson to step down – another emotional event, in Tooze's recollection – there was not an immediately obvious candidate in prospect. However, Tooze helped to resolve the question both by suggesting the name of Fotis Kafatos, who was a Greek *Drosophila* biologist then working at Harvard, and agreeing to act as Director General himself for a year to give Kafatos time to organise his move to Heidelberg.

## 5 Putting EMBO on a permanent footing

Like Appleyard before him, Tooze acted as secretary to EMBC as well as EMBO.

> *EMBC meets twice a year, and each country sends a delegation usually of two persons, it can be one, can be more. MRC head office administrators would most often represent the United Kingdom. The Dutch always brought a scientist and always brought an administrator. The Finns and the Icelanders usually sent a scientist from their academies. The Germans always sent civil servants, usually accompanied by a scientist, likewise the French. What they do is vote an annual budget which is the monies EMBO uses for courses, workshops, and fellowships.*

The main challenge facing Tooze when he took over as EMBO Executive Secretary was to make sure that the member countries renewed the EMBC agreement.

> *The agreement was coming up for renewal two and a half years after I took over. And that was renewed for five years, and then after that they started renewing it for 8 years. There was always the fear that if the EMBC decided to disband itself then the EMBO would be an organization without any resource to do any of the things it did. You could argue that was just being neurotic, and they were never going to shut themselves down, but there were periods when governments – especially when they had to pay much larger contributions to the lab – they were looking at their global spend and saying 'Who wants these damn fellowships?' That never happened, and the EMBC renewed itself and continued to renew itself.*

With their funding secure, the members of EMBO Council saw it as important to put Heidelberg on the map. Previously, as a dispersed organization, the location of its offices had been of little significance, but the move to Heidelberg and the prospect of the new lab changed that. An early idea was to organise an annual EMBO symposium, a task that Hermann Bujard took on. The first one was in 1975.

*I enjoyed working with John Tooze on a couple of issues, including the organization of the first EMBO Symposia. We tried to create something like a Gordon Conference at Hirschhorn, a village in the Neckar valley near Heidelberg, where we more or less took over the whole village for a couple of days. It was exciting to be part of the organizing committee… and then to have – later – [Francis] Crick in Hirschhorn sitting in the front row in every session asking his sharp questions. It was great – it all happened in or near Heidelberg.*

Tooze, however, had his work cut out to manage all the symposium organization along with EMBO's other activities and The EMBO Symposium was later discontinued.

**EMBO SYMPOSIUM 1975**
**DEVELOPMENTAL GENETICS**
**Hirschhorn-Heidelberg,**
**April 30 - May 3 inclusive, 1975**

Invited speakers will include:

M. Ashburner (U.K.), W. Beermann (Germany), A. Garcia Bellido (Spain), S. Benzer (U.S.A.), E. Bradbury (U.K.), S. Brenner (U.K.), A. Chovnick (U.S.A.), F. Crick (U.K.), E. Davidson (U.S.A.), W. Gehring (Switzerland), A. Gierer (Germany), F. Gros (France), F. Jacob (France), R. Kornberg (U.K.), P. Lawrence (U.K.), N. Ringertz (Sweden), K. Sander (Germany), P. Sengel (France), D. Suzuki (Canada), A. Tissières (Switzerland), L. Wolpert (U.K.), D. Yaffe (Israel).

Applications should reach J. Tooze, Executive Secretary, European Molecular Biology Organisation, 6900 Heidelberg, Postfach 1022.40, West Germany, before January 31, 1975. They should include a curriculum vitae, and an indication of the applicant's scientific background and current interests. Applicants will be informed whether or not they can be accepted during March 1975. A registration fee of 40 DM will be charged. Accommodation in Hirschhorn (15 DM to 30 DM per night) will be arranged by the Symposium Secretariat but participants will be responsible for their living and travel expenses. A small number of fellowships are available which will be awarded by the Organising Committee to young participants unable to obtain other sources of support. Persons wishing to compete for these few fellowships should so indicate in their letter of application.

**The Organising Committee:**
**M. L. Birnstiel, S. Brenner, H. Bujard, A. Gierer, F. Gros, A. Monroy (Chairman), N. Ringertz, J. Tooze (Secretary)** (2179)

Advertisement for the first EMBO Symposium held near Heidelberg in 1975.

In addition to scientific talks, the meeting included workshops on the maintenance of determined state, chromosome structure and the regulation of gene expression.

## 6 EMBO and recombinant DNA

In the early 1970s, recombinant DNA technology was in its infancy. Beginning in laboratories in the United States, scientists were developing reliable ways of getting the techniques to work, and beginning to pass on that information to others who came to visit. John Tooze remembers

that this kind of need was exactly what the EMBO short-term fellowships had been designed to supply.

> *It was hard to get messenger RNA except from viral genomes, things couldn't be cloned, you couldn't buy things in kits. If you wanted to [perform] protein synthesis [in an] in vitro system you had to start from scratch… So there were labs which had developed a particular technique and could do it very well, and people went there to learn the secret… Or there would be just pieces of equipment that were not available locally… Either you went there because they had a piece of kit you didn't have that you wanted to use, or they were particularly skilled at a particular technique and you wanted to learn from the master chef how to bake the cake.*

Almost as soon as recombinant research began to take off in the United States, one of the leading scientists in the field, Paul Berg of the University of Stanford, wrote a letter to the National Academy of Sciences in the United States calling for a moratorium on certain types of recombinant research until guidelines had been drawn up. It was published on 26 July 1974 in the journal *Science*. The fear was that recombinant organisms might escape into the environment, with unpredictable and possibly lethal effects. This letter had been preceded by correspondence in 1973 from Maxine Singer and Dieter Söll, chairpersons of the Gordon Research Conference on Nucleic Acids, also highlighting the possible risks. The upshot was an international conference held at Asilomar in California in February 1975. Along with members of the EMBO Council, Tooze was worried that unwarranted fear of recombinant organisms might lead to regulations that would make research all but impossible.

> *The EMBO Council met in December 1974 before the Asilomar meeting. There was discussion about this international conference… Many of the European scientists were individually going. And it was Hans Zachau who said 'Well EMBO ought to have somebody there as an organization, so why don't you go John?' I was happy to go.*

James Watson, of course, was also at the meeting. *'I and Joshua Lederberg were the only ones who got up and said anything,'* he says. '*We*

*said 'This is crazy.'* Despite the protests of this vociferous minority, the conference agreed to put in place a voluntary moratorium on recombinant DNA research.

After Asilomar, while the National Institutes of Health (NIH) set about drafting a stringent set of guidelines, EMBO took its first major step into international science policymaking, and set up its own recombinant DNA committee. One of the more serious issues was that the guidelines that were being proposed included the need to conduct all recombinant experiments in Level 3 containment – an extremely expensive investment. John Tooze and others who had worked on viral DNA saw this policy as unnecessary and misguided.

> *EMBO decided as a scientific organization – and many of the people involved wanted to do recombinant DNA experiments – that we should set up some kind of group to chip in to this debate. So the EMBO Recombinant DNA Committee was set up, and we met fairly frequently at Heathrow Airport… on a Saturday and a Sunday… What happened was a discussion of how risky it really*

James Watson and Sydney Brenner in discussion at the Asilomar Conference on Recombinant DNA in 1975. The meeting was organized by Paul Berg to discuss the potential biohazards and regulation of biotechnology. Photograph courtesy of National Academy of Sciences Archives.

*was. We set up an experiment with Ken Murray, and it was published in Nature,*[18] *putting polyoma [a tumour virus] in E. coli and sticking them in mice and seeing if the mice went down with polyoma. Ken Murray went to Porton Down and did the whole thing in full Category 3 containment. We came to the conclusion that the way NIH was going about it was just madness. Because our lot argued that the absolute safest way to study viral genomes is to have them in a plasmid in E. coli, either in whole genome or fragments of genome. And the most dangerous way is to have tubes of virions, because they've spent all their lives evolving to be infectious agents. And so you had this enormous security once they were cloned into E. coli.*

The meetings continued, and eventually, in December 1977, Tooze travelled to Washington DC to put the EMBO view to the National Institutes of Health.

*I stood up and said my piece about EMBO feeling, in particular with viruses, that the NIH rules were nonsense. Much to my surprise the NIH suggested that we hold a workshop in Britain to sort this out. On March 31st 1978 at Ascot, not far from the racecourse, we held a US/EMBO workshop specifically to discuss the risks of recombinant DNA with plant and animal viruses. To my knowledge it was the first time any organization like EMBO had held a meeting with NIH, based outside the 50 states of the US. I was quite stunned really. The Americans came anxious to use this as a way of dismantling where they'd got themselves. And once that happened, and it's [accepted that it's] safer to study viral genomes in E. coli, then can it be really dangerous to study all the other genomes? So I think that was a turning point in the regulation of recombinant DNA research in terms of its potential as a biohazard.*

18 Fried M., Klein B., Murray K., Greenaway P., Tooze J., Boll W. and Weissman C. (28 June 1979) Infectivity in mouse fibroblasts of polyoma DNA integrated into plasmid pBR322 or lambdoid phage DNA. *Nature* 279, 811–816.

The outcome was that the NIH drew back from demanding Level 3 containment for recombinant DNA research, and Tooze is in no doubt that the EMBO committee played a key role in influencing that decision.

> *I think that was a response of EMBO to an important, and possibly for the development of science, threatening situation. At one stage with these public meetings in Boston and Cambridge, [at least one Nobel Prize winner] put their names to protests. The general public, seeing Nobel Prize winners saying 'This is an extraordinarily dangerous business, why are you doing it?' could reasonably come to the conclusion that this was an extremely dangerous business and maybe we shouldn't be doing it. I think that was probably EMBO's most significant contribution to science policy or science regulation.*

Of course, there were scientists in the United States who also opposed the draft guidelines, among whom Jim Watson played an active role.

> *In 1977 we went to Stanford on three months sabbatical. The California legislature was considering legislation. So I went and testified against it in front of Governor Brown, and Brown never went ahead. If he had, it would have killed off the recombinant DNA industry.*

Watson and Tooze had previously worked together on publishing projects, and they decided that it was important to document the history of recombinant DNA and the reaction to it. Rather than writing a continuous narrative, they edited a scrapbook of cuttings and images that vividly recreate the period, which was published in 1983.[19] *'No one could write a book,'* says Watson. *'You had to actually see [what was being written at the time].'*

Meanwhile EMBO had also taken a lead in organising practical courses on recombinant DNA techniques to bring European scientists up to speed. The first was organised by Werner Arber in Basel in 1976, with the support of many other EMBO members including Ken and Noreen

19 Watson J. and Tooze J (1983) *The DNA Story: A Documentary History of Gene Cloning.* W. H. Freeman.

Murray. The experiments undertaken during this workshop were published as a paper in *Proceedings of the National Academy of Sciences,* which carried the acknowledgement:

> *The participants of the EMBO course on 'DNA restriction endonucleases: reactions and applications' performed, with interest and enthusiasm, several restriction, ligation, transfection and in vitro packaging experiments and we thank them for allowing their results to be included here.*[20]

The flurry over recombinant DNA had a knock-on effect for EMBL, as Tooze remembers:

> *During this period, at the peak of the pressure to put recombinant DNA research into a containment facility, John Kendrew decided to add on to the EMBL buildings a containment lab. He had a Dutch biocontainment expert from their biowarfare group come and advise, and a guy from Porton Down – an ex-Navy commander, an incredible man. They advised us on how many showers you needed, what sort of tiles etc, and a whole containment lab was built. By the time it was completed the regulations had been dismantled, and nothing that was going to be done at EMBL would require Category 3 containment. So that containment facility became the programme that Ricardo Cortese developed on gene regulation, and that's where he and Iain Mattaj still [had] their labs. So one of the outshoots of the recombinant DNA regulation furore was that EMBL got an extra single storey lab block, not huge but enough for 6–8 groups.*

20 Hohn B. and Murray K. (1977) Packaging recombinant DNA molecules into bacteriophage particles *in vitro. Proc Natl Acad Sci* USA 74, 3259-3263.

## 7 The venture into publishing: *The EMBO Journal*

In 1982, EMBO took a further high-risk initiative when it launched *The EMBO Journal.* On top of all his other duties, John Tooze became its editor. He had, of course been deputy editor of *Nature* for several years, as well as editor in chief of *Trends in Biochemical Sciences* (TIBS).

> *The journal was an EMBO Council initiative. They felt that EMBO, its name and what it stood for, was not that well known outside Europe, so a journal with that name would be a tool for disseminating the EMBO brand around the world. There was also the view that apart from Nature there were not that many good molecular biology journals.*

Although EMBC has continued to exist and provide support for EMBO's programmes, a secondary consideration was that a journal might provide income that was independent of the vagaries of political decision-making. The first steps were very cautious, and Tooze essentially undertook to run the journal without any extra paid support.

> *When you start a new journal you never know whether it's going to be a failure. My first wife helped me begin the journal and we set up a log book which was just one of those old-fashioned account books, and it was all done by hand on cards, logging them in. Basically it was very similar to processing applications for fellowships: you get the applications, you send them out to reviewers, you get the reviews and you make a decision. I had an editorial board, but they were primarily lustrous names to put on the masthead: they didn't want to do much work when you got down to it. And that was a relief to me, because I just wanted to do it myself.*

There was of course the question of who would publish the journal, and again Tooze decided to start small.

> *I had at some stage in my career had dealings with Information Retrieval Limited, IRL Press. We did a deal that they would publish The EMBO Journal. They were in a little town called Eynsham just outside Oxford. And that worked very well, because we were*

*their only regular monthly journal of primary research papers. When you start a journal there's a lot of money to be invested. EMBO invested nothing: all the capital investment was the publisher's problem. But it became profitable within three years, which is a very, very fast rate of return, and we got on very well with the people at IRL. And it started making money, that all went straight to EMBO and was used for other activities.*

Within a few years Tooze oversaw the transfer of the journal from IRL Press to its much larger neighbour, Oxford University Press.

*Several of the people from IRL Press who'd worked on EMBO were incorporated into OUP and carried on running the journal. Oxford did a good job, and I guess during those years we reached the highest impact factor that the journal's ever had. By that time I was running it just with my two EMBO secretaries [Mare Kriis and Jennifer Schulze-Eyssing]. We had three offices butting up to one another, and we had a porthole cut between one and another so that if one of the girls was in the journal and the other was in the EMBO office they could just shout through the hole in the wall.*

While the journal was a success, with submissions coming from all over the world, Tooze felt a sense of disappointment that it was not fully serving one of its primary functions, which was to showcase the excellence of European research, especially of EMBO members themselves.

*There was a frustration with the journal because you would see these guys, who thought so highly of the journal and had pressed to have it, publishing their papers in Cell or Nature, and I would ring them up and say 'What the hell are you doing X?' And they'd say 'Oh it's my post-docs, it's for their careers.' They were sheltering behind the idea that their post-docs needed to publish in Cell or Nature for their careers. So it was always a battle, and we always knew we were essentially going to lose it. But we hoped to get the next tier down, which I think on the whole we did.*

The toughest part of the job of editor, complicated by the fact that Tooze was also EMBO Executive Secretary, was dealing with disappointed authors whose papers he rejected. While the business of refereeing and publishing was straightforward, it was this aspect that came to occupy most of his time.

> *With the fellowships you would read the application and then appoint the referees. You'd do the same with the papers, but there were many more papers. And the trouble with the papers [that were turned down] was that the authors were more inclined to argue with you. I had these extraordinary phone conversations, not every day but significantly often. I'd say 'Look, no matter what you say I'm not changing the decision, but if you want me to listen, I'll listen.' And then they'd talk to me for 20 or 25 minutes from California. And at the end of the conversation I'd say 'We're back where we started from, I'm not changing the decision.' And they would feel relieved to have had this conversation. It was a sort of psychotherapy. And there was pressure from EMBO members saying 'You've got to help, I'm just coming up for tenure,' or 'I'm just coming up for promotion,' or 'My post doc's just entering the annual CNRS jamboree,' and so it goes on.*

Eventually even Tooze recognised that he could not do everything himself.

> *After our first 8 or 10 years I used to use people in Ricardo Cortese's lab to deal with some of the manuscripts, or when I went on holiday. I remember being on holiday in Skye in Scotland, in the middle of this torrential rainstorm, standing in one of those red British telephone boxes, phoning the office and asking them to read off titles and authors, and then phoning back potential referees, while my wife, who was American, drove off on the wrong side of the road into the mist. So Iain Mattaj took over as co-editor.*

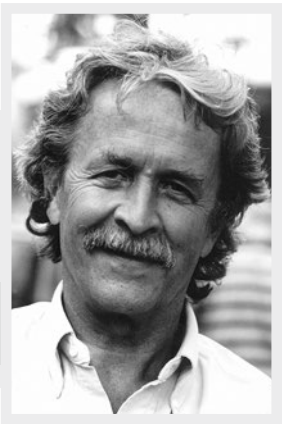
Reflecting on his time as Executive Secretary, Tooze muses on the question of whether there was something that you could call a molecular biology community in Europe.

*There was more of one in 1973 than there was in 1963, for sure. It depends what you mean by community. I would say yes, but restricted to a core of people. Like all organizations there are a core of people who are deeply involved, and then there are lots of people who are signed up members of the party or organization but actually don't do anything. I would say there was a growing community, and that EMBO certainly fostered that. In my experience there was always maybe a core of 100 people who really participated in the activities. That core I got to know quite well. They bounce around from committee to committee. Once EMBL was established, they would appear in different guises on EMBL committees; some of them were EMBC delegates. Whereas the bulk of the members you didn't get to know unless you happened to go to a workshop or a meeting when they were there. One of the issues was that we had all these members scattered across Europe, but what did that mean?*

Considering that he established EMBO in Heidelberg, helped to establish and set the future direction of EMBL, played a major role in the recombinant DNA negotiations and founded and ran *The EMBO Journal,* Tooze is unjustifiably self-deprecating about his contribution to EMBO over his 20-year tenure of the post.

*I started very few initiatives... I can't decide whether that's a result of lack of ambition on my part, or scepticism of the value of spreading yourself so thinly that nothing is very effective.*

His merits were obvious to EMBO Council, which awarded him the first EMBO Gold Medal in 1983. In 1993, once Fotis Kafatos had arrived to take over at EMBL, Tooze was feeling ready to move on. Just at that moment, an opening appeared at the Imperial Cancer Research Fund laboratories where he had previously worked. He answered the call from Paul Nurse, then the scientific director, to go there as director of core support services. And once again EMBO was looking for an executive secretary.



# Hermann Bujard

*Heidelberg champion and EMBO helmsman*

Hermann Bujard, who led EMBO as Director from 2007 – 2010, also shares the credit for EMBO coming to Heidelberg in 1973. His experience of working in American laboratories in the 1960s gave him a lifelong determination to provide a better environment for fast-moving subjects such as molecular biology in Germany's hierarchical university departments.

Bujard had switched from natural compound chemistry to molecular biology after doing his PhD at the University of Göttingen. *'Some of my friends did a PhD with Manfred Eigen,'* he says. *'So I was exposed to the new thinking of the Eigen lab. And that got me into molecular biology.'* He went to the United States, initially as a postdoc in Charles Heidelberger's laboratory at University of Wisconsin-Madison.

*'We had a collaboration with Gobind Khorana's lab, where they were just deciphering the genetic code – about one to two codons a week,'* he remembers. He was also exposed to the unique atmosphere of the Cold Spring Harbor meetings. *'There were people like Monod and Crick and Delbrück, probably a dozen present and future Nobel laureates,'* he says. *'This was unbelievably inspiring, and they were all easy going: no ties, T shirts, hanging around using first names.'*

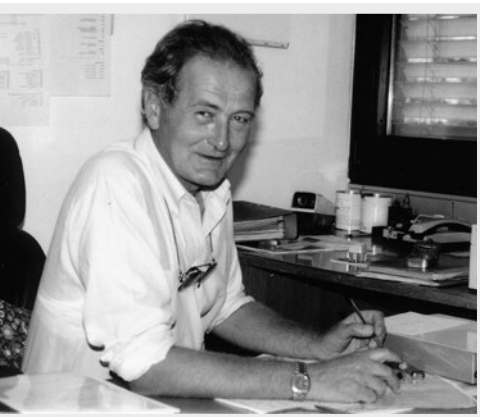
Bujard returned to his homeland in 1969 and took up an associate professorship in molecular genetics at Heidelberg University. Almost immediately, working with Peter von Sengbusch from Ken Holmes's lab at the Max Planck Institute for Medical Research, a case was put together for EMBO to come to Heidelberg. *'I always thought we can only develop here if we attract more molecular biologists who had been 'culturally*

*immersed' in the United States or the United Kingdom and that's how Heidelberg finally grew,'* he says.

In the early 1980s, Bujard helped to set up the Centre for Molecular Biology at the University of Heidelberg (ZMBH). At that time the authorities refused to set aside centuries of tradition and adopt an Anglo-Saxon departmental structure. So he left to set up a molecular biology laboratory for the pharmaceutical company Hoffmann-LaRoche. There he began to work on a vaccine against malaria. *'I decided late in my life that I should try to do something useful, which is much more difficult,'* he says. *'If I were just to work on mechanisms of malaria parasite transcription I would always have papers, and no child would ever profit from that.'*

After four years, he returned to ZMBH as chairman, and this time succeeded in establishing the department structure he wanted. *'This went up to the governor here in the state, and it was agreed,'* he says. *'It was at that time the only German institute in the field that had an American-type department structure.'*

Since handing on the Directorship of EMBO to Maria Leptin in 2010, he has been a Distinguished Professor at ZMBH and still runs an active lab. He is looking forward to seeing his candidate malaria vaccine enter clinical trials. *'If this should work out, my goal is to go back to Africa and see if we can demonstrate efficacy,'* he says. An ambitious goal – but so was bringing EMBO to Heidelberg all those years ago.



# John Tooze

*Indispensable adjutant and founding editor*

John Tooze has called the EMBO secretariat under his leadership (from 1973 – 1994) a *'string and sealing wax operation.'*[21] And to any of his successors it must be a mystery how he ran EMBO, including founding and editing *The EMBO Journal* and supporting Lennart Philipson at EMBL, with only the support of his two invaluable secretaries Mare Kriis and Jenny Schulze-Eyssing. The answer is that he has always had an unerring sense of what can be achieved within the resources available.

That is not to say he has not been ambitious, playing a key role within EMBO in persuading the mighty NIH to change its guidelines on recombinant DNA, for example. And powerful research leaders have found him invaluable at turning their visions into practical reality. His training was a textbook preparation for the founding years of molecular biology. *'I did my first degree in Cambridge,'* he says, *'a PhD at Kings [College London] in the biophysics department where Maurice Wilkins and John Randall worked, and then I spent two years in Jim Watson's lab at Harvard working on phage genetics.'*

Returning to a lectureship at Kings, he started writing a cell biology column for *Nature* every week, and got to know the editor, John Maddox. For two years he worked full-time as assistant and then deputy editor of *Nature,* until Maddox fell out with the publisher, Macmillan, and decided to resign. *'I thought what do I do? And [the virologist] Mike Stoker had just moved to be Director General of the Imperial Cancer Research Fund (ICRF) labs. He offered me a job of being essentially a recruiting agent for*

21 *EMBO: 40 years of success*, 2004, p. 11. (EMBO '*Silver Book*')

*him, and also running a small lab.'* It was Michael Stoker who suggested he apply to be Ray Appleyard's successor at EMBO, where he stayed almost 20 years.

By the early 1990s, Paul Nurse had just become scientific director at the ICRF. *'I felt that if I didn't move then I was going to stay until retirement,'* Tooze says. *'Neither my wife nor I wanted to stay in Heidelberg that long. And Paul said 'Why don't you come down [to ICRF]?'… I became director of core support services.'* Tooze was on hand as Nurse, by then Director General, embarked on an ambitious merger of the United Kingdom's two largest cancer charities, ICRF and the Cancer Research Campaign. When in 2003 the Nobel laureate Nurse became President of Rockefeller University in New York, he lured Tooze across the Atlantic.

On Tooze's watch as Vice-President for scientific and facility operations, Rockefeller has undertaken a massive capital building project, transforming two early 20th century buildings to create new lab space. The saving on material over building anew appeals to Tooze's sense of the need to conserve world resources. The economists' argument that we can spend our way out of recession appals him. *'Are we arguing that that's a sustainable future?'* he asks incredulously. *'I don't believe it.'*

# 4

Chapter 4

# Expansion and engagement

*Programmes and policies within and beyond Europe*

## Introduction

While John Tooze had kept EMBO's operations at a scale that he could largely manage single-handedly, Frank Gannon had wider ambitions. During his tenure of the role, now called Executive Director rather than Executive Secretary, he began a number of new initiatives involving EMBO members and fellows, looked beyond the borders of Europe to the world outside, started two new journals, and expanded the EMBO secretariat, including journal editors, from 4 to 40. EMBO for the first time moved into its own building, adjacent to but distinct from EMBL.

## 1 From Galway to Heidelberg

The successor to John Tooze turned out to be living and working in the West of Ireland, where he headed a research group in the Department of Microbiology at University College Galway and ran the successful National Diagnostics Centre. Frank Gannon had previously learned recombinant techniques at the University of Wisconsin and had won an EMBO Fellowship to go to Strasbourg as a postdoctoral researcher with Pierre Chambon. His return to the country of his birth, which had few resources for science, had made him expert in targeting research funds from elsewhere, principally the European Union. He was an EMBO member, and had run EMBO practical courses in Galway. He had got himself noticed in the European Union context for championing the cause of countries like his own that were less well endowed for science than the United Kingdom, France or Germany. But it was a complete surprise when he was approached by Fotis Kafatos and Michael Ashburner after one such European Union meeting, asking him if he might apply to replace the 'irreplaceable' John Tooze. He quickly saw opportunities in the role, put in his application, and joined EMBO in 1994.

*My priorities were really reflections based on my own experience. One was that as a member I didn't feel part of a club, part of a community. I was in total admiration of EMBO for what it was doing, but I thought it was missing an opportunity to be a new organization that was going to bring together scientists all around Europe in a very active way, and I felt that it had a very restricted programme of activities: it had long-term fellowships, short-term fellowships, courses and workshops and the journal. And I started thinking is there something an ambitious, quasi-academy should do? I started talking about this as a dispersed academy, which was a way of me saying that you [the members] were important to this entity. … I saw EMBO as a way of permeating science throughout Europe with excellence, and of influencing the European Union who were becoming very strong at this stage. So I had a different series of core agendas, and one was to make EMBO a really strong European academy that was good for change in all the areas of science that we were dealing with.*

Before he embarked on any new programmes, Gannon looked around to see how well EMBO was handling the basics, the programme of fellowships, courses and workshops that had been set up by the first EMBO Council with the support of Raymond Appleyard.

*Like John [Tooze], all of those were things that I did myself. Mare [Kriis] and Jenny [Schulze-Eyssing] knew the ropes and knew what was right and wrong, so that was a big help. I made a few rules: each member could not review more than two fellowships per session, which meant I was obliged to get to know more of them. There had been a smaller number of people who would do a lot. I remember that Spanish scientists were visited by an EMBO member who interviewed the lot of them at once, and the same was true of Israel: I thought that didn't make any sense. Inevitably there was a ranking: 'these are the best of these, and we will give them two or three fellowships.' That wasn't happening to any of the other countries. So there were some practical changes required.*

Having worked in England, The USA, Ireland and France, and spent a lot of time wrestling with European Union funding mechanisms, Gannon already had an international outlook. But as the new Director, he took the time to study EMBO and its relationships with its dispersed community.

> *I spent the first year visiting each of the member states, which was not popular with a family just arrived in Germany. What I got from every one of the visits were complaints. Vicious complaints about papers being rejected, about members not being elected, complaints about members being elected who shouldn't be elected, complaints about not being on this committee and no one from their country being on that – it was non-stop. It was also the time that Italy had announced its intention of leaving the EMBL, and I was down there in Italy getting roasted… It seemed that the members who were quiet were not exactly docile. And I thought this was something that could be turned to the positive.*

## 2 Forging a network

One of the outcomes of this series of visits was a programme of networking events and programmes, designed to give EMBO members and fellows a stronger sense of being part of a community. Gannon had been elected an EMBO member in 1983. It struck him at the time that although the election was an honour, it wasn't clear how he might come to feel part of the organization.

> *I got a letter saying you're an EMBO member Frank, congratulations, but felt there was no sense of engagement. I didn't feel part of a club. I probably got a message to vote every year. I decided that the newly elected EMBO members would come together, and we created a scroll that we would give them. They would talk and give a short presentation – and by definition the science was of the highest standard, because these were people who were performing in diverse areas on the stage.*

The existing members were all invited to attend the first Members' Workshop, which took place in Rome in 1996. The Members' Workshop moved each year to a different country.

> *That was a way of bringing something to the members in their country, and they really were great scientific meetings. They were great also for me and for the EMBO staff, because they learned about new people and what they were good at and that was used when looking for reviewers for fellowships. It was all part of what I thought of as building a community.*

Gannon also thought it would be a good idea if the EMBO Long-Term Fellows, young scientists at the start of their careers who had just won a prestigious award in open competition, had the opportunity to meet and interact with one another, and hear something from EMBO members about how their own careers had played out. Again beginning in 1996, he set up an annual Fellows' Meeting for this purpose.

> *Anybody who got a [long-term] fellowship in the two years previously and was coming to the end of theirs was brought to Heidelberg – It was an opportunity to show off the EMBL as well. We got EMBO members to chair the sessions. I told them that they had 30 minutes at the start to explain how they had ended up being the chair of this session – to talk about the choices they had made in their careers. And some of those were fascinating.*

The number of fellowships that could be offered in any year was limited by the available funds, and the application process was highly competitive. Gannon wanted to find a way to recognise and support more early career scientists.

> *Because I was active in the European Union and on the Marie Curie programme committee, I saw that there were lots and lots of young scientists who were at a delicate stage in their career. Because the ethos in EMBO was supporting the young, I thought we should do something about it. I was also aware that EMBO had a staid old image, and I was trying to work against that.*

The solution he found was to set up the EMBO Young Investigator Programme. Launched at the end of 2000, with Gerlind Wallon as programme manager, the Young Investigator Programme's first round of selections was made during 2001 from a total of 415 applicants from 24 countries. The sum of money available to each successful applicant – €15,000 per year for three years that came from the young investigators' member states, not EMBC – was modest by comparison with most fellowships. The main purpose of the programme was to give the young scientists, who had to have been working independently for not more than three years, a mark of distinction that they could use to help them raise further funds.

> *All we were doing was giving them the stamp of 'you are a particularly promising individual'. I recall the first meeting, and the big problem was that because there's no budget, there's no reason not to select everyone. And there was a wonderful discussion that ended with the decision that we had to set a very high bar. At the end of the session, which was chaired by Jean-David Rochaix, we selected about 13% of the applicants. And in subsequent years we selected about the same. It was a mark of distinction that people could go back and parlay with their universities or put it on their CVs.*

The programme also provided a number of valuable opportunities for networking and support, including privileged access to EMBL core facilities, mentoring by an EMBO member chosen by the Young Investigator, and an invitation to attend an EMBO Members' Workshop. Importantly, the award increased the visibility of the young investigators by informing international granting agencies of their new status. And in keeping with the philosophy of encouraging face-to-face networking, there was an annual Young Investigator Programme meeting.

> *I thought these young people should get together, present their work, get to know each other, and we put up some small amount of money to help joint projects, if they could think of something interesting to do. I remember at the first meeting being absolutely astounded, that all these high performing young people who on paper*

*were absolutely running the world, were totally insecure. They were just learning how to run a lab. With time other aspects were added: there are now laboratory [management] courses that are essential. We looked at them as a stream of people who were going to be very successful, and every year a few more of them are elected as EMBO members and their careers develop.*

## 3 Enlarging EMBO, installing excellence

At the beginning of 1999, EMBO still employed only four full-time and two part-time members of staff. These were housed in four rooms in different parts of the EMBL campus. By this time Gannon was actively seeking to recruit staff to manage the Young Investigator Programme and other programmes that had been introduced. Good relations with EMBL,

Max Perutz and Frank Gannon at the ribbon-cutting ceremony for the new EMBO building in March 2001. By 2000, EMBO had outgrown its existing space on the EMBL campus and required additional space to accommodate future activities. Photograph by Marietta Schupp, EMBL PhotoLab.

which owned all the buildings on the Heidelberg site, were essential so that all these people could be housed.

> *I took an active role in EMBL when EMBO was growing. I was the dean of graduate studies, set up the PhD programme, with others, set up technology and helped in the formation of the first spinout companies; I was also a senior scientist, and had my own lab in EMBL. So it wasn't surprising that when we needed more space we got more space. But what was obvious was that this would be a problem if we needed even more space. Lots of things were tolerated the way it was by Fotis Kafatos, but if anyone had come in to head EMBL who was against it, they could stop it immediately. So I put in place a concord between EMBO and EMBL. Just for clarity.*

When it became apparent that occupying odd corners of spare office space was not going to meet EMBO's needs in the long term, EMBL generously offered to provide space for a dedicated EMBO building. Foundations were dug in November 1999, and the building – by then home to 40 people – was opened by EMBO's first Council chairman Max Perutz in March 2001.

The secretariat expanded because the role of EMBO was expanding. As Gannon had found when he undertook his tour of member states of EMBC soon after his appointment, some of them felt that they were not getting a just return for their contribution to the organization: that too few of their scientists were winning fellowships, or being elected members, for example. Having had the experience of working in Ireland, Gannon was keen to do more to build support for the countries with weaker scientific resources, and, as the new countries of the former Eastern bloc joined, to make sure that their scientists did not lose out because the existing EMBO members were not aware of their work.

> *EMBO during John's time had been adding member [states]; it became something that a country that was beginning to get on its feet wanted to do, to become an EMBC member. It was a time that Europe was broadening, those things all went together. There was a concern – I*

*think old EMBO members would have thought 'these are weaker scientists,' and that was a problem with the core EMBO philosophy. Because you can put excellence on a pedestal, but equally it is totally unsympathetic to what is needed in order to allow others to become excellent. Maybe because I come from Ireland I believe that you have to move people up, and that EMBO was a mechanism for doing that – for setting standards and moving people forward. There wasn't a hard choice really about where to stop, because all of the European countries were members potentially. Our budget would not change too much, because the GDP was the definer: small countries with small GDPs paid less. It was more to show that we were a broad organization.*

The fairness of always making decisions on scientific merit alone was a frequent topic of debate in Council. Hermann Bujard says:

*You can look at the established countries like Britain or Germany, they don't need the same support as what I call the peripheral countries, Croatia, Turkey, Poland and so on. I thought we needed to focus on those countries. EMBO in a way is counterproductive to the development of science in these areas – we give fellowships to bright young Turks to go to Britain, and they usually never go back. When you visit bright young scientists in Turkey they often don't even take a PhD any more: they take a master's, and then they leave to Max Planck or to Cambridge or somewhere. These people are not in a good competitive situation.*

In order to get around this problem, towards the end of his tenure, Gannon began a new programme known as EMBO Installation Grants. Run alongside the Young Investigator Programme, it is a programme that involves collaboration with member states to encourage bright scientists to develop labs there.

*In the expansion to the different countries, you couldn't miss the fact that the best scientists were not in the weaker countries, and I thought we should do something to improve the quality locally. After some discussion, we*

*came up with the concept of installation grants. There were two ways of looking at EMBO: either you kept excellence as the only thing that counted – in which case you didn't care about the weaker countries – or you saw EMBO as a mechanism for raising the standards, which it was why it was set up in the first instance, and in which case we did have an obligation to try and do something. One of the ideas that I developed and came into fruition was these installation grants.*

Exactly how to decide which countries should be eligible for these grants was less than straightforward.

*You can imagine the complications. How do you pick the 'weak countries'? My suggestion was to pick the countries whose research spending was less than the European average. Because then you've got fewer resources, and you end up not being successful. That didn't work because some countries that had good opinions of themselves would have been defined as 'weaker countries.' So then it was left that the countries could volunteer to participate.*

The countries that stepped forward to join in the first round of grants were Croatia, the Czech Republic, Estonia, Poland, Portugal and Turkey (Hungary joined later). Ten grants were awarded in the first round to help scientists to set up labs in these countries.

*These installation grants were designed to bring people from outside back or into the country that had self-selected, and all we asked was that the host country put up €50,000 per year for three to five years. The host institution had to say what they were giving them. So if you were going back to Poznan and the university wanted you to apply for this internationally prestigious grant, they had to say 'You will get this laboratory,' and the person was set up. I think it did change people's perception about the reason they were returning to their home countries.*

The installation grant programme continues to this day, and successful applicants are able to form links across Europe through participating in

the activities of the Young Investigator Programme: Gerlind Wallon has run both programmes from the start.

## 4 Society and the world

At the same time as improving the engagement of members and fellows with the organization, expanding EMBO's reach among young scientists and establishing mechanisms to encourage science to grow in less well resourced countries, Gannon wanted to do more to increase EMBO's impact. He put his mind to how this community of excellent scientists might extend its influence beyond the existing (and flourishing) programme of fellowships, courses and workshops, and the new grant programmes he was bringing forward.

One area was in the public perception of molecular biology. EMBO had played a key role during the 1970s in providing experimental evidence that genetically modified organisms were not intrinsically harmful to humans, and ensured that sensible guidelines for research in the area were implemented. However, in the mid-1990s public anxiety about the use of genetic modification to grow food plants such as soya swept through Europe. In 1997, Dolly, the world's first cloned sheep, was born. In 1998, the Swiss electorate voted in a referendum that would have banned the production and distribution of transgenic animals, field trials with genetically modified organisms of any sort, and the patenting of genetically modified animals and plants. If the referendum proposal had passed – it was rejected by a two-to-one majority – it would have terminated much of the Swiss biotech industry, as well as the research of many EMBO members.

> *That was dangerous stuff, that could have gone another way and that would have changed everything. We were depending on the member states of the EMBC to provide funding for us, and therefore if the societies in those countries were against this sort of research, we were not going to get support from the politicians with the money. We couldn't stand by and let that happen. We had to provide some sort of a basis that would allow the EMBO members to get engaged and*

*to get our story out, to speak at meetings, to get invited to meetings to put the other side of the story.*

In 1998, the Science & Society committee, set up by EMBO Council to monitor areas of public concern, met for the first time in a meeting chaired by Charles Kurland: the following year it appointed a programme manager, Andrew Moore. The programme consisted of events and training initiatives that brought scientists face-to-face with members of the public and influential groups such as school teachers.

*The whole area of science and society was something that I thought that EMBO should not avoid, although we had no expertise in the area, and we weren't quite sure what we were going to do. We had every sort of angle on it that you could think of. We gave prizes for Science & Society, we had articles about Science & Society – we tried to get the community to engage.*

An annual EMBO|EMBL Science & Society conference discussed a wide range of topics, while EMBO created an Award for Communication in the Life Sciences and a Writing Prize for young scientists. Members' meetings, EMBO workshops, Young Investigators' meetings and Fellows' meetings have all added discussions on science policy to their programmes. A detailed study of the difficulties that prevented women scientists from progressing in their careers at the same rate as men, which took place in 2001, led to the launch of restart fellowships for scientists who had taken a career break for family reasons. Subsequently these fellowships were mainstreamed into the EMBO long-term fellowship programme.

In 2000, the same year that the Science & Society programme was launched, EMBO also started a new journal, *EMBO reports*. Gannon thought there was a need for a different kind of journal that could give EMBO a voice on a wide variety of topics.

*The EMBO Journal was a fantastic success and it was making money that was very useful to allow us to do things, and I pondered whether we should have a second journal… I saw it as a business opportunity, and also another opportunity for EMBO to raise its profile. The EMBO fellowship meetings made me realise that there*

*was a need for discussion among scientists beyond the papers. EMBO reports could be everything that The EMBO Journal was not. It could carry not full papers but short papers. The EMBO Journal no longer carried reviews – so we would have reviews. There was nobody reporting on scientific meetings and I thought that was a huge opportunity. And the whole discussion about science and society was growing. I thought EMBO had an opportunity, if not a responsibility, to do something in that space.*

Gannon was himself the founding senior editor of *EMBO reports,* a post in which he continued until 2009. Through his monthly editorials, he addressed a wide range of issues concerning science policy, science and society and the conduct of science, a body of writing that reflects many aspects of his personal experience as a scientist and science administrator.

As well as examining the relationships and responsibilities of science within the society that supports it, EMBO began to look outside its traditional geographical boundaries. The definition of Europe had expanded massively since its foundation. The initial 10 countries that had signed up to be members of EMBC had expanded to 25 by 2000 (it now stands at 27). However, even with this enlarged constituency, Gannon saw the potential for EMBO's reach to be truly global.

*If people think EMBO is the prime organization in Europe, then it doesn't have to be inward looking. Thirty per cent of our fellows were going abroad to the United States, and about ten per cent were coming in… We also had associate members who were great scientists around the world.*

Gannon had previous experience that led him to explore the possibility of EMBO engaging with the massive growth in bioscience and technology research that was then under way in China. More Asian connections were made by his role as an advisor to the newly formed A-IMBN (Asia-Pacific Molecular Biology Network), which is modelled on EMBO and still retains strong links with it. In 2001, the EMBO Council decided to establish a World Programme that would extend EMBO's interactions with the global community, especially in certain emerging countries. The programme offered the same tried and tested formula that EMBO

had established within Europe: workshops and practical courses (in association with other international bodies such as the United Nations Educational, Scientific and Cultural Organisation and the International Cell Research Organization), funding for keynote lecturers to travel to conferences, and fellowships to allow scientists from these countries to benefit from short-term visits to laboratories elsewhere. The interaction with China could clearly help to bring Chinese scientists into the world molecular biology community.

> *The number of papers coming in [from the Asia-Pacific region] to The EMBO Journal was surprisingly high. It became inevitable that if you were going to do something about China you would also do something about other countries such as India, Brazil, and South Africa. So we thought about what we should do and put together a world programme. That grew, and with it Council looked for more associate members from the emerging countries.*

South Africa was the first of these countries that sought a closer association with EMBO, something that Gannon was keen to encourage.

> *I could see an advantage to EMBO scientists in having closer links with the countries that were known as emerging economies, and South Africa was clearly the one on the African continent. But more than that, they had different problems, disease material, multiple cases of tuberculosis in the same individual, lots of things that were non-standard – and building up links there would also change and improve their science. All these things seemed to be positive. So we came to an agreement with the Pretoria government.*

From 2004, the separate fellowships and courses that had been managed through the World Programme were integrated into existing programmes.

## 5 Policy advice and strategy

By the early 1990s, EMBO was well established and its impartial opinion was seen as a valuable commodity by its member states. When Austria wanted an outside organization to review the quality of its

molecular biology effort, it naturally turned to EMBO. At the time, John Tooze was still the Executive Secretary, already overcommitted with his many responsibilities. When Frank Gannon arrived he handed over the request from Austria with the words 'This is the poisoned chalice.' Gannon, fresh in the job and keen to raise EMBO's profile, put together a review of the Austrian Molecular Biology Programme within his first year.

> *The reason why the Austrian scientists wanted it was because the Austrian physicists had had a review, and the government had given them more money. And the biochemists said 'Do us too.' So I had to imagine how to put together a review of a country. I thought I would have to have a report on all of those that were in positions – and defining that was hard – of running the laboratories. There were people who were annoyed because they were included, and people who were annoyed because they were excluded, so I presume that was wrong. And then there were those who refused to participate. I set it up with an all-German panel (for language reasons) chaired by [the German biochemist] Kurt von Figura, a very excellent straight, analytic person. We produced a report highlighting that our review had revealed a total blockage in their system: that if you were an aspiring scientist and you wanted to get a job in Graz, you stayed in Graz, and you worked for the Herr Professor Professor, because he was eventually going to give you the job. We threw a little light on that.*

Soon afterwards another request came in to review the Biotechnology Programme in Finland, and by that time Gannon felt he had a better understanding of how to go about it.

> *We did a better job in Finland and we had a big impact. We learned a lot of lessons doing that. We put together an international panel, chaired by Lennart Philipson, to do it, and it was very rigorous, and it ended with an event in Helsinki with all the scientists that were being reviewed. And the results were revealed in a very Scandinavian, open way, and some people who were heroes were told*

*they were hopeless, and they were very good with the media. It was a very brave thing but it was done with such seriousness that the parliament released new funds for science. We did an interesting one in France. The French government had set up a number of different Génopoles. We were called in to decide if they were doing a good job. I remember we brought Mike Ashburner in on it, and initially he was totally negative about this top-down French programme. And then he came back from his visits and he was totally positive and said how wonderful they were. So we got good people who were unafraid, who were willing to write down what they saw and what they thought, and I got the report together.*

EMBO subsequently set up panels to review molecular biology in Spain and Hungary. The reviews were a reaction to requests from individual countries or organizations. However, EMBO and its Executive Director also had ambitions to influence how policy was implemented at the European level.

One concern was the way much of the research funding from the European Union was distributed. The successive Framework Programmes were 'top-down' exercises that identified areas of priority and invited scientists to bid for part of the programme. Many scientists felt the greater need was for more 'bottom-up' funding, to support the research ideas of creative, independent scientists. While the European Union did this on a small scale through the Marie Curie fellowships for young scientists, an increasing number of scientists within Europe wanted to see a 'European Research Council' (ERC) on the model of national research councils, that would be open to all on a competitive basis. EMBO took a lead in pursuit of this objective.

*What the scientists were saying was that the programmes were not rewarding excellent science. They were going in to support the economy. It was top-down, trying to nudge people to do what industry wanted. The Marie Curie programme was very good: it supported excellent postdocs, and although we were working in the same space, we worked very well together. What was not available in*

*Europe was anything that was bottom-up: investigator-driven research didn't really get a chance. Those of us who believed that excellent research is necessary for an excellent result, weren't able to have access to this growing amount of money. The member states were putting more money into science because they had accepted that good science meant good economies. The problem was how do you get the European Union to fund an ERC?*

Eventually Gannon thought he detected that after years of resistance (and some resentment) towards EMBO's insistence that excellence should be the only criterion for awarding funds, there might be some softening of the European Union position. He took the opportunity to write an editorial calling for a European research council or equivalent to the United States National Science Foundation.

*Because of that I was invited with Fotis to a meeting in Sweden, when Sweden had the European Union presidency. One of the people from a Swedish bank said 'Do you realise that we spend more money per cow [in the European Union] than we do per scientist?' And the feeling was that there was a lot of money in the agricultural programme that was being spent on the past and not on the future. There were reviews carried out in the European Union about investing in the future, and in knowledge, and that language was beginning to filter through the committees.*

By 2002, the campaign for a European Research Council was gaining momentum. European research ministers called on European Union member states and the European Commission to discuss the purpose and scope of a Europe-wide research council. Taking over the presidency that year, the Danes convened an expert group to examine the feasibility of such a funding body.

*The Danes had a very transparent view. They said 'We are not driving a policy – we want to hear from people on this. Although they went in neutral they came out convinced they had to do something. They were convinced, but the European Union officials were not. I decided that EMBO should take a lead in this, because it was a*

*campaign that was Europe-wide. [The Denmark-based cancer researcher] Julio Celis, who was still the chair of the EMBC, was very involved in this, and he was also Secretary or Secretary General of FEBS. We decided we would establish the European Life Sciences Forum.*

The European Life Sciences Forum was founded in 2000 jointly by EMBO, FEBS, EMBL and ELSO (the European Life Sciences Organisation, a pan-European organization launched the same year to hold annual congresses in the life sciences whose first President was Kai Simons).

*The European Commission respected ELSF, and they always sent a representative [to meetings], and the commissioner came once or twice. And then at one meeting the Director-General for Research Achilleas Mitsos, said 'The problem is that we are hearing different things from different scientists.' So I said 'Fine, we're going to broaden ourselves from the life sciences to all sciences, to establish the Initiative for Science in Europe.*

The Initiative for Science in Europe was formed at the end of 2003, with the founding members being the European Life Sciences Forum, EuroScience, the European Science Foundation, the European Physical Society, the European University Association and the Group of European Nobel Laureates.

*We held the first meeting in Ireland, at the Royal Irish Academy. It became undeniable that all the scientists were saying the same thing. Then the argument that came again and again was 'we can only give money for economic benefit.' And we said 'But you will have economic benefit indirectly.' And eventually at one meeting Mitsos came and he agreed – that he could see the benefit of all Europe working together, competing with each other to get the best out of it. It was just one of those 'what happened?' days.*

The European Research Council (ERC) was launched in 2007 with a budget of €290 million to support grants: Fotis Kafatos, having ended his period at EMBL, was its first President. The first call for proposals was for what were known as ERC Starting Grants, aimed at early-career

researchers looking to become independent research leaders. There was no restriction on the research topics that could be funded. The response was almost overwhelming: ERC had to sift over 9000 applications. By 2012, the ERC had awarded grants totalling €4.2 billion to more than 2,500 early career and advanced researchers of 53 different nationalities working in some 480 different institutions across Europe. The commitment to excellence was underlined when two ERC grant recipients won Nobel Prizes for physics, in 2010 and 2012. However, while Gannon himself always associated the name of EMBO with excellence, he continues to worry about the impact of nothing-but-excellence criteria on those who need more support.

> *I'm not necessarily beloved by all of those in the ERC because I think they've made one tactical error. Eighty per cent of the funding goes to three countries, and 80 per cent in those three countries goes to three cities. And that is the absolute consequence of supporting excellence only. You are getting all of the other countries that are weaker to support, at a growing level, an activity that is benefiting the already strong. There are some groups that are getting so much money they don't need it, it's not going to make any difference. For the early-stage researchers it would make a difference and that ERC programme has made a difference. But they need to do something about the weaker countries. I've argued that they should have a separate competition, for those countries that spend less than the European Union average. And I think with time if that doesn't happen it will come to bite them. The political dialogue goes on, but the ERC is terrific and it wouldn't have happened without EMBO.*

In 2007, Gannon was moving on from his role at EMBO. Under his leadership the organization had taken on the size, shape and ambition that it retains today, and become an influential force in science policymaking. He moved back to Ireland, where he headed the national research funding body, Science Foundation Ireland.

# Frank Gannon

*Ambitious expansionist and compulsive networker*

Born in Galway in the west of Ireland, EMBO's third Executive Secretary Frank Gannon has built a career out of seeing possibilities where others might not see them, for himself and for the organizations he has worked for.

*'I'm pretty international,'* he says. *'I did my PhD in Leicester. After that I went to the University of Wisconsin-Madison and I changed from being an enzymologist to being an oestrogen receptor person. Then back to Strasbourg [as an EMBO Fellow] in Pierre Chambon's laboratory. And I think that was where I started making my networks.'* After six productive years in France, Gannon decided to go back to the University College Galway in Ireland.

*'When I went back there I wrote a letter saying 'I'm going to do three things. I'm going to have a laboratory that is respectable at world level. I'm going to introduce genetic engineering into the scientific community there. And I'm going to have an impact on industry through biotechnology.' '* Despite the under-resourcing of Irish universities – Gannon was criticised for using the telephone too much – he achieved all three.

As one of Ireland's few international scientists (he was elected an EMBO member in 1983), Gannon represented his country on various European Union committees, one of which was chaired by EMBL Director Fotis Kafatos. *'At the end of one meeting I heard that John Tooze had stepped down [as EMBO Executive Secretary],'* he says. Soon afterwards at a meeting in Brussels he was approached by Fotis Kafatos and Mike Ashburner and encouraged to apply for the job.

*'I recall saying to Mary [his wife], I'm 45, it's going to be a very hard life trying to keep the show on the road in Galway. So we looked at different aspects, like where was the Irish economy going at the time? Down the drain. Was it likely that our daughters would stay in Ireland when they grew up and qualified? No. Therefore why feel that we should stay in Ireland?'* As detailed elsewhere in this book, Gannon stayed at EMBO from 1994 until 2007, developing programmes such as the Young Investigators, World and Science and Society, all of which continue in some form today.

After EMBO, he returned to Ireland as director of Science Foundation Ireland (the funding agency for all areas of research in Ireland). *'Every year I asked the scientists 'What industries are you interacting with, if any?' And it became the most powerful tool I had with the government. I was able to tell them that there were 400 industries working with 600 scientists that had been selected and funded by Science Foundation Ireland on the criterion of their research excellence at any level.'*

For his latest move Gannon has returned to his first love, research. Since 2011 he has been director of the QIMR Berghofer Medical Research Institute in Brisbane, Australia, where he also heads a small group working on control of gene expression. *'Running a medical research institution is quite different from running EMBO or Science Foundation Ireland,'* he says. *'I've shifted along the line to be much more demanding of people to make good use of their science. Because the money that's going into research from the countries needs to be justified.'*

# 5

Chapter 5

# EMBO embraces the life sciences

*From the organism to the molecule and back*

## Introduction

In its first three decades, EMBO had expanded the range of its activities and established itself as an influential voice in the world. For its Directors, the challenge is now to adapt to rapid change in both science and world affairs, and to plan for the future.

## 1 We'll meet again

Hermann Bujard, who had played such an important role in bringing EMBO and EMBL to Heidelberg, is still an active scientist, working on a vaccine to treat malaria. Having spent most of his scientific career in the city, he had always had a close relationship with EMBO, and was a Council member from 1989–1994, the period that saw the launch of *The EMBO Journal.*

> *I felt honoured, sitting there with Jeff [Gottfried] Schatz, [Pierre] Chambon, Jeff Shell and others. I was on the first editorial board of The EMBO Journal. John [Tooze] lived just around the corner from where we lived, we had a good exchange – John even paticipated in one of our seminars on phage genetics. The students enjoyed that.*

Nevertheless, he was surprised when the then Secretary General of EMBO, Christiane Nüsslein-Volhard, asked if he would take over as Executive Director. Thinking it would be a matter of months, he agreed. The EMBO secretariat had grown very rapidly between 1999 and 2007, with new people being brought in as new programmes developed. Bujard saw it as his first task to organize the staffing and systems so that managers were in place who could run activities smoothly and efficiently regardless of who was in charge. *'Hermann gave it a structure and simplified many procedures,'* says Maria Leptin, who would eventually succeed him. *'It was a really fantastic piece of work.'* He also introduced the ideas that certain committees of Council, such as the publications and Science &

Society committees, should include external advisers with special expertise, rather than only molecular biologists. At the same time, he felt that the title of EMBO's chief executive needed updating. Frank Gannon had shifted from Executive Secretary to Executive Director: now Bujard simplified the title further.

> *I felt [the post] should be simply called Director, and have full responsibility to execute what the Council wants EMBO to do. But in order to get the Council to decide what it wants to do, I think the EMBO Director has to make proposals. After all council members are elected on their scientific merits, not necessarily because they are particularly experienced in policy matters and politics…*

The major new development that Bujard undertook was to restore the annual symposia that had been discontinued not long after they began in 1974. Then the aim had been to bring people to Heidelberg: with EMBO and EMBL now well established, Bujard saw them as having a broader educational purpose.

> *I was pleased that Council supported the idea of a large meeting in Europe. There are more than 300 million Europeans… why should a young scientist from Turkey have to travel to Los Angeles when he or she can participate in an equally fine symposium in Europe, for example in Istanbul? So there might be a bit of European ideology behind it, but I think it does not hurt, if we create more identity at this level.*

He was not the first person to be thinking like this. Kai Simons had founded ELSO in 1999, an organization set up principally to hold an annual life sciences meeting in Europe. ELSO had always struggled with a lack of resources. Bujard brought in a professional team led by Suzanne Beveridge to handle the administration, and the two organizations collaborated on the final ELSO meeting at Nice in 2008. The inaugural EMBO Meeting took place in Amsterdam in 2009; since then it has gone to Barcelona, Vienna, Nice and back to Amsterdam in 2013. The meeting attracts around 1500 participants, and Bujard would like it to be even bigger. He believes passionately that these meetings, which cover a wide range of topics in the life sciences, are important for inspiring

young scientists. However, it is an argument that does not find universal acceptance.

> *Many of my younger colleagues feel their students have to go to the more specialised meetings. This is well taken. However, they also need a broader outlook… this is the aim of The EMBO Meeting. We had fantastic lectures, for example from the former president of the Royal Society, Sir Martin Rees. I tried to establish the tradition that we have one lecture that gives a view from outside molecular or cell biology, and he gave a talk 'From the beginning of the Universe to the biosphere.' He spoke for an hour – I could have listened to him for two hours. It was fantastic. When I invited him, he said he felt very honoured but that as a physicist he found our field so complicated that he didn't feel competent or justified to talk to us. What an understatement. Another time, we invited primatologist Franz de Waal, who works on the evolution of morality. Well, I think we have to work on the attitude of our colleagues so they allow the time for their coworkers and for themselves to participate in these broad scope symposia.*

As time went by and no permanent Director was in prospect, Bujard became fully engaged with EMBO's activities on the world stage. His work on malaria had taken him to Africa many times, and strengthening science in emerging countries is something in which he believes strongly. Although the initiative has to come from the local scientists, EMBO can provide a useful framework for cooperations through its Global Activity Programme, which he initiated.

Bujard intended to run EMBO while continuing to pursue his research. He ended up running EMBO for a full three years, but getting back to his research was always his goal.

> *I didn't foresee how much work it would be. Several times in my life I had the choice of moving up, to being a fonctionnaire, or going to the lab, and I always decided to go to the lab. Having my students and co-workers and looking at the data. I still like this best.*

## 2 Ask a busy person

Maria Leptin thought she was the last person who would accept the post of Director of EMBO when Council began to look for someone to succeed Hermann Bujard. Like him, she knew the organization very well from the inside. Elected a member in 1996, she joined (and later chaired) the membership committee that also had oversight of publications. And she was elected to Council in 2009. One of the reasons that Council was having such difficulty appointing a new director was that they had made it a condition that the appointee should be an active scientist. As Hermann Bujard had found, combining the oversight of a large international organization with running a top-class laboratory is not easy, and not many would be prepared to take it on. Leptin is a professor at the Institute of Genetics at the University of Cologne, where she runs a lab working on mechanisms of development and immunity. She has a second group based in the EMBL. She is also a past and present member of numerous scientific advisory boards, evaluation panels, and editorial boards. As the old adage goes, if you want a job done properly, ask a busy person. And Leptin believes in EMBO as an organization.

> *I loved it, otherwise I would never have taken this job. People said I was crazy! I thought it was a great organization, the work they were doing was good, the people here were great, that's why I considered it. Scientists don't like to take on jobs like this. It took me over a year to think about it, but it was somehow clear that I would do it. I think it was the right decision for the recruitment committee to say that they wanted to recruit an active scientist. It's very important, because an organization can develop a kind of tunnel vision otherwise. It's important to have access to the community all the time, to be seen by them as one of them.*

When she was interviewed for the position of Director of EMBO in 2010, she told the panel she thought everything was working well. And in general, her experience has borne out that impression.

> *I know everybody in the building: we're 50 people – half of them are editors – and we have eight managers who talk on the corridor all the time. So things can*

*in fact be done from one day to the next. I have the support of Council: if we need to make quick decisions I can ask them by email. They are fantastically wise people. It's a great organization in the way it's run.*

The core of EMBO's activity remains the programme of fellowships, courses and workshops, as originally established by the founders. While these run smoothly and are highly valued across the community, the way scientific careers have changed means that EMBO has to think how best to distribute its resources. And since the 1960s, when EMBO pioneered such Europe-wide fellowships, other sources of funds have become available to young scientists.

*Do we want [more fellowships] or do we want elite quality? The fellowships have to become more competitive: other organizations give more; postdoctoral training has changed from a brief two year stint to a long five-year period of preparing to establish your independence; we have to take account of that. Fellows used to be able to spend two years with no social security. It didn't matter, they'd get a job afterwards. Now postdocs often have to wait five years, going from one fellowship to another.*

On taking up the post Leptin was interested in developing two areas in particular: the organization's involvement with European central science management and policy, and the work that was going on to support science outside Europe. However, the one area where she thought she would have nothing to do – scientific publishing – has turned out to be one of most demanding of her time.

## 3 New publishing models

Much has changed since the days when John Tooze documented journal papers on index cards and sent manuscripts for review in brown envelopes. Electronic publishing has brought new opportunities, both for existing journals and for new publications. Simultaneously with electronic means of production and distribution, the much bigger upheaval occasioned by Open Access has given any journal publisher much food

for thought. EMBO was no exception, as Leptin found during her time on the membership and publications committee.

> *A lot has happened in the way papers are reviewed, in the way journals are sold, in the way journals are used for careers, the impact factor: these things needed addressing. Pernille Rørth [executive editor of The EMBO Journal until 2009] had done a lot of work on that and the current director of publishing [Bernd Pulverer] has really carried that forward.*

The seismic change in scientific publishing came about as a result of increasing levels of discontent about the high cost and secretive reviewing practices of traditional journal publishing. The movement towards Open Access, meaning that journal articles were free to online readers while scientists paid a fee to have them reviewed and published, became unstoppable. In 2003 and 2004, publication of *EMBO reports* and *The EMBO Journal* had switched from Oxford University Press to Nature Publishing Group, a move that increased the visibility of both journals. Manuscript submission and tracking moved online, as did refereeing, with a new publishing database set up in 2005. Both journals had online as well as print versions. Launching an online-only journal was a logical next step.

> *Open Access became an issue in the early 2000s, and I remember when Frank was director we were talking about starting another journal. I was on the publications committee, and it became clear that if one started another journal it would have to be Open Access. It was then decided to start in a field where that philosophy would be most likely to resonate with the community, and that was systems biology. And that's how EMBO started Molecular Systems Biology, as an Open Access journal.*

*Molecular Systems Biology* was launched under the joint ownership of EMBO and Nature Publishing Group. It provides *'a forum for the publication of papers describing the molecular properties and behaviour of complex biological systems,'* and supports structured data formats such as Systems Biology Markup Language (SBML). In 2007, it added an associated blog, called *The Seven Stones* (blogs.nature.com/sevenstones).

The journal has proved very successful, and despite the fact that like all Open Access journals it covers its costs by charging fees to authors, it has enjoyed a high rate of submissions. When the time came to launch another new journal, *EMBO Molecular Medicine,* it was not immediately envisaged as Open Access.

> *Again EMBO looked for a field where there was a need, and there was a niche. Molecular medicine, the translational aspect of molecular biology, was becoming requested by many on the political side. The first year it was open – and that went quite well – but from year 3 the publishers planned to sell subscriptions. In 2010 we had to decide what to do – it was one of the first things I faced. Here was our new baby journal, which was attracting good papers, and which was now going to be made closed. So we started trying to convince the publisher, Wiley-Blackwell, that it would have to be Open Access.*

Leptin was concerned that if the journal was subscription only, it would not generate enough subscriptions, due to increasingly tight library budgets and a way had to be found to make the journal economically viable. She worked with the head of publications Bernd Pulverer and his deputy Thomas Lemberger who is also editor of *Molecular Systems Biology.* Between the three of them they gradually developed a case that would convince the publishers.

> *First we got an impact factor: you get an impact factor after two years, and it was very high immediately, so that was good. It made the journal more attractive: we immediately got more submissions. So we finally convinced them to go Open Access. It was a huge financial risk, which we had to discuss with Council. Council allowed it, we did it, and immediately the submissions went up again. So far it's a success story, but it was a hard and very interesting period of negotiations.*

Another issue was the constant grumble that anonymous, secret refereeing could allow referees to indulge personal biases that were unfair to authors. EMBO has sought a move towards a much more open system of refereeing, which preserves quality but eliminates bias.

*Pernille Rørth was editor of The EMBO Journal while she was a scientist here at EMBL, and she changed a number of things about the way she worked with the editorial team – it was very intensive, very analytical. She introduced procedures for dealing with papers and for reviewing for the editors. First she introduced the transparent review, where the reviews are published alongside the paper. Which means that the referees are more careful about their tone. One of the things we have introduced since is called referee cross-comment, which means that when the referees' reports come in they are circulated among the referees [before the editor makes a final decision]. So the referees can see what the others wrote and comment on it (all anonymously). It's very good because it weeds out [unfair] extremes.*

Since then further adjustments have been introduced, all of which add up to a set of procedures known as '*transparent process*.'

*It's not uncommon in some of the big journals that if, after you've submitted a paper, another one comes out covering the same area, they say 'sorry, it's no longer novel.' So that you get scooped and you are left with empty hands after three years' work. We said that is outrageous. If the paper is submitted before anything else like it is published, then we consider it original, so there's scooping protection. And there's a long list of other provisions – I call them the commandments. It keeps the standards high. We just have to keep reminding the scientific community that that's one of the things we do, and that's one of the things I find important.*

At a time when questions have been raised about the quality of Open Access publishing – there is evidence that publishing outfits across the world have gone into it just for the money, and are less than rigorous about peer review – EMBO's dual role as a publisher and a scientific academy has stood it in good stead.

*We're in a good place – we're between the membership, who are the scientists – I'm a scientist, so I really*

*represent the scientists side more than the journals side – and we have the journals. So we're really in a good position to do as publishers what the community needs. We have now set up an EMBO Press with Wiley and HighWire, a visible external unit with all four journals, where we can actually promote our policies.*

## 4 An identity for EMBO

The question 'Who – and what – is EMBO for?' needs to be asked and answered at regular intervals, and the answer changes as the science and the scientific environment changes. As the tools of molecular biology have pervaded almost all areas of life science, EMBO itself has broadened its focus, beginning with its name: since 2012 the organization has been branded as *EMBO – Excellence in Life Sciences*, and the acronym (that highlighted both Europe and Molecular Biology) is no longer spelt out on documents such as the annual report. Leptin feels there are good reasons for the change.

*The history of EMBO was very special. It started at a time when there was a scientific focus – when there was a new science that needed to be spread. A group of people saw this and noted the example of CERN and said 'We want the same.' So it started around a focus, and it started very small, and it started with dedicated people who pushed it ahead. Everything happened to be right. I don't think you could do it now.*

From maybe 300 people all across Europe who called themselves molecular biologists, the community now numbers thousands, and the boundaries between disciplines have become ever more blurred. Leptin's aim is to be as inclusive as possible.

*We've stopped spelling out EMBO, so that people who are not yet interested in the molecular basis of [the life sciences] don't feel excluded. Molecular biology has expanded, that focus has gone… The membership represents about 80 per cent of the*

*life sciences, which doesn't make sense, because there's this 20 per cent who are left out.*

The 20 per cent include those working across the full range of neurobiology, from magnetic resonance imaging to optogenetics; and those working in areas such as ecology and biodiversity, looking at living organisms in the broader context of their habitat and social organization. Such sciences had been looked on as belonging to *'old fashioned'* categories, such as physiology, zoology and botany, but are now becoming increasingly important as the intensive study of life at the molecular level begins to shift its focus to whole organisms and ecosystems. For EMBO's anniversary, the Membership Committee is seeking to boost these two under-represented areas by fielding selected lists of nominees. This is a project dear to Leptin's heart.

*I hope that this engagement with all the life sciences will work. I hope that these communities will feel wanted and engaged, and will propose more members from their communities. I think it's very important that we become European life sciences and not just molecular biology.*

Meanwhile, Leptin worries less than some of her predecessors have done about the confusion that continues to exist, even within the community, about the respective roles and relationships of EMBO and its sister organization, EMBL.

*I get on extremely well with EMBL and with Iain Mattaj as Director. EMBO and EMBL are different, and the community doesn't understand that. It's hopeless to try and explain. But I think it probably ends up benefiting both of us. They are the lab, we are the academy. We cooperate wherever we can. For our birthday in 2014 we will have a joint event for policymakers and politicians. We hold a joint conference series at EMBL's ATC [Advanced Training Centre]; many of the EMBO courses are held there as well because they are run by EMBL scientists. For EMBO our mission is to spread training throughout Europe, and for EMBL it's to bring people here to learn about what EMBL does. There is an overlap. We collaborate, but we do actually do very different things.*

## 5 EMBO, Europe and the world

EMBC has more than doubled the number of its constituent member states, which now total 27. These include many former Eastern Bloc countries, as well as Turkey, which have a long way to go before they can match the resources for science enjoyed by countries such as the United Kingdom, France and Germany. Maria Leptin is only the latest of EMBO's directors who have had to face the challenge of running EMBO's programmes in a way that is fair to all and still retains excellence as the overriding criterion.

> *Not everybody is equal. Some countries feel that they don't get enough out of EMBO, but I have to say that of all the 27 member countries, during the period of crisis over the past three years, not one has pulled out. That's very impressive. Countries profit in very different ways. So people in Britain get fellowships, lots of people want to go to Britain, lots of people want to go to Switzerland. But that's because the science there is good, they have excellent structures, they put a lot of money in, and they are both very open to international exchange. Britain and Switzerland have very large numbers of foreign scientists. And if you look at who is getting the fellowships, they are often not British or Swiss nationals.*

In common with the European commissioner for research, innovation and science Màire Geoghegan-Quinn, Leptin believes that if countries want to get more out of EMBO or the ERC, they need to look at their own national investment in science.

Meanwhile the Installation Grants Programme continues to perform well. One of the original recipient countries, Portugal, has already had two of its grantees accepted into the Young Investigator Programme.

> *Turkey had five installation grantees in 2012, and these young people are doing wonderful work in the country. Turkey was one of the countries who felt they weren't getting enough benefit from EMBO, so we have invited them here and discussed with them what they needed. Iain Mattaj and I went there to talk to their political leaders,*

*to their research granting organizations, to the ministry. We engaged in ways of talking to them, advising them, getting their young investigators together, identifying with them the gems they have there, and advising how they might use them better and how they might get more out of us. And that's happening. We're now working on integrating the Installation Grantee concept with the Young Investigator concept in a more coherent way.*

*There's a very clear principle that the only thing we go by is excellence. And then it is hard for some countries to compete. So we have to find a way where everybody can participate, but we don't have quotas and we don't compromise quality.*

EMBO has continued to engage with countries outside Europe including, for example, India, China, Taiwan and Singapore. Cooperation agreements provide a way for the countries concerned to participate in EMBO activities, with the expectation that they will make a financial contribution.

*The country gains access to all EMBO programmes. They have access to the fellowship programme anyway. The bar for a fellow to go outside Europe is slightly higher than for fellowships within Europe: that bar is lowered to equal with Europe for cooperation countries. They gain access to courses and workshops: courses and workshops can be held in those countries, and they are being held.*

## 6 The Science Policy programme

EMBO continues to monitor and support the progress of women in scientific careers, an activity that continues to be overseen by Gerlind Wallon along with the Young Investigator Programme and the Installation Grants. Other aspects of what used to be called Science & Society have now been developed and formalised into a Science Policy Programme led by Michele Garfinkel, who joined the office in 2011. Its principal aim

is to establish more, and higher level, contacts with the European Union. Leptin sees this as a key role for EMBO.

> *Science and politics are so different…Here is what could easily be called an academy. We have as our members the 1600 top life scientists in Europe. Yet EMBO is not asked about policy issues by Europe. Neither are we asked by individual member countries: if they need advice on release of microorganisms, plant modification, stem cells, they ask their own national bodies. But they could ask an international body with no national bias and a much broader body of expertise.*

Already the new focus is bearing fruit, although Leptin would like to have five times as many people working on it.

> *I'd love to have a policy group of ten people, then we could be more effective, but for now we have one manager and one assistant working on this. And we begin to see effects. Michele has been asked to sit on committees, working groups and so on, she's bringing in money to do analyses and studies. And we were involved in consultations on Horizon 2020 [the European Union's €70 billion research and innovation programme for 2014–2020]. There was the Nobel Prize winners' letter [22] calling for protection of the science budget in Horizon 2020. Together with the Initiative for Science in Europe [ISE] of which we and EMBL are members, we coordinated a huge collection of signatures.*

If she didn't have enough to do already, Leptin accepted the presidency of the ISE in 2010, underlining her commitment to a strong voice for the scientific community in Brussels.

> *Michele talks to the coordinator Wolfgang Eppenschwandtner, and they've just put together a working group of the ISE on Open Access. They both talk to Europe. We've had Anne Glover [Chief*

22 Published on 23 October 2012 in European newspapers including the *Financial Times*, *Le Monde*, and the *Frankfurter Allgemeine Zeitung*.

*Scientific Adviser to the President of the European Commission] here, so she knows we're there for advice. She's asked for input from the community and we will try and mediate that. We are getting there, they are aware of us, but it needs constant direct contact.*

EMBO's founders acted directly in response to what they perceived as an American advantage over Europe in molecular biology. While in some senses science is now a global community, Leptin still sees competition with the United States as a driver of continued improvement.

*Individual scientists want an optimal environment to do their science in. It is clear that the American environment, if measured by Nobel Prizes, papers per dollar, papers per person, patents, is the better environment. And it's clear that the environments within Europe differ vastly. Of course Europe wants its patents, its Nobel Prizes, its applied research to have start-up companies. So yes, there is competition, because that brings money and wealth. Each country has to look after itself, and Europe has to look after itself. That's something where policy advice can help. It's amazing how much each country wants this, yet does not look at what it is in those countries that do well, such as Britain and Switzerland.*

But quite apart from the willingness of individual countries to invest in science and build structures that support it, Europe still suffers relative to the United States from being a union of 27 very different countries, rather than a single large country. Sorting out the problems that result requires a massive dose of political will.

*In America, if you don't get tenure at Harvard there are dozens of other opportunities in the next tier universities. And Americans are mobile, they are happy to move. Here the mobility between countries is very difficult, so if you don't get tenure at the LMB in Cambridge, you can't easily move to a university in Karlsruhe in Germany, or to the Pasteur, for example, because you lose your pension or it's a different language and your children are at school... Europeans are more sessile by nature, but there are also*

*actual practical things that make it harder to move. And yes, we are engaged in working on career progression, for instance on the idea of a mobile pension. The European Union is working on that with the idea of the European Research Area [ERA], with scientists' passports to enable them to move. But you can imagine how hard it is, because that involves national governments agreeing on all sorts of things that are hard for them to agree on.*

It might seem surprising that it takes so much effort for an organization representing the cream of European life science to gain the ear of those in government. But outside its field, EMBO is less well known than its members might realise. Leptin is not unduly worried about this low public profile.

*It is surprising how few people know about EMBO even within science. If you say the Royal Society, everyone knows – it's royal, it's old. The French Academy everybody knows. But EMBO is not so well known. I don't know why not. It would only matter if it affected the way EMBO was able to work. And I'm not sure that is the case. Would it be better? Probably – the better known you are the more clout you have, the more people will listen to you. But our own community listens and appreciates us.*

# Maria Leptin

*Multitasker extraordinaire*

When it came to finding a new Director of EMBO in 2010, the members of Council were determined to appoint an active researcher. Few can compete with the level of activity of Maria Leptin, a professor at the University of Cologne's Institute of Genetics. As well as running research teams in both development and immunology, she has served on EMBO committees, including Council. She has been chair of a review panel of the Advanced Grants for the European Research Council since its inception in 2007.

Leptin is still somewhat surprised to find herself in an administrative role. *'My whole life has been like that,'* she says. *'I never did what I planned to do.'* She still runs her lab in Cologne, commuting back and forth from Heidelberg weekly.

Leptin did her PhD at the Institute of Immunology in Basel, where she used to go and listen to talks in molecular biology at the Biozentrum. Later, determined to shift fields, she did her research and made applications. *'I ended up with someone to whom I hadn't applied, working on a subject that I had definitely excluded, just because I liked the lab and the project best,'* she says. She joined Mike Wilcox at the MRC Laboratory of Molecular Biology in Cambridge, using antibodies to study cell surface molecules during development in *Drosophila*.

Having determined on a group leader position in America, she ended up going to the Max Planck Institute in Tübingen. Leptin planned to go back to England, but was also offered a job in Cologne. At the University of Cologne, she helped establish the Graduate School for Biological Sciences and currently serves on its Executive Board.

Leptin is an EMBO Member since 1996. She joined EMBO Council in 2009, when the search for a new director was in full swing. And history repeated itself when she was asked to apply. *'If someone asks me to do something I tend to do it,'* she says.

Now she also heads a group at EMBL, using the superb imaging facilities to study cell shape determination in *Drosophila* and innate immune responses in zebrafish. *'One needs the science to stay sane – grounded in reality,'* she says.

# 6

Chapter 6

# Future visions

*A few last words*

*For those who came in at the beginning, the growth and development of EMBO have been remarkable. Where the organization will go in the future will very much depend on where the science goes.*

# John Tooze

For John Tooze, it is the technological change since he joined EMBO in 1973, the massive growth of the field, and the pressure to do target-driven research, that represent the biggest challenges.

> *I think molecular biology itself has changed beyond recognition. The technical developments – gene cloning, DNA sequencing, protein sequencing, synchrotron radiation, mass spectrometry, bioinformatics – it is just not the same world as in the 1970s. The technical capacity is astounding. I think there is a problem at the minute that people are able to accumulate data faster than they might be able to interpret it. The employment prospects for new postdocs are pretty bleak if they want to stay in academic research – I do think that causes enormous pressure to publish in prestigious journals, but also the outflow of data is such that publishers can proliferate journals endlessly and still find material to fit into them. Funding agencies are being expected to try and discover things of economic or medical utility. The real breakthroughs come from work that seems to have no practical application whatsoever. I mean who would have thought that looking at restriction enzymes in bacteria that can chop up foreign invading DNA would lead to cloning? The world is best served by a large chunk of its academic research money being spent on purely open-ended research for its own sake, because that's what in the end produces extraordinary technological development.*

# Jim Watson

For Jim Watson, still engaged with research and courses at the Cold Spring Harbor Laboratory, a current preoccupation is how science is to be funded in a period of great social change. He sees EMBO as being in a strong position relative to Cold Spring Harbor Laboratory.

> *Cold Spring Harbor today cannot compete with the support that EMBO has, because NIH support has gone down, and we do not have any inherent wealth... Cold Spring Harbor's future is fragile unless they can get more substantial endowment behind their teaching... EMBO has money to support EMBO fellows through its transnational funding model.*

# Georges N. Cohen

Georges Cohen, who still at over 90 years of age goes in to work each day at the Institut Pasteur in Paris, has also seen great change, and has his own ideas about where the future of life science lies. Despite his life-long career working on microbes, his choice falls at the other end of the evolutionary spectrum.

> *When I first came here [to the Institut Pasteur] in 1943 the population was about 250 people, and now there are 3000. And they were all French – it was during the German occupation. Now there are people of all nationalities. Molecular biology is part of our lives now, but at that time it was something very new. Now it's just what biochemistry was when I was younger. The interesting thing to come is neurobiology. If I had to make a new career now I would go into neurobiology. Consciousness, the biochemistry of memory – how can you choose something that happened 50 years ago and bring it back to your mind?*

# Hermann Bujard

Hermann Bujard points out that molecular biology has expanded far beyond the borders surrounding it when EMBO began, when the subject was almost exclusively concerned with microorganisms. Now it is important to understand not just how individual organisms work, but how they interact.

*I'm now in infection biology – it is a most exciting field. In malaria you see evolution at work: three genomes – parasite, mosquito, human – co-evolving. And there are many other fascinating systems. I shock my friends from the liberal arts by saying the human body is a hollow tube filled with microorganisms interacting among themselves and with the human system. At first glance this utterly complex symbiosis is a strange idea but that's what we are made of. Unravelling the interactions between the human system and the microorganisms it harbours or gets infected with will yield deep insights into how complex eukaryotes, of which we are probably the most intricate one, came about. A problem I see in present day research is that too often scientists have to involve themselves in programs and networks made up to investigate the obvious in order to secure sufficient grant support. We should recall the success of the "individual researcher grant" policy which, if done properly, favours the original independent researcher. Discovering and furthering these talents has to remain EMBO's foremost task.*

# Sydney Brenner

Sydney Brenner is best known for his work on the nematode *C. elegans*, which he chose partly because he thought it might be simple enough to study its functions all the way through from genes to behaviour. It was an over-ambitious project at the time. But today, perhaps, we are on the verge of answering some of the outstanding questions.

> *Finding out how things work at the molecular level is increasingly important. The big challenge today is the nervous system, no doubt about it… How you build a brain, how you build this kind of brain as opposed to any other kind of brain: this is going to be important. And I think that's the most important area to populate now. Most people that work with genes know nothing about neurons, and people that work with brains know nothing about genes. So we have these two fields that clearly should be united. Because the new thing is that we can do human molecular biology: we can find out about ourselves. And I think the human is the most important animal in the world. I think the really challenging problems will be in finding out about this peculiar animal that invented molecular biology. It's the only animal that thinks it can see the future. The future is what we can see with the only brain that can talk about the future.*

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