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Neuroscience as an international enterprise

Jean-Gaël Barbara, CNRS, 2009
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At the turn of the twentieth century, French biological sciences were widely open to international relations. Numerous institutes and international societies were created, among which was the famous Marey international commission for the control of graphical instruments used in physiology, housed in a new cottage which E.J. Marey built in the *Parc des Princes*, near Paris, and which eventually became the *Institut Marey*, where a new CNRS neuroscience centre was created in 1949 and became the birth place of French neuroscience after the Second World War. At the turn of the twentieth century, the institute was known internationally in the field of physiology and beyond. Many of the most famous scientists of the time were part of its executive committee, the *Association de l'Institut Marey*, with Sherrington, Waller, Ramón y Cajal, Pavlov, Mosso, Einthoven, Kronecker, Frédéricq or Héger. In the field of neurology, the *Brain Commission* enabled international exchange, in particular with the school of Salpêtrière in Paris.

Nevertheless, a marked decline in the international commitments of the French scientific community occurred in the interwar period, in particular in the field of physiology, and particularly nervous physiology. The weight of Parisian institutions and the power of full chair professors and physicians, especially in hospitals and the *Faculté des sciences de Paris* led to a characteristic isolation of local schools.

The revival of the physiological sciences of the nervous system after 1945 in France was made possible by the development of a national research strategy developed by the French government and the *Centre national de la recherché scientifique* (CNRS) in the novel integrated international context,

with the active role of the Rockefeller foundation[1], the United Nations[2], and the scientists themselves who organised international conferences to promote scientific exchanges with the help of novel scientific international organisations (IBRO[3]). The specific context of the Franco-American scientific relations, where the Rockefeller foundation played a major role, must be described back to the thirties, when the scientific leaders in charge of the revival of French science were trained with new standards, such as collaborative work and international exchanges[4].

French leaders understood the ideological and political necessity for peace of developing scientific and technological cooperation between nations, in a broad perspective, with foreign funds, especially from the Rockefeller foundation and the US Air Force in the field of neurophysiology. These ideas were general in the biomedical sciences as can be seen in the policy of the Rockefeller foundation and the actions of Louis Bugnard (1901-1978). Bugnard was a polytechnician, professor of physical biology, assistant manager of the French Anticancer Centre (1942-1945), and the director of *Institut National d'Hygiène* (INH) after 1946. In 1946, he was sent to visit the American medical research committee between December 1945 and April 1946, with Alfred Fessard (1900-1982), a leading Parisian neurophysiologist, missioned by the CNRS. Together, they planed to visit and select the best research laboratories in the US to send them for training the best young French fellows.

The way such scientific cooperation was planned was not new, but it followed what the best French scientists did for themselves in the thirties, often thanks to political support of biomedical research, in particular by the Rockefeller foundation[5]. A large and important network of Rockefeller fellows was created[6], which was extremely profitable to neurophysiology after Second

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[1] L. Tournès. Les élites françaises et l'américanisation : le réseau des boursiers de la fondation Rockefeller (1917-1970), Actes du colloque (université Paris-I/Institut de Hautes Etudes Internationales de Genève, 13-14 juin 2003), *Relations internationales*, n° 116, novembre-décembre 2003, pp. 501-513. L. Tournès, Le réseau des boursiers Rockefeller et la recomposition des savoirs biomédicaux en France (1920-1970), *French Historical Studies*, janvier-mars 2006, pp. 77-107.

[2] P. Petitjean. The Post-War International Laboratories Projects, in Sixty Years of Sciences at Unesco, 1945-2000, P. Petitjean, V.Zharov, G.Glaser, J. Richardson, B. de Padirac, G. Archibald (eds), 2006, pp. 52-57.

[3] The Josiah Macy conferences, the conferences of the Ciba Foundation of London, those organised by Ivane Beritashvili, director or the Physiological Institute of Tbilisi and those by Henri Gastaut in Marseilles. Early history of IBRO: the birth of organized neuroscience, *Neuroscience*, 1996, 72, 283-306.

[4] L. Tournès, 2003, 2006, *op. cit.*

[5] La fondation Rockefeller et la recherche biomédicale, J.F. Picard, éd., Paris, 1999, PUF. L. Tournès, 2003, 2006.

[6] L. Tournès, 2003, 2006, *op. cit.*

World War. Bugnard worked in the laboratory of the Nobel Prize winner Archibald V. Hill, while Fessard received a fellowship twice, in 1936 and 1939, to visit two British laboratories, among which that of Nobel Prize Edgar Adrian[7]. Fessard will keep close contacts with Adrian, but also Sherrington and his pupil John C. Eccles throughout his life. These connections highlight the particular need to track networks of scientists for at least two generations to fully understand how a scientific policy was able to shape a new area of research and reorganise the patterns of disciplinary boundaries[8].

The early revival of French neuroscience after 1945 is part of a broader story beginning in the thirties, in the context of French-American cultural exchanges in science, where the field of biomedical sciences was considered highly important to society. It was felt that it should be reshaped by the French Government, the Rockefeller foundation and NATO, with an interdisciplinary strategy where relations between biology and physics and biology and medicine should be favoured[9]. This context explains why disciplines such as biochemistry, molecular biology and parts of histology were selected[10]. However, little attention has been paid to the importance given to the developments of neurophysiology and neurology and their relations in the thirties and after the Second World War. These fields were, nevertheless, of immense importance, since they evolved in the sixties and later in the gigantic movement of neuroscience.

In the field of French neurophysiology, the international commitments of a leading Parisian figure, Fessard, were highly controversial in Parisian scientific circles. Louis Lapicque, professor of physiology at the Sorbonne, the

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[7] Alfred Fessard was first given a grant by the Rockefeller Foundation for six months to go to England, at Plymouth, in a laboratory of the *Marine Biological Association*, to work with zoologist, Alexander Sand (1901-1945), on the stretch receptors in the pelvic fin of the Ray with an oscillograph built by B.H.C. Matthews. In 1939, with a new grant from the Rockefeller Foundation for 4 months, Fessard joined the physiology department of Edgar Adrian in Cambridge, to work under the supervision of Brian Matthews. Fessard was able to record unitary potentials from dorsal roots of spinal cord which they called for the first time « synaptic potentials ».

[8] Our study relies on the work of L. Tournès on the networks of the Rockefeller fellows in the field of biomedical research. Our study can also be related to the work of Picard, 1999. The latter study indicates the need to study identified networks of scientists in particular fields. This was done by Tournès in the last years, mainly focusing on biochemistry and molecular biology. We thank him for providing his articles and for discussions. We aim here to focus on a rather different domain, also in between biology, physics and medicine: neurophysiology. This discipline, which eventually led to Neuroscience, highly benefited from a large variety of international networks, where the Rockefeller foundation and the United Nations played a major role.

[9] L. Tournès, 2003, 2006, *op. cit.*

[10] *Ibid*.

leading French neurophysiologist, was close to several British scientists, including Nobel Prize A.V. Hill. However, he never collaborated directly with his British colleagues. On the contrary, he struggled against the attacks of the Cambridge school against his theory of chronaxy. Lapicque and his student Alexandre Monnier (1904-1986) did not pay attention to the discoveries abroad in the fifties and sixties. The teaching of Monnier was incredibly centred on French science and the Hodgkin and Huxley model of the action potential was not taught, although Monnier personally knew these scientists[11].

On the contrary, Camille Soula (1888-1963), professor of physiology at the *Faculté de médecine* de Toulouse (1935-1961), the uncle of Bugnard, had close relations with the Oxford School of Sherrington. Soula deplored French physiological sciences lost the willingness to settle international collaborations after the Great War[12].

However, Fessard was an exception and was very active to work with foreign colleagues. Thanks to the help of Henri Piéron, and funds from the Rockefeller foundation and the Singer Company, he was able to create his own independent laboratory away from the Sorbonne in the nearly abandoned *Institut Marey*, whose international relations had been exceptional. In 1939, Fessard arranged an international collaborative work at the marine station of Arcachon (France), where he invited two Jewish emigrants, Wilhelm Feldberg and David Nachmanson, escaping Nazi persecutions, and already settled in the laboratory of Henry Dale (University College, London), and at the Sorbonne respectively. All three together, they were able to demonstrate the cholinergic transmission of the electric organ of torpedo, in agreement with the debated chemical theory of nervous transmission[13].

For Fessard, training abroad and international collaboration were necessary for the revival of French neurophysiology. According to Pierre Buser, Fessard lost too much of his time fighting against Lapicque, whose theory was also under attack in Great Britain and the US. Fessard wished to create his own school, but in a radically different manner, with connexion with his collaborators in Brasil, Great Britain and the US. International relations were necessary not only for the training of his students, but also in order to make their own research plans and to become independent research fellows, as Fessard did when he turned back from the school of Lapicque. But Fessard gathered a wide experience from the very beginning of his career, together with

[11] Philippe Ascher, personal communication.
[12] Yves Laporte. Les débuts de la recherche en neurophysiologie à Toulouse, in L'Essor des neurosciences en France, 1945-1975, C. Debru, J.G. Barbara, C. Cherici, éds., Paris, Hermann, 2008.
[13] V.P. Whittaker. Arcachon and cholinergic transmission, *J Physiol Paris*, 1998, 92, 53-57.

Toulouse, Laugier, Piéron, and also with his colleague Daniel Auger. With his wife Denise Albe-Fessard, he arranged a franco-brasilian exchange program on the electrophysiology of electric fish, with the reknown institute of Carlos Chagas, a former student of René Wurmser.

The way Fessard envisaged international cooperation in neurophysiology was similar to the general commitments of the Rockefeller foundation, the convictions of the network of the Rockefeller fellows of the same age of Fessard (Bugnard, Wurmser)[14] and the policy of the CNRS, when it was created in 1937 by Léon Blum. This policy was continued by Henri Laugier, CNRS director, 1939-1940 anf 1943-1944). Laugier worked in the field of the physiology of work and Fessard was one of his students. In 1946, when Fessard was travelling with Bugnard in the US, Laugier was in New York to revive scientific international relations in a different manner. He was Assistant Secretary-General of the United Nations in charge of social affairs until 1951 in the United Nations Economic and Social Council (ECOSOC)[15]. Laugier wished to establish an international research system based on the French CNRS system with international laboratories[16]. In the field of brain sciences, the neuropsychiatrist Roger Pluvinage made a report in 1948 arguing for the creation of an international brain institute[17]. Together with two other projects, the institute was granted priority by UNSECO[18]. The following year, it was Fessard who took up discussions on the same matter with ECOSOC, suggesting the brain institute could established on the model of the *Centre International de Calcul*[19]. However, the project did not succeed until the international colloquium on EEG in Moscow (1960).

When Fessard returned from the US in 1946, he reported French neurophysiology was way behind the best American teams[20]. This lead to the creation of a CNRS laboratory centred on his former team of the *Institut Marey*, the *Centre d'études de physiologie nerveuse et d'électrophysiologie*. Fessard

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[14] L. Tournès, 2003, 2006. For Tournès, the Rockefeller fellowship program was much more than travel grants. It aimed to establish collaborations between young investigators and the best US laboratories, at a crucial period of their training, generally after Ph.D.
[15] P. Petitjean, 2006.
[16] *Ibid*.
[17] R.J.L. Pulvinage, Projet d'un institut international du cerveau in « Le Problème de l'établissement des laboratoire de recherche des Nations Unies », 1948, 259-294.
[18] Bulletin of the International Statistical Institute, 1952, page 90.
[19] M.A. Ozorio de Almeida, Recherches sur le cerveau: rapport sur la création d'un institut international du cerveau, 1952, 14 p.; NS/BR/1; WS/052.101 ; F.L.Golla, L'Institut du cerveau: les arguments qui militent pour ou contre sa création, 1952; 9 p.; NS/BR/2; WS/062.20, A. Fessard, Projet portant sur la création d'un institut international du cerveau, 1952; 18 p.*; NS/BR/3; WS/062.90.
[20] John McKenzie, personal communication.

headed this laboratory aimed at training young French research investigators in electrophysiological techniques. Best research fellows were sent abroad to learn new techniques in the laboratories Fessard had selected. This was made possible thanks to grants from the French Ministry of foreign affairs and to private foundations, such as the Rockefeller[21].

This research policy benefited to many young scientists in contact with Fessard, Bugnard, or other leading scientists. Alphone Baudouin suggested his nephew Antoine Rémond should apply for a grant, Yves Laporte was informed by Soula and Bugnard, while Fessard and Gastaut respectively sent Buser and Naquet in the US. Other young scientists were Paul Dell and Michel Jouvet. Rémond remembered: "There was a call for grants from the Ministry of foreign affairs for people wishing to go to the States. This was exceptional at that time. French never left abroad. People felt they were so much better in France, that why would we go in America. I applied and got the grant. For the first trip, twenty young physicians went to the States on a "Liberty ship" with a thousand men back home. We arrived in New York and saw the statue of liberty. We were astonished to see shops with all their goods on display […] We were helped during a full month to go all around the country to choose the laboratory we would like to go to. It was amazing! From time to time, we came back to the direction of cultural affairs where excellent people helped us after each visit, when we presented a short report. We were told to go to some other places, and we did. I visited this way Boston, Montreal, Philadelphia. I chose Philadelphia where Detlev Bronk was. He had invented the coaxial needle to record muscles. I also visited Erlanger and Gasser at Saint-Louis, all great names of neurophysiology."[22]

This French policy to select young fellows in the best French laboratories, to enable them to go the US, to visit the best places and to finally choose a laboratory where they would spend several years for training is reminiscent of the fellowship policy of the Rockefeller foundations and the excellent work of its officers[23]. This may be explained by the significant role played by senior scientists in this French scientific policy, who had themselves been fellows of the Rockefeller foundation, part of the same network, and inspired by team working and international collaborations[24].

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[21] L. Tournès, 2003, 2006.
[22] Interview of Antoine Rémond made by Bernard Renaut in 1995. Reproduction with permission.
[23] L. Tournès, 2003, 2006.
[24] *Ibid*.

When French physicians and researchers returned from several years of training usually from the US, or South America or Great Britain for a few of them, they brought back to France novel techniques and instruments. They did not only acquire new skills and expertise in their new areas of research, but also prototypes of new devices and promising electrophysiological recording techniques their French laboratory would benefit from. Henri Gastaut brought back a stereotaxic apparatus from the department of Horace Magoun. Buser and Jouvet learnt how to implant chronic animal with electrodes in the laboratory of Hernández-Peón. Thanks to a grant from the Rockefeller foundation, Scherrer was trained with Percival Bailey and Naquet learnt the implantation of electrodes in the brain stem of the cat, first with the group of Giuseppe Moruzzi (*Instituto di Fisiologia, Università di Pisa*), then in the department of Magoun. Laporte was trained on of muscle spindles, a topic he will pursue at the Collège de France throughout his career. Later, Henri Korn worked with the Nobel Prize John C. Eccles, and Constantino Sotelo learnt electron microscopy of the central nervous system with the pioneer Sanford L. Palay at the Harvard Medical School.

The French policy of research also favoured the coming, training and hiring of young foreign students in many places, including the institute of Fessard. Most of them were people escaping their country for political reasons, but not only. The Czech Ladislav Tauc (1926-1999) was invited to the *Ecole Normale Supérieure* in 1945, as a foreign student after previous work in Brno with Vladimir Ulehla on the electrophysiology of plants. On advice of Robert Lévy, director of the ENS department of zoology, Pierre Buser brought him to the institute of Fessard, where he was suggested to stay and defend his PhD dissertation with Fessard and Alexandre Monnier. With the 1948 events in Czechoslovakia and the communists coming to power, Tauc definitely settled in France and developed cellular neurophysiology in the laboratory of Fessard[25]. Fessard advised him to work on Aplysia, a neuronal model developed by two their foreign students from the school of Henri Cardot (1886-1942) in Lyons, Angélique Arvanitaki (1901-1983) from Greece and Tchou Si Ho from China[26]. Tauc was later joined by two other foreign scientists on the topic, Ian Bruner from Poland, a student of Jerzy Konorksi[27] and Eric Kandel from the US, who imported the model back to the Rockefeller institute in New York, on which he made his discoveries leading him to the Nobel Prize. Tauc, Arvanitaki, Bruner

[25] F. Clarac. Les Neurones géants d'Aplysie et les débuts de la l'électrophysiologie cellulaire in L'Essor des neurosciences en France, 1945-1975, C. Debru, J.G. Barbara, C. Cherici, éds., Paris, Hermann, 2008.

[26] Tchou-Si-Ho, Contribution à l'étude de la physiologie des cellules nerveuses chez l'Aplysie (Bosc et Rion, Lyon, 1942). ZHU Xihou (Tchou-Si-Ho), 朱锡候.

[27] JacSue Kehoe. The history of neuroscience in autobiography. Larry Squire, ed., Vol. 4, Amsterdam, Elsevier, 2004.

and many others obtained research positions in France. Among them, Thomas Szabo from Hungary performed anatomical studies with Fessard[28], Sotelo escaped Franco in Spain and Hersch Gerschenfeld the Peronist Riot in Argentina in 1962. All these scientists developed high standard international collaborations between France and other countries world wide and excellent research.

The multiplication of international relations favoured the organisation of international conferences and the creation of new specialised international societies. For example, when he came back from the international EEG conference in London 1947, Henri Gastaut created the *Société d'électroencéphalographie de langue française*. This enabled him to organise the next year the new international EEG meeting in Paris, where the International Federation of societies for EEG and Clinical Neurophysiology (IFSECN) was founded. Another French speaking society *L'association des physiologistes de langue française* organised meeting in many countries in South America and Eastern Europe. The collaboration between Fessard and Jean Posternak from Geneva in 1950 highlights these privileged relations in the French speaking world. They published together an important review in the *Journal de Physiologie (Paris)* on "The elementary mechanisms of synaptic transmission". This collaboration brought in close contact the Fessard institute and those in Geneva and Lausane, where regular meetings from the *Association des Physiologistes de langue française* were held and strengthened relations between France and Switzerland[29].

Since 1949, the CNRS funded large international colloquia in all areas of research thanks to funds from the Rockefeller foundation[30], which were regularly held in the field of brain sciences. Ten conferences were organised between 1949 and 1978[31]. The important CNRS international colloquium

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[28] P. Moller, B. Kramer, J. Serrier, M. Ravaille-Veron. Thomas Szabo 1924-1993, *Brain Behav Evol*, 1995, 46, 50-60.

[29] M. Wisendanger. Neuroscience, neurologie et neuropsychologie : Quelques liens entre la France et la Suisse romande, in L'Essor des neurosciences en France, 1945-1975, C. Debru, J.G. Barbara, C. Cherici, éds., Paris, Hermann, 2008.

[30] L. Tournès, 2003, 2006.

[31] Electrophysiology (Louis Lapicque, Alfred Fessard and Alexandre Monnier, Paris, 1949), Microphysiology of excitable elements (Alfred Fessard and Alexandre Monnier, Gif-sur-Yvette, 1955), Aging of psychological and psychophysiological functions (Henri Laugier, Paris, 1960), Physiology of the Hippocampus (Pierre Passouant, Montpellier, 1961), Psychophysiology, neuropharmacology and biochemistry of the audiogene crisis (a form of epilepsy – R.G. Busnel, Gif-sur-Yvette, 1961), Anatomical and functional aspects of sleep physiology (Michel Jouvet, Lyon, 1963), Cytology of the anterior pituitary (Jacques Benoit, Paris, 1963), Photoregulation of reproduction in birds and mammals (Jacques Benoit and Ivan Assenmacher, Montpellier, 1967), Motor behavior and programmed nervous activities (Jacques Paillard and Jean Massion, Aix-en-

entitled “Les machines à penser” (“machines for thinking”) in Paris 1951, was the first international conference on cybernetics. Paris was one of the birth place of this field since the famous book of Norbert Wiener, *Cybernetics*, jointly published by Hermann (Paris). French neurophysiologists had close contacts with Wiener and other cyberneticians from the US and Great Britain, and the Paris meeting was a convenient occasion to discuss the relations between mind, brain and machines.

Following a European conference on EEG, Gastaut regularly held conferences in Marseilles (*conférences de Marseille*) which had a great success. The fifth was devoted to “Electric activity of the brain in relation with psychological phenomena” (1955). Naquet recalls: “Western and Eastern worlds could exchange their views on conditioning and reactivity in EEG for the first time since long ago”[32]. Gastaut realised the vast majority of discussions dealt with electroencephalographic aspects of conditioned activities. New parallels between Pavlovian higher nervous activities and modern neurophysiology were drawn. The last day of discussions was entirely devoted to these questions. Gastaut wrote “such results were unpredictable in western countries where circumstances had depreciated Pavlovian methods with the benefit of psychological techniques, and the disappearance of electroencephalographic researches on conditioned reflexes and higher nervous activities.”

This meeting favoured new Franco-Russian scientific relations, made possible after the death of Staline, in the context of Cold War and cybernetics. A large and new interest in Soviet science spread in France and throughout the Western world. The following year, the Symposium organized by the *Association de psychologie scientifique de langue française*, in Strasburg was devoted to conditioning and learning, with the invitation of a Russian developmental psychologist A.N. (Alexis Nicolaevich) Léontiev (1903-1979). A year after, the first International Congress of Neurological Sciences in Brussels gave Pierre Buser and Annette Roger the opportunity to pursue the paper given by Fessard and Gastaut in Strasburg on the neurophysiology of conditioning with electrophysiological correlates and interpretations in terms of neuronal structures, a subject in direct relation with Soviet studies and studies from Russian scientists working abroad. The review was entitled “Interpretation of conditioning on the base of electroencephalographic data”. Much emphasis was put on Russian studies, with a historical international overview, besides difficulties in collecting and translating Russian studies. Since then, a great number of Western studies addressed specific problems from the Russian

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Provence, 1973), Cell biology of hypothalamic secretory processes (Claude Kordon and Jean-Didier Vincent, Bordeaux, 1978).

[32] R. Naquet. Hommage à Henri Gastaut (1915–1995), *Neurophysiologie Clinique*, 1996, 26, 170-176.

literature. We can mention French papers by the Marseilles school, Scherrer, Jouvet and Buser (relating to studies started under Hernández-Peón), and especially those on conditioned secondary cortical responses by P. Buser, A. Rougeul and P. Borenstein.

In 1956, Gastaut was invited by Vladimir S. Sergeevich Rusinov and Georgiy D. Smirnov (1914-1973), both present at colloquium of Marseilles. He proposed Alexander Vassilievich Topchiev, Secretary of the USSR Academy of Science, to have the new "Marseilles' meeting" in Moscow. Naquet called it the "colloque de Marseille à Moscou", which took place in October 1958 at the House of Scientists in Moscow and where the idea of an international brain organization was formulated. The Moscow colloquium was so successful that funds allowed a special survey on EEG, personality and sensorimotor functions.

Related to the multiplication of international conferences and to the renewal of East-West scientific relations was the successful attempt to found an international organization for brain research with the creation of IBRO (1960). However, IBRO was not an isolated endeavour, previous projects were under study in the late forties within UNESCO, and soon, the role of IBRO was taken over by the national Neuroscience societies. It was Gastaut and Fessard who presented the final resolutions at the Moscow colloquium, and Fessard and Herbert Jasper were to write them. They were favourably accepted by UNESCO. Initially, Gastaut wished the foundation of a committee for the study of cerebral mechanisms in the framework of the federation of societies. He clearly formulated his idea at the first session of IBRO in Paris at the *Maison de l'UNESCO*, 4-7 October, 1960[33]. However, Fessard insisted on the necessity to think IBRO in a broader context in affiliation with UNESCO and the CIOMS. He thought the goals of IBRO should be to fund "fellowships for exchange of individual workers", "temporary working teams", missions, conferences, particular in the field of fundamental science, including all aspect of brain researches (anatomy, neurophysiology, ...). Several scientists regretted no clinicians were part of IBRO, however, Fessard thought it was contingent and due to the existence of clinical federations. Within ten years (1961-1971), IBRO funded international workshops in ten different countries, fellowships (39) for scientists from distant countries (13 for Japan). Among host countries, France was among the first (USA 23 fellowships, France 10, Netherlands 9, Sweden 8). IBRO also funded temporary research teams and International training workshops[34].

[33] IBRO first session. NS/IBRO/2, WS/0161.55.
[34] IBRO at crossroads, retrospect and prospects, tenth anniversary report. Review of activities during 1961-1971. UNESCO/IBRO/5.

The creation of IBRO was the result of the international scientific activities during 1955-1960. This period was pivotal for international neurophysiology, where France was at the heart of the revival of East-West exchanges. However, soon after, American and Russian scientists also established close and direct relationships. Wilder Penfield was invited in 1955 by the Academy of Sciences to spend two weeks in USSR, where he met Topchiev and Smirnov[35]. Also, Horace Magoun was continuously interested in Soviet science since the February 1958 Macy conference on "Central Nervous System and Behavior", where Mary Brazier analysed the history of Russian physiology. The two following years, Magoun invited E. Grastyan, V.S. Rusinov, E.N. Sokolov and A.R. Luria[36]. However, Gastaut's meeting in Moscow was by far the most outstanding, with the revival of conditioning studies in various areas including instrumental conditioning (Buser, Rougeul), pharmacology and psychiatry. At the Salpêtrière, Georges Heuyer (1884-1977), holding the first chair of paediatric neuropsychiatry, created the *Laboratoire du conditionnement, chirurgie, psychiatrie infantile*, where Catherine Popov made important contributions, with Jean Scherrer and Léon Michaux.

In the following decade, French neurophysiologists rediscovered the work of Bernstein and Konorski, especially at the Marseille *Institut de Neurophysiologie et Psychophysiologie*. Gilbert Lelord and Jean Massion visited the Nencki Institute of Konorski in Warsaw. Fessard asked them to write a report on their visit, later published in the *Année psychologique*[37]. This was actually part of an exchange with two students of Konorski, Mrs Jankowska and Jan Bruner, working in the Institute of Fessard. A new research topic was developed by Bruner and Ladislav Tauc on conditioning at the neuronal level, a subject Fessard had discussed at the Moscow colloquium. Concepts of integration, facilitation, convergence of heterogeneous paths on a single neurone, and later, desensibilisation, facilitation, heterosynaptic depression and habituation were put together. These paths were opened by Jan bruner and Tauc, then in collaboration with Eric Kandel on Aplysia neurones. These studies will lead to the Nobel Prize of Kandel (2003).

Therefore, France was the site where concepts from West and East merged in the frameworks of Pavlov, Konorski and Lashley. From 1950 to 1960, France witnessed the union of neurophysiologies from areas of the world long separated. Western scientists realized the importance of Soviet science progressively discussing its main implications for contemporary research and

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[35] W. Penfield. A glimpse of neurophysiology in the Soviet Union. *Can Med Assoc J*, 1955, 73, 891-899.
[36] L.H. Marshall. Early history of IBRO: The birth of organized neuroscience. *Neuroscience*, 1996, 72, 283-306.
[37] G. Lelord, J. Massion, A. Fessard. Compte rendu d'un séjour d'étude au Laboratoire de Conditionnement du Pr J. Konorski. *L'année psychologique*, 1963, 63, 51-83.

establishing new collaborations for future decades, especially in the field of cognitive sciences. Franco-Russian neurosciences have always awaken much interactions and passion since the twentieth century, up to the sixties throughout the Cold War.

In relation with Franco-Russian relations, scientific space cooperation favoured international exchanges with USSR, but many other countries, including US and China. These collaborations were developed in a rather specific framework where military and industrial interests met the neurophysiology of sense organs in conditions of microgravity. These researches were related to the distant projects of inhabited space flights. They led to enhanced international collaboration not only in scientific areas, but also later in space industry of communications.

In the sixties, at a local level, French laboratories progressively developed wide international networks and influence in all domains of neuroscience. Let us take, as an example, the *Institut de Neurophysiologie et de Psychophysiologie* (INP)[38]. This institute based its reputation on sensorimotor functions, when scientists were abandoning purely reflex models and were interested in cybernetics. The founding director of the institute, Jacques Paillard, pioneered this new field. He was open to cybernetics when he was a student of Fessard. He had met Wiener and he attended the Paris meeting in 1951. He and the different teams of his institute (Jean Massion, François Clarac) developed several research programs in collaboration with Russians. The domain of biomechanical research progressed at the international level and a new society was created. Jacques Paillard was a founding member of the European Brain and Behavior Society, with Akert, Berlucchi, Kuypers, Ploog, Elizabeth Warrington and Weiskrantz. The first meeting took place in Marseilles in 1969[39]. INP and the *Institut für Hirnforschung* (Zurich) were ahead of what became cognitive neuroscience. The role of INP in this field was highlighted by the organisation of a colloquium in Aix-en-Provence on "Motor aspects of Behaviour and programmed motor activities", with the main renown specialist in the world[40]. As INP, many French institutes developed their research activities in an expanded international network in their own specialized areas of research.

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[38] J. Massion, F. Clarac. Jacques Paillard, son oeuvre et son rayonnement scientifique, in *L'Essor des neurosciences, France 1945-1975*, C. Debru, Jean-Gaël Barbara, C. Cherici, éds., Paris, Hermann, 2008.
[39] J. Massion, F. Clarac, *op. cit.*
[40] *Ibid.*

In the seventies, Neuroscience was part of a vast international network which enabled the Society for Neuroscience to grow from 500 members to more than 38,000 at present. After the creation of this society in 1969, people asked whether IBRO was still necessary. The report presented at the tenth IBRO anniversary mentioned: « it is possible that the success of IBRO and other organization promoting brain research at the national or international level – stimulated at least in part by IBRO – may have reached a point where IBRO is no longer necessary, having reached its original objectives. »[41]. However, a revival of IBRO occurred in the eighties and it still has programs in developing countries. The stake of the early seventies was the turn of cellular neurobiology, and IBRO appointed a special committee chaired by Nobel Prize Jacques Monod. It recommended closer interactions between cell biology and cellular and behavioural neurobiology.

We conclude that in the sixties new international relations shaped neuroscience. The networks of scientists involved emerged in the thirties and were finally united in the single IBRO organisation after ten intense years of discussion within UNSECO. Initially, local networks were shaped by the Rockefeller fellows[42], by the research policy of various international organizations and by international conferences regularly held in some countries. The work of Fessard, Bugnard, Laugier, Gastaut was finally productive at the colloquium of Moscow with the foundation of IBRO. The revival of French neuroscience was actively integrated to the international concert, but it was also pivotal in the rise of neuroscience as an international endeavour. The usual role of France in diplomatic affairs, a reserved domain of the head of state Charles de Gaule, played an important role in scientific cooperation. This was particularly striking for the reestablishment of East-West relations, particularly in the domain of physiology and neurophysiology, where the Pavlovian session in USSR had stopped Russian contacts with Western science. The privileged situation of France between USSR and the US was decisive in the making of French and international neurosciences at a similar level of excellence, with the new international standards already at play in the thirties.

[41] IBRO at crossroads, retrospect and prospects, tenth anniversary report. Review of activities during 1961-1971. UNESCO/IBRO/5, p. 4.
[42] L. Tournès, 2003, 2006, *op. cit.*