DOI 10.24412/2076-8176-2021-2-143-157

The Fifth International Congress of Biochemistry, Moscow, 1961

Jérôme Pierrel

University of Bordeaux, Bordeaux, France; jerome.pierrel@u-bordeaux.fr

The Fifth International Congress of Biochemistry was held in Moscow sixty years ago, on 10-16 August 1961. Back then it was the biggest event with thousands of participants and proceedings counting more than 3,500 pages. Comparing this congress with the preceding and succeeding events held in Vienna in 1958 and in New York in 1964 allows to identify both the qualitative and the quantitative trends in biochemistry. Furthermore, the Fifth Congress marks a turning point in the history of molecular biology because it was during this congress that Nirenberg announced the cracking of the genetic code. The rest of the abstracts, however, certainly deserves more attention. The congresses of this size promote fruitful exchanges among scientists but rather in the spirit of "Olympic internationalism". At the same time they also provided an international scientific audience for the whistleblowers on nuclear fallout. In the early 1960s, the international congresses of biochemistry and zoology were facing the same challenges (their heterogeneity and size, the issue of molecular biology) but biochemistry dealt with these challenges more successfully than zoology.

Keywords: international congress, biochemistry, molecular biology, genetic code.

The Fifth International Congress of Biochemistry was the first to be held outside Western Europe. Held every three years, the first one took place in Cambridge UK in 1949, the second in Paris (1952), the third in Brussels (1955), the fourth in Vienna (1958) (Slater, 2000). The Moscow congress was the largest one which was held up to then. They were about 1700 participants in the first one, around 3000 in Vienna while more than 5000 people have attended the Moscow congress (Slater, 2000, p. 332; Whelan, 2003). It was only superseded by the 1964 New York congress with an attendance above 6000 (Ochoa, 1964, p. 9). Such a "mammoth" congress, held in one week, was attended by many scientists, students, and even journalists. Given its size, it is only possible to describe its main features (qualitative and quantitative) and to describe in more details some abstracts. It is also possible to analyze selected trends and issues as Konashev did while analyzing Soviet participation at the series of International Congresses of Genetics (Konashev, 2010).

Results

The congress took place at Moscow University, while Moscow was celebrating the safe return of its second Cosmonaut, Herman S. Titov. Alexander I. Oparin was the president of the congress, Norair M. Sissakian was Secretary-General of the congress, Vladimir A. Engelhardt was the president of the scientific committee.

The congress of biochemistry includes three different types of communications. Two plenary lectures were held (by US biochemist David E. Green and Czech biochemist František Šorm). There were 8 symposia and 28 sections (27 were included in the program but the 28th, "biochemistry of lipids", was included in the proceedings)[1].

The eight symposia

They were edited as eight separate volumes and constituted, according to Engelhardt (1961, p. 1109), the most important part of the congress, in particular because they examine current problems. Their topics are listed in Table 1. These titles reflect the priorities of the congress as shown by a comparison with the proceedings of the previous (Vienna) and the following (New York) symposia. For instance, in Moscow, steroids and antibiotics were not longer topics for a separate symposium as they were in Vienna (despite, of course, being present in the sections, see Table 2). The proceedings start with a volume entitled "Biological Structure and Function at the Molecular Level" edited by Engelhardt. As pinpointed by Hargittai (2007, p. 33–34), Engelhardt wrote that he had proposed this title because the previous one, "molecular biology", had not been accepted by the organizing committee (Engelhardt, 1982, p. 16–17). One shall point out that "molecular biology" as such was also not retained as a title for the proceedings of the next meeting in New York where the president of the congress, John T. Edsall, said in his opening remarks (1964, p. 4):

> One could imagine that biochemistry, in becoming so all pervading, might have lost its separate identity. Indeed we see some of our closely affiliated colleagues, including some members of this audience, advancing to the conquest of the unknown, carrying a banner emblazoned with the word, "Biophysics". Others carry a similar banner labeled, "Molecular Biology". Regardless of those labels, all of us are dealing with the biological problems at the molecular level; the biophysicist working at this level perforce becomes a biochemist, and the biochemist commonly must master some of the tools, and some of the outlook, of the physicist. For myself, I am happy to continue being called a biochemist, while hailing the biophysicists and molecular biologists as fellow workers in the same field.

Molecular biology was thus a challenge for biochemistry, but a challenge from within that was dealt with.

The total number of communications at the eight symposia was 227 (without chairman's introductions and conclusions, discussions). While 39 % of the abstracts published in the sections were written by a single author, in the symposia, 65 % of the communications (147 out of 227) were made by a single author which shows that symposia gather a different

[1] This has been pointed out by Bud (2014). The program of the congress is available online. Cold Spring Harbor Archives Repository. James D. Watson's files. File JDW/2/14/6. Retrieved February the 21 st, 2021 from http://libgallery.cshl.edu/items/show/53878

type of communications than the sections. In the symposia, the communications look more like authoritative lectures. In case of communications with several authors, none were the product of an international team of authors. A further argument which shows how distinct were the symposia is that they included a pleiade of Nobel prize winners. Among the authors from the symposium "Biological Structure and Function at the Molecular Level", two were already Nobel prize winners (Lipmann in 1953 and Ochoa in 1959, both in medicine and physiology) and four more were awarded the prize in the following years: Kendrew (chemistry, 1962), Jacob and Monod (medicine and physiology, 1965) and finally Nirenberg for the very work he had presented in the Moscow congress (medicine and physiology, 1968). At the time of the congress, together with the first symposium, the third (Tatum) and the fourth (Theorell), included communications by Nobel prize winner. Later, many Nobel prizes were awarded but the highest total number was to be found in the first symposium[2]. Only speakers from the last symposium, dedicated to more applied sciences, have not yet been awarded a Nobel prize.

	Title	Editor	Communications	Single author (%)	USA	USSR
I	Biological Structure and Function at the Molecular Level	Engelhardt V.A.	33	48	17	4
II	Functional biochemistry of cell structures	Lindberg O.	24	79	8	3
III	Evolutionary biochemistry	Oparin A.	38	82	22	6
IV	Molecular basis of enzyme action and inhibition	Desnuelle P.A.E.	26	50	14	4
V	Intracellular respiration	Slater E.C.	22	55	12	2
VI	Mechanism of photosynthesis	Tamiya H.	27	67	15	5
VII	Biosynthesis of lipids	Popják, G.	32	63	18	3
VIII	Biochemical principles of the food industry	Kretovich, V. L. and Pijanowski, E.	25	72	4	5
			227	64	110	32

Table 1. Topics of the eight symposia held. Bottom: sums and mean
(in the case of the percentage of communications with a single author)
Таблица 1. Темы восьми проведенных симпозиумов. Внизу: суммы и среднее значение
(в процентном соотношении указаны сообщения с одним автором)

[2] Here is the full list per volume:

1. 5 prizes, all in medicine and physiology apart one: Lipmann (1953), Ochoa (1959), Kendrew (chemistry, 1962), Jacob and Monod (1965), Nirenberg (1968).
2. 1 prize: De Duve (medicine and physiology, 1974).
3. 2 prizes, both in medicine and physiology: Tatum (1958), Wald (1967).
4. 4 prizes: Theorell (medicine and physiology, 1955), Lynen (medicine and physiology, 1964), Anfinsen (chemistry, 1972), Moore and Stein (chemistry, 1972), Boyer (chemistry, 1997).
5. 1 prize: Boyer (chemistry, 1997).
6. 1 prize: Calvin (chemistry, 1961).
7. 1 prize: Lynen (medicine and physiology, 1964).

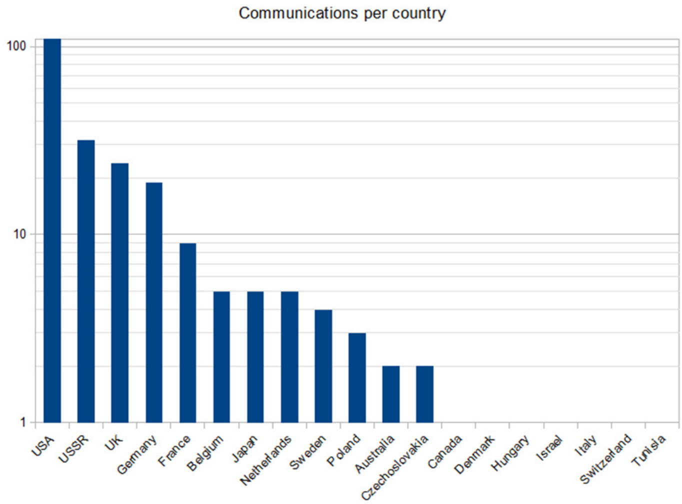

Fig. 1. Number of communications per country at the eight symposia
Рис. 1. Количество сообщений от каждой страны на восьми симпозиумах

One may notice also the lion share of the US in the symposia (50%), whereas the host country share, USSR, is 14 %, the second largest one (Fig. 1). The highest number of contributions, both total, US and Soviet, is found in the third volume edited by Oparin.

The 28 sections

Most of the communications of the congress were included in the sections (Sissakian, 1963a). A total of 2218 communications were included in 28 sections (Table 2). At the closing session, the Secretary-General of the congress said that (Sissakian, 1963c, p. 54):

> 2600 papers and communications were read and discussed at the two plenary sessions, 8 symposia and 28 sections. A wide discussion developed in which 1596 speakers participated.

It means that communications must have been discarded by the editors or given up by the authors in the editing process. However, this figure remains much higher than in the New York congress which includes a total number of 664 communications in its program.

The number of abstracts per section range from 28 (section 25, Biogeochemistry and biochemistry of trace elements) to 203 (section 5, Enzymology). While the average number of communications per symposium was 28 with a standard deviation of 5,4, the average number of communications per section was 79 with a standard deviation of 48. The dispersion is much higher and one can conclude that sections accommodate the variability of biochemistry across topics while symposia seem to fit a more fixed structure. This was indeed the case: symposia were carefully scheduled while sections were filled according to the received abstracts (Engelhardt, 1961, p. 1109).

A major difference with the symposia was that USA and USSR shares are almost equal, they are accounting for a quarter of the total number of abstracts each. However, their patterns of contributions are quite distinct with huge differences in some sections, the extremes being found in sections 5 and 24. The next five countries represent a quarter of the number of abstracts (Fig. 2). Thus seven countries represent more than 75 % of the abstracts. At the New York congress, the share of USA was similar (46 %, with 304 communications) while the Soviet one was much lower (less than 3 % with 18 communications). This reflects an asymmetry on traveling possibilities.

In contrast with symposia where two-thirds of the communications are signed by one author, in the sections, less than 40 % of the abstracts are authored by a single scientist. Abstracts were thus more representative of a team-work at the bench rather than a lecture style communication at the symposia.

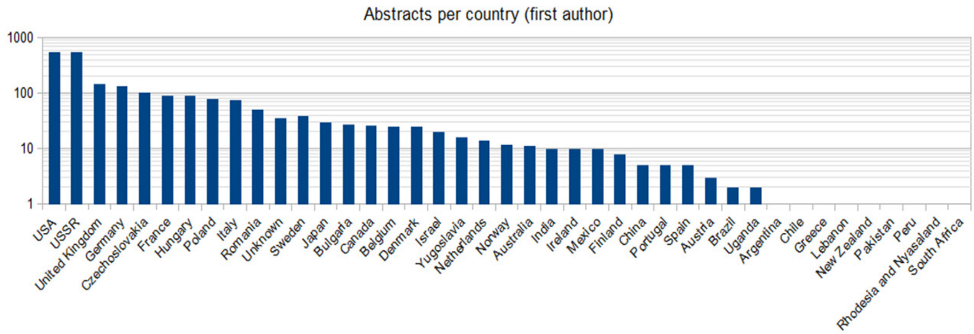

Fig. 2. Number of communications per country (of the first author) at the twenty-eight sections
Рис. 2. Количество сообщений на страну (первого автора) в двадцати восьми секциях

It was reported in the proceedings that scientists from 58 countries attended the congress (Sissakian, 1963b). Only 40 different countries can be listed among the 2218 abstracts published[3]. While, as we have seen, most of the abstracts were signed by two or more authors, there were only 19 abstracts signed by authors from different countries (in New York, there were only 8). International collaboration was thus the exception. Only one abstract is signed by scientists from the two sides of the Iron Curtain (in New York, there was none): abstract 11.5, by Polish and French scientists.

The French case

French scientists did not deliver plenary lectures but gave 9 communications at the symposia[4]. There were 93 abstracts from France in the sections (in three case, as a second country). The majority is from Paris (50 out of 90). The highest number of French abstracts,

[3] This number reaches 42 if one takes into account the symposia, which include a communication from Switzerland and Tunisia. Countries of the United Kingdom have been merged in our dataset.

[4] The full list is:
— vol. 1: 3 (F. Jacob and J. Monod, F. Gros and H.H. Hiatt, G. Cohen);
— vol. 3: 1 (J. Roche);
— vol. 4: 1 (P. Desnuelle);
— vol. 6: 2 (R. Wurmser, A. Moyse);
— vol. 7: 1 (E. Lederer);
— vol. 8: 1 (L. Genevois).

Section	Title	Communications	Single author (%)	USA	USSR
1	Chemistry of compounds of biological interest	84	35	21	19
2	Biochemistry of proteins and amino acids	201	35	65	31
3	Biochemistry of nucleic acids and nucleoproteins	128	40	48	23
4	Biochemistry of viruses	31	35	13	1
5	Enzymology	203	36	68	22
6	Comparative and age biochemistry	48	52	7	16
7	Biochemistry of antibiotics	44	23	6	13
8	Industrial biochemistry	33	55	2	22
9	Cyto- and histochemistry	43	47	7	15
10	Muscle biochemistry	72	36	13	16
11	Biochemistry of the nervous system	66	39	16	16
12	Vitamins and nutrition	84	36	19	24
13	Biochemistry of hormones	117	33	37	23
14	Biochemistry of microorganisms	163	38	34	22
15	Plant biochemistry	121	58	14	43
16	Clinical biochemistry	118	40	15	40
17	Biochemistry of carbohydrates	68	35	22	16
18	Biochemical pharmacology	71	27	19	17
19	Biochemical genetics	29	48	14	4
20	Immunochemistry	59	41	15	14
21	Biochemistry of malignant tumours	49	29	15	11
22	Biochemistry of photosynthesis	52	50	10	29
23	Respiration and oxidation	74	39	27	10
24	Radiation effect on biochimical processes	72	39	9	40
25	Biogeochemistry and biochemistry of trace elements	28	61	3	22
26	New apparatus and methods	57	54	11	16
27	Varia	39	41	8	10
28	Biochemistry of lipids	64	25	21	11
Total		2218	39	559	546

Table 2. Topics of the twenty-eight sections. Bottom: sums and mean (in the case of the percentage of communications with a single author). The number of communications is counted according to the first author.

Таблица 2. Темы двадцати восьми секций. Внизу: суммы и среднее значение (в случае процента сообщений с одним автором). Количество сообщений подсчитано по первому автору eleven, is found in section 5 Enzymology. More interestingly, scientists experts on RNA, who were prime movers in the field of molecular biology in France, had communications at the congress: François Gros and François Jacob from Paris, Jean-Pierre Ebel from Strasburg, Roger Monier from Marseille[5]. In May 1961, Gros, Jacob and colleagues, in two separate papers in *Nature*, had been publishing the discovery of the messenger RNA (Gros et al., 1961; Brenner et al., 1961). In July, Ebel and Marianne Grunberg-Manago organized an international symposium on RNA and polyphosphates in Strasburg (Grunberg-Manago and Ebel, 1962). Among the 64 authors of communications at the Strasburg congress, 20 were also authors of communications at the Moscow congress a month later. Among them, five had communications at symposia (H. Fraenkel-Conrat, F. Gros, G. Schramm, M.S. Smellie, A.S. Spirin). Later on, Ebel and Grunberg-Manago were key in the French-Soviet cooperation in molecular biology (Kisselev, 2008, p. 71). RNA was making headlines in science at that time and it was also at the heart of Nirenberg's announcement.

Case Studies

We will study more closely three abstracts taken from sections. The first one was an obvious choice, considering its fate in science. Compared with this one, the remaining two have fallen into oblivion. However, we have picked them because they reveal other aspects of this congress that were relevant during the Cold War.

Nirenberg & Matthaei

The abstract submitted by Marshall Nirenberg and Heinrich Matthaei, entitled "Comparison of ribosomal and soluble *E. coli* systems incorporating amino acids into protein", was included in section 2, "Biochemistry of proteins and amino acids". This was certainly relevant since the abstract was about their results with a cell-free bacterial extract incorporating amino acid, in other words, synthesizing proteins *in vitro*. Their abstract has two intriguing features. First, their system lacks a definite messenger RNA. In fact, the deadline for sending the abstract was December the 31st 1960 and at this point, the messenger RNA had not yet been discovered (*cf. supra*). When the abstract was submitted, as shown by Rheinberger (1997, p. 209), Nirenberg and Matthaei "shared the prevailing picture of the ribosome, whose RNA — or part of it– they believed played the rôle of a template <…>". Second, it lacks the mention of the genetic code and includes nothing about the deciphering of the genetic code. Did they fail to mention it? The answer is no. At that time, the famous poly-UUU experiment, proving that UUU is coding for phenylalanine, was not yet performed. This occurred in late May 1961 (Kay, 2000, p. 252–253). It was communicated to the *Proceedings of the National Academy of Science* in early August, a few days before the congress and was thus published afterwards. As a consequence, most participants were unaware of their breakthrough. The story of how the public was stunned by their communication has been told many times[6]. Indeed, the fact that a team of two biochemists beat, so to speak, the

[5] Historian Gaudillière describes those experts as an "RNA network" (Gaudillière, 1991).

[6] See for instance Riddley (2018, p. 127): "<…> Nirenberg gave a 15-minutes talk in a classroom. The talk was sparsely attended, but Matt Meselson heard it and went straight to Crick, who quickly added Nirenberg to a session

RNA-tie club, which was including many influential scientists like Francis Crick or Edward Teller, at breaking the code could remind us the David and Goliath struggle (Kay, 2000). Let us quote Nirenberg (2004, p. 49) about what happened in Moscow:

> I gave my talk in Moscow to an audience of ~35 people. However, Francis Crick invited me talk again in a large symposium that he was chairing on nucleic acids, which I did to an extraordinarily enthusiastic audience.

As a result, their communication was included in the proceedings of the first symposium, which were edited by Vladimir Engelhardt and entitled "Biological structure and function at the molecular level", side by side with communications by other luminaries from the field of molecular biology like John Kendrew, Matthew Meselson, François Jacob, and many others. This communication states clearly, albeit in a scientific, cautious fashion, that the code has been broken:

> Poly-U appears to function as a synthetic template, or messenger RNA, in this system. One or more uridylic acid residues appear to be the code for phenylalanine. Attempts are now being made to determine other letters of the code (Nirenberg and Matthaei, 1963, p. 189).

After the congress, there was a race to complete the code and the remaining «letters» were deciphered in the following years.

Molecular biologist Gunther Stent (1968, p. 394) wrote that after 1963, "By that time many of the details of the genetic code were known <...>". According to Stent, Molecular biology, after having fulfilled the goal of understanding the two functions of DNA, replication and translation into proteins, was now moving to a more "academic phase", lacking the thrill of the early time of the field when its theories were elaborated. In a TV report from December 1965, François Jacob stated that the genetic code was "<...> a very important result, a great achievement of human knowledge"[7]. Finally, Molecular biologist and Historian of molecular biology Michel Morange has recently depicted the communication as the "main event" of the congress (Morange, 2020, p. 134). Retrospectively, it is hard to overestimate the importance of this discovery which led Nirenberg to be awarded a share of a Nobel prize in 1968. But one may also notice that in a dense ten-pages report about the eight symposia published soon after the congress, there was not a single line about this breakthrough (Engelhardt, 1961). One may suggest as an explanation that perhaps, at that moment, the communication of Nirenberg and Matthaei was not expected to be published in the proceedings of the first symposium, whose program has been carefully prepared in advance. Anyway, one might also argue that this communication is an outlier among the 2218 abstracts which outshines the remaining abstracts. There is no doubt that many other abstracts deserve more attention. We shall add two more below, because they are related to the Cold War context.

---

he was chairing at the end of the meeting so that Nirenberg could repeat it".

[7] Original quote: "<...> un très grand résultat, une très grand acquisition de la connaissance humaine" (Barrère, 1965).

Kent & Slade

In section 20, "immunochemistry", was included what seems to be at first a purely technical abstract entitled "20.19 Immunochemically-active cross-linked polystyrene preparations". This communication is about an interesting method for adsorbing antigens from a solution thanks to antibodies linked to a substrate. The paper was coauthored by two scientists, L.H. Kent and J.H.R. Slade, both affiliated to Oxford. Despite this technical appearance, historian Robert Bud has shown that there is a fascinating story. In fact, L.H. Kent was a senior scientist from Porton Down:

> The British delegation included four senior members of staff of Britain's secretive but very large Microbiological Research Establishment at Porton Down, part of the country's War Office, dedicated to preparing against the eventuality of biological warfare with the Soviet Union. The scientists at Porton were working on plague bacillus, producing large quantities to model an attack, for defensive purposes, but, truth to tell, the line between defence and offence in this technology was narrow. The group included the distinguished biochemist. Dr L. H. Kent, who was also the Establishment's distinguished Deputy Director, with the rank of Major (Bud, 2014, p. 452).

Was the visit a spy operation? No, because according to Bud (2014, p. 452): "There was no secret as to who they were (…)".

Indeed, although it was not written in the Moscow abstract, in two previous papers describing the method, Kent and Slade were affiliated to Porton (Kent, Slade, 1959, 1960). In these very two papers, their method was applied to plague toxin and anthrax antigens. Their Moscow communication was an incremental improvement of an already published method. One may thus ask what was the goal of their visit. According to Bud (2014, p. 453), they visited in the meantime their "Comintern counterparts" and up to "eight visits to Soviet biochemical and microbiological laboratories were arranged".

Thus, Bud shows that a large congress like this one may be used to organize behind the scene activities in an inconspicuous fashion.

Genevois & Flavier

Louis Genevois (1900–1989) published two contributions in the proceedings. The first and the main one, entitled "Biochemical improvement of crops" was part of the symposium "Biochemical principles of the food industries"[8]. This was indeed the area of specialization of the French biochemist, who, as a professor of biological chemistry and plant physiology at Bordeaux University, had already worked on fermentations and wines (Genevois, Ribéreau-Gayon, 1947). However, we would like to focus on the abstract he had submitted together with Henri Flavier, his doctoral student, and which was incorporated in the 25th section "Biogeochemistry and Biochemistry of Trace Elements". This abstract is entitled "25.8 Radioactivité des végétaux en terrains sablonneux" [Radioactivity of plants in sandy soils]. In this communication, Genevois relies on his expertise in the field of ion exchanges in plants which dated back in the

[8] Original title in French "Amélioration biochimique des plantes cultivées". Translated by the author.

1920s (Le Roux, 2019). But here, this expertise was applied with a special focus on ^{90}Sr, a radioactive Strontium isotope, which was a concern in the nuclear fallout issue for the Medical Research Council in the UK and the Atomic Energy Commission in the USA (Jolly 2002; de Chadarevian 2006). In this communication, Genevois and Flavier stress that due to the fallout of 1958 and 1959, the level of radioactivity in plants growing in sandy soils in the South of Bordeaux are high in 1960. To our knowledge, such a communication about radioactivity was unusual for Genevois and he started publishing in this field a few months prior the congress, in March (Genevois, Flavier, 1961). Henri Flavier had started collecting data about radioactivity from the fallout in the Bordeaux area at least since 1958 (Flavier, 1963). One may conclude that this is a typical whistleblower communication, in which a scientist, based on his expertise, aims at stressing an issue for a broader (but still a scientific one here) audience. In Moscow, this was to our knowledge the first time that Genevois reached an international audience about this issue. This kind of research was not new because Linus Pauling had already published a scientific paper about the hazards of low dose of ^{90}Sr fallout in 1959. Even earlier, in 1957, many scientists were involved in the Pugwash conferences, but they were concerned with nuclear disarmament. At the Moscow congress, this communication was not the sole about ^{90}Sr. Three others were dealing explicitely in their title with ^{90}Sr but there was no communication including the English term fallout in the title and this communication seems to be the only one explicitely speaking about ^{90}Sr fallout in the abstract. In this respect, this was another contribution to a collective effort by scientists toward preventing future contamination. These efforts were timely, both on a national stage — since February 1960, France had joined the nuclear power club by testing its first atom bomb- and an international stage. But they were at first ineffective since aerial tests continued after the congress (Jahn, 1963). Fortunately, a Limited Test Ban Treaty was signed in 1963 and Pauling was awarded a Nobel Peace prize in 1963.

Discussion

Such a large congress is so multifaceted that it is impossible in a short communication to discuss all its features. We would like to consider here two issues. The first one is how molecular biology, with its new theories and its claims, its techniques sometimes imported from fields outside biochemistry, was a challenge for biochemistry. The second one is about the very meaning of the word *international* in the case of this International Congress of Biochemistry.

The challenge of molecular biology

Molecular biology could be perceived as a challenge for a more ancient and established discipline like biochemistry. Indeed, the very first communication in volume 1 of the proceedings is made by a physicist (based on his methods, X-ray cristallography), John Kendrew, who was the founding editor of the *Journal of Molecular Biology*. We have seen how Edsall at the 1964 congress considered molecular biologists as "fellow workers in the same field". At that time, Jacques Monod was advocating a unifying view of molecular biology stating that it was not a new branch of biology but that rather (Barrère, 1965):

<…> one must consider Molecular biology as unifying biology, as being the basic discipline, the basic theory of biology. All the important results of molecular biology are true both for animals, plants or bacteria <...>[9].

Monod reasoned that, as a result, at the University, the former separated topics like zoology, plant biology, embryology, were no longer relevant if one was looking for the basic causal explanation, which, according to him, was provided by molecular biology[10]. To tackle this molecular level, Monod thought that biochemistry should be part of the training of young molecular biologists but should not define their professional identity. A striking comparison could thus be made between the situation of biochemistry and zoology in the early 1960s. In her study of the 1963 International Congress of Zoology held in Washington, Johnson (2009, p. 428) shows that Zoology was facing the challenge of the claims of molecular biology:

E.O. Wilson has recounted how in the 1960s the heady claims of the molecular biologists, led by James Watson, made the atmosphere in the department of biology at Harvard so stifling that the organismal biologists planned a mass exit.

There was also a second issue for zoology: its very size and diversity. In this respect, zoology and biochemistry were also very similar and what Johnson (2009, p. 419) wrote about zoology could be written for biochemistry, *mutatis mutandis:*

"zoology" had always encompassed a range of research styles and approaches to the study of animal life. Zoologists not only studied a huge variety of organisms, from birds to protozoans, but they also worked in museums, industry, medical faculties of universities, and a range of academic departments. To make matters even more complicated, what zoologists of seemingly the same type did often varied within different countries due to the idiosyncratic historical development of institutions, patronage networks, and links between science, national culture and politics.

As a result, attendances at International Congresses both in zoology and in biochemistry were in the same range with between three and four thousands scientists expected at the 1963 congress (Johnson, 2009, p. 426). However, zoology and biochemistry had different fates. The next International Congress of Zoology was held only in 1972 in Monaco, and was more than ten times smaller. This was the last one until a revival in Athens in 2000. Johnson concludes that zoology "had imploded under the weight of its many sub-disciplines and specialties", but the challenge of the reductionist view of molecular biology bore also a responsibility (Johnson, 2009, p. 451). In biochemistry, congresses were held much more regularly, albeit their attendance decreased also (Slater, 2000). They cope too in a better fashion with molecular biology because it was a challenge from within: the key results of the early 1960s, like the messenger RNA, the deciphering of the genetic code, the sequencing of the first

[9] Original quote: "<...> il faut considérer la biologie moléculaire comme établissant l'unité de la biologie et constituant la discipline fondamentale, la théorie fondamentale de la biologie. Tous les résultats importants de la biologie moléculaire s'appliquent aussi bien aux animaux, aux végétaux ou aux bactéries <...>." Translated by the author.

[10] However, Monod did not include biochemistry, in this list.

tRNA, were mainly got by biochemists. In France and in the Soviet Union, biochemists like Monod and Engelhardt were leading scientists in establishing molecular biology.

Internationalism in science

The world "international" may reflect different conceptions of "internationality". For our purposes, Somsen distinguishes the "The Republic of Letters" of the early modern period in which "Men of learning were supposed to form a cosmopolitan Republic that transcended national rivalries and conflicts", the "Scientific Nationalism" which after the French Revolution combines patriotic values with scientific research, the "Olympic Internationalism" with its international conferences much like Olympic games both as a pacification mean and as allowing to assess the results of different countries, the rise of "Socialist Internationalism" between the two World Wars, according to which science is by essence international (Somsen, 2008).

One would thus expect a "socialist internationalism" tone in the opening and the closing address of the congress. Indeed, the Chairman of the State Research Co-ordination Committee of the Council of Ministers of the USSR, K.N. Rudnev (1963, p. 2), said that "Large scientific gatherings in a country, or on an international scale, are as necessary for the successful development of research as is the publication of scientific papers or exchange of opinions with one's colleagues".

But at the same time, Rudnev (1963, p. 2) emphasized that Soviet Union was "<...> the first to solve the problems of the peaceful uses of atomic energy, creation and launching of artificial satellites <...>".

True, several speakers (Sissakian, Rudnev, Keldysh) had emphasized the achievement of Soviet cosmonaut Titov. Beside these statements, our data fit more clearly an "Olympic Internationalism" pattern, because of the low number of international communications, not to mention the lack of joint paper between the two sides of the Iron Curtain. Promoting understanding, peace, fruitful applications of scientific research in medicine, in agronomy, in human welfare as a whole, was for sure stated as it was in New York in 1964. Yet research remained mostly national in terms of authorship. Still, one important advantage of international congresses is to promote new contacts among biochemists and in this respect, the bigger the congress, the higher the probability of new contacts, here even through the Iron Curtain. At the height of the Cold War, this scientific international congress was maintained and one could contrast it with the situation in the 1930s where some international congresses in Germany and the Soviet Union were cancelled (Doel, Hoffmann, Krementsov, 2005). One may even add that in the case of the symposia, their programs were scheduled according to a process which involved notably both a Soviet scientist and a foreign one in the field of the symposium (Engelhardt, 1961, p. 1109).

Our tour of the Fifth International Congress is now completed. We have only scratch the surface of such a large congress and one may be confident that thousands of stories remain to be told.

References

Barrère I. (1965) [director]. *Trois hommes dans un grenier*. TV report for the Office National de Radiodiffusion Télévision Française. Retrieved from https://www.ina.fr/video/CPF86656428/trois-hommes-dans-un-grenier-video.html (last accessed February 22nd, 2021).

Brenner S., Jacob F. and Meselson M. (1961). An Unstable Intermediate Carrying Information from Genes to Ribosomes for Protein Synthesis, *Nature,* 190, 576–581.

Bud R. (2014). Biological warfare warriors, secrecy and pure science in the Cold War: how to understand dialogue and the classifications of science, *Medicina nei secoli arte e scienza*, 26, 451–468.

De Chadarevian S. (2006). Mice and the Reactor: The ''Genetics Experiment'' in 1950s Britain, *Journal of the History of Biology*, 39, 707–735.

Desnuelle P.A.E. (ed.). (1963). *Molecular basis of enzyme action and inhibition: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Doel R.E., Hoffmann D., Krementsov N. (2005). National states and international science: A comparative history of international science congresses in Hitler's Germany, Stalin's Russia, and Cold War United States, *Osiris*, 20, 49–76.

Edsall J.T. (1964). Opening remarks. In *Proceedings of the plenary sessions and the program: Sixth International Congress of Biochemistry* (pp. 3–5), Washington D.C: Federation of American Societies for Experimental Biology.

Engelhardt V.A. (1961). Piatyĭ mezhdunarodnyĭ biokhimicheskiĭ kongress [The Fifth International Congress of Biochemistry], *Biokhimiia* [Biochemistry], 26(6), 1108–1117. (in Russian).

Engelhardt V.A. (ed.). (1963). *Biological structure and function at the molecular level: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Engelhardt V.A. (1982). Life and Science, *Annual Review of Biochemistry*, 51, 1–19.

Flavier H. (1963). *Mesures des retombées radioactives dans les plantes sauvages et quelques poissons des étangs des Landes près de Bordeaux*. Doctoral thesis, Bordeaux University. (in French).

Gaudillière J.-P. (1991). *Biologie moléculaire et biologistes dans les années soixante: la naissance d'une discipline, le cas français*. PhD thesis, Université Paris VII. (in French).

Genevois L., Ribéreau-Gayon J. (1947). Le vin, Paris: Hermann. (in French).

Genevois L., Flavier H. (1961). Recherches des substances radioactives d'origine atmosphérique dans les végétaux et les poissons de la région landaise, *Procès-Verbaux des Séances de la Société des Sciences Physiques et Naturelles de Bordeaux*, March, the 15th 1961. (in French).

Gros F., Hiatt H., GilbertI W. *et al.* (1961). Unstable Ribonucleic Acid Revealed by Pulse Labelling of *Escherichia Coli*, *Nature,* 190, 581–585.

Grunberg-Manago M., Ebel J.-P. (ed.). (1962). *Acides ribonucléiques et polyphosphates: structure, synthèse et fonctions: Strasbourg, 6-12 juillet 1961,* Paris: Éditions du Centre National de la Recherche Scientifique.

Hargittai I. (2007). *The DNA Doctor: Candid Conversations with James D Watson,* Singapore: World Scientific Publishing.

International congress of Biochemistry (1964). *Proceedings of the VIth International Congress of Biochemistry. New York, USA. July 26-August 1, 1964. Proceedings of the plenary sessions and the program*. Washington D.C: Federation of American Societies for Experimental Biology.

Jahn G. (1963). Award ceremony speech. Nobel Peace prize 1962. Retrieved from https://www.nobelprize.org/prizes/peace/1962/ceremony-speech/ (last accessed February 19, 2021).

Johnson K. (2009). The Return of the Phoenix: The 1963 International Congress of Zoology and American Zoologists in the Twentieth Century, *Journal of the History of Biology,* 42, 417–456.

Jolly C. (2002). Linus Pauling and the scientific debate over fallout hazards, *Endeavour*, 6, 149–153.

Kay L.E. (2000). *Who Wrote the Book of Life?: A History of the Genetic Code*, Stanford: Stanford University Press.

Kent L.H., Slade J.H.R. (1959). Immunochemically active cross-linked polystyrene. *Nature*, 183(4657), 325–326.

Kent L.H., Slade J.H. (1960). Immunochemically-active cross-linked polystyrene preparations, *Biochemical journal*, 77(1), 12–17.

Kisselev L.L. (2008). Half a century later and, still, I am not disenchanted with science, *Comprehensive biochemistry*, 46, 1–113.

Konashev M.B. (2010). Mezhdunarodnye geneticheskie kongressy i sovetskie genetiki [The international genetic congresses and Soviet geneticists], *Istoriko-biologicheskie issleovaniia* [Studies in the History of Biology], 2(2), 9-24. (in Russian).

Kretovich V. L., Pijanowski E. (eds.). (1963). *Biochemical principles of the food industry: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Le Roux B. (2019). *Comprendre la structure moléculaire du vivant au début du XXe siècle : Une biographie scientifique d'Henri Devaux (1862–1956)*. PhD thesis, Bordeaux University. (in French).

Lindberg O. (ed.). (1963). *Functional biochemistry of cell structures: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Morange M. (2020). *The Black Box of Biology: A History of the Molecular Revolution*, Paris: La Découverte.

Nirenberg M.W., Matthaei H. (1963). The dependence of cell-free protein synthesis in E. coli upon naturally occurring or synthetic template RNA. In Engelhardt V.A. (ed.). (1963). *Biological structure and function at the molecular level: proceedings of the Fifth international congress of biochemistry* (pp. 184–189), London: Pergamon.

Nirenberg M.W. (2004). Historical review: Deciphering the genetic code — a personal account, *Trends in Biochemical Sciences*, 29(1), 46–54.

Ochoa S. (1964). Opening remarks. In *Proceedings of the plenary sessions and the program: Sixth International Congress of Biochemistry* (pp. 9–10)*,* Washington D.C: Federation of American Societi es for Experimental Biology.

Oparin A.I. (ed.). (1963). *Evolutionary biochemistry: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Popjak G. (ed.). (1963). *Biosynthesis of lipids: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Rheinberger H.-J. (1997). *Toward a history if epistemic things: Synthesizing Proteins in the Test Tube*б Stanford: Stanford University Press.

Ridley M. (2008). *Francis Crick: discoverer of the genetic code*, New York: Atlas books.

Rudnev K.N. (1963). Opening session. In Sissakian N.M. (ed.). (1963a). *Plenary sessions and abstracts of papers: proceedings of the Fifth international congress of biochemistry* (pp. 1–3), London: Pergamon.

Sissakian N.M. (ed.). (1963a). *Plenary sessions and abstracts of papers: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Sissakian N.M. (1963b). Opening session. In Sissakian N.M. (ed.). (1963a). *Plenary sessions and abstracts of papers: proceedings of the Fifth international congress of biochemistry* (p. 1), London: Pergamon.

Sissakian N.M. (1963c). Closing session. In Sissakian N.M. (ed.). (1963a). *Plenary sessions and abstracts of papers: proceedings of the Fifth international congress of biochemistry* (pp. 53–54). London: Pergamon.

Slater E.C. (ed.). (1963). *Intracellular respiration: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Slater E.C. (2000). International Congresses of Biochemistry — personal recollections, *IUBMB Life*, 49(5), 331–337.

Somsen G.J. (2008). A History of Universalism: Conceptions of the Internationality of Science from the Enlightenment to the Cold War, *Minerva*, 46, 361–379.

Stent G. (1968). That was the molecular biology that was, *Science*, 160, 390–395.

Tamiya H. (ed.). (1963). *Mechanism of photosynthesis: proceedings of the Fifth international congress of biochemistry*, London: Pergamon.

Whelan W.J., Kornberg H.L., Stone B.A., Slater E.C., Campbell P., Tsou C.L., Vella F., Littauer U.Z., Clark. B.F. (2003). 54 years of International Congresses of Biochemistry and Molecular Biology, *IUBMB Life*, 55(4–5), 183–191.

Пятый международный конгресс по биохимии, Москва, 1961 г.

Жером Пьеррель

Университет Бордо, Бордо, Франция; jerome.pierrel@u-bordeaux.fr

60 лет назад в Москве, с 10 по 16 августа проходил Пятый международный конгресс по биохимии. На тот момент это было самое крупное мероприятие: в нём приняли участие тысячи участников, а сборник материалов конгресса составили более 3 500 страниц. При его сравнении с предыдущим и последующим конгрессами, проведёнными в Вене в 1958 г. и в Нью-Йорке в 1964 г., можно проследить тенденции в биохимии как в качественном, так и в количественном отношении. Более того, Пятый конгресс представляет собой поворотный момент в истории молекулярной биологии, потому что именно на нём Ниренберг объявил о взломе генетического кода. Однако остальные тезисы, безусловно, заслуживают большего внимания. Такие конгрессы, учитывая их размер, способствуют плодотворному обмену между учёными, но в большей степени в духе «олимпийского интернационализма». В начале 1960-х гг. международные конгрессы по биохимии и зоологии столкнулись с теми же проблемами (их неоднородность и размер, проблема молекулярной биологии), но первые решали их более успешно, чем последующие.

Ключевые слова: международный конгресс, биохимия, молекулярная биология, генетический код.