


Review

Birth and Early Steps of the Organization of Biophysics in Spain

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Abstract: In the 1960s, Biophysics was an unheard of scientific field in Spain, and even outside Spain, the distinction between Biophysics and Molecular Biology was not clear at the time. This paper describes briefly the developments that led to the foundation of the Spanish National Committee for Biophysics (1981) and of the Spanish Biophysical Society (1987), the incorporation of Spain into IUPAB and EBSA, and the normalized presence of Biophysics as a compulsory subject in undergraduate curricula in Spain.

Keywords: Biophysics; Molecular Biophysics; Spain; IUPAB; Sociedad de Biofísica de España

1. Biophysics: A New Term? A New Field?

The term Biophysics was already used internationally before World War II, and its prominence increased during the years after it. It encompassed a broad field of study in biology, in which knowledge and techniques from physics were used. Then, the development of atomic physics during WWII, inseparable from that of the biomedical sciences, included demands for further research on biomolecules and their interactions, on cells, and on subcellular structures, particularly on chromosomes. The promotion of physical-chemical approaches in the life sciences, supported by the Rockefeller Foundation, also had a direct influence. All this worked like a new culture that selected and promoted many initiatives and projects that were considered as a part of a novel field, Biophysics. In practice, Biophysics was defined by those who claimed to practice it. Manuel Cortijo, improving on a previous definition by Peter Bailey, has defined Biophysics as “the study of biological phenomena using physical and physical-chemical concepts and methods” [1].

Important landmarks in the early stages of Biophysics as a differentiated discipline were the launching of new journals and the birth of new learned Societies, who in turn organized scientific meetings devoted solely to our discipline. The journal *Progress in Biophysics and Biophysical Chemistry* appeared in 1950, and in their preface the editors confessed that they had difficulties in deciding the specific field that the magazine was going to cover. The US Biophysical Society was created in 1950 and held its first congress in 1957, one of its objectives being “to know if there is such a thing as Biophysics and what kind of thing can that Biophysics be?” Later, other Biophysics journals appeared as the field was becoming more clearly delimited: *Biophysical Journal* (1960); *Quarterly Reviews of Biophysics* (1968); *Biophysics of Structure and Mechanism* (1974), etc. The British Biophysical Society was founded in 1960, and a year later, the German Society (*Deutsche Gesellschaft für Biophysik*) followed. The International Union for Pure and Applied Biophysics (IUPAB) was created in 1961 in Stockholm, beginning to organize its congresses on a three-yearly basis. The European Biophysical Societies’ Association (EBSA) had a late birth (Bristol, 1984) and did not manage to hold its first congress until 1997, in Orléans, France, under the chairmanship of Manuel Cortijo.

The present essay owes much to the book “*Veinticinco años de la Sociedad de Biofísica de España* (1986–2011)”, edited by Manuel Cortijo, Juan Carmelo Gómez-Fernández, José López



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Carrascosa y Juan Antonio Subirana [1]. This book, together with extensive conversations with those four colleagues, plus my own reminiscences, constitute the basis on which the present summary has been built.

2. The Origins of Biophysics and Molecular Biology in Spain: International Relations

In Spain, a generation of researchers who returned from abroad in the second half of the 1960s considered Molecular Biology as their field and contributed to defining it both philosophically and experimentally. The international scientific organizations that emerged since the 1950s played an essential role in that articulation, in which specialists from different countries were able to use that international space in full emergence as a mechanism of legitimation of their academic and research interests in their own national laboratories. Spanish scientists participated from the early stages in these strategies, and this participation had the consequence of a permanent scientific update and an exchange of recognition that made these scientists, if not founders, at least pioneering participants in the emergence of a new academic and experimentation space.

In 1968, the possibility of Spanish scientific groups joining the international institutions in Biophysics and Molecular Biology was considered. The International Union for Pure and Applied Biophysics (IUPAB) was the main target. In this international context, in which both Biophysics and Molecular Biology were being defined, the contacts established by the Catalan molecular biologist Juan Antonio Subirana were particularly important. Subirana used his previous personal relationships to network with IUPAB leaders and in particular with the molecular biologist John Kendrew, who was also, for many years, the Secretary General of the European Molecular Biology Organization (EMBO).

Subirana's contacts were at the origin of a proposed biophysics meeting, to be held in Barcelona. John Kendrew had been in town to give a lecture at the College of Physicians in 1969. There he announced that the EMBO Executive Council had agreed to accept as members the Catalan biologists Subirana and Jaume Palau, and the biochemist Ángel Martín-Municio, a Professor at the Madrid Complutensis University. Subirana considered Kendrew's lecture and the announcement of the first Spanish members of EMBO as a wake-up call to the academic authorities on the possibilities of the development of Molecular Biology in Spain.

In the Summer of 1967, the then IUPAB Secretary General and Harvard Medical School biophysicist Arthur K. Solomon met Subirana through Harvard's molecular biologist Paul Doty and suggested that the Spanish Section of the International Union be created. Aaron Katchalsky, head of the Department of Polymer Chemistry at the Weizmann Institute where Subirana had spent a year during his postdoctoral training, was the IUPAB president at the time. After exchanging some letters, in April 1969, Solomon reported to Subirana that the third international congress of the IUPAB would take place in September of that same year at the Massachusetts Institute of Technology (MIT) in Boston and that, during that meeting, Solomon expected the incorporation of Spain to that organization (in fact, Spain's incorporation to IUPAB did not take place until 1981).

Meanwhile, Ángel Martín-Municio created a Biophysics group at the *Real Sociedad Española de Física y Química* (Royal Spanish Society of Physics and Chemistry, RSEFQ). Two scientific organizations in Spain dealt with Biochemistry and Molecular Biology, the Spanish Society of Biochemistry (now *Sociedad Española de Bioquímica y Biología Molecular*, SEBBM), created in 1963, and the Royal Spanish Society of Physics and Chemistry (RSEFQ), dating from 1903. Thus Biochemistry, and closely related Molecular Biology, seem to have competed to occupy an academic and research space and for achieving institutional recognition. This happened through two independent societies, one predominantly biological and one mostly chemical in approach, suggesting the weight of disciplinary origins in the negotiation of new academic disciplines.

3. The First National Meeting of the Biophysics Group, Barcelona 1969

Subirana and Martín-Municio prepared the First National Meeting of the Biophysics and Molecular Biology Group, which was held on the 14–15 of November 1969, at the Barcelona School of Engineering. Many of the participants were members of the SEB, although this Society was not formally invited.

The summary of the issues discussed at this meeting was collected in a monographic volume of the journal of the Royal Spanish Society of Physics and Chemistry, *Anales de Química* [2]. The conference was attended by a large part of the Spanish scientists dedicated to molecular biology in Spain, or at least by most of those who then ran laboratories, mostly located in Madrid or Barcelona. The opening ceremony was chaired by Ricardo Granados, president of the local section of the RSEFQ. José Ignacio Fernández-Alonso, Professor of Physical Chemistry at the University of Valencia, gave the inaugural lecture. In it, he collected proposals that had been defended in similar forums in Spain and abroad about the interest of investigating in the most comprehensive way the characteristics of the structure and conformation of proteins, and the mechanism by which DNA would act as a carrier of genetic information in biological systems.

Juan Llopis, Head of the Electrochemistry Group at the Rocasolano Institute (Spanish National Research Council, CSIC, Madrid), and Antonio Fernández-Molina, a scientist at the *Centro de Investigaciones Biológicas* (CSIC, Madrid), discussed the concept and boundaries of Molecular Biology and Biophysics. Llopis commented: “There are probably no two scientists who agree on a definition of Biophysics, but during the last five or ten years there has been a growing awareness that in this area, in which Physics, Physical Chemistry, Biology and Medicine overlap, revolutionary advances are likely to take place in the next ten or twenty years. The possibility of elucidating at the molecular level some of the fundamental issues in Biology has been increasingly attracting first-class intellects, trained in the disciplines of Physics and Chemical Physics”. In turn, Fernández-Molina contended that: “Biophysics is a science that studies the function and structure of living organisms through physical ideas and using physical methods. Biophysics is not teaching Physics to Biology or Medicine students; it is not to build or maintain physical instrumentation for anatomical, biochemical, physiological or clinical uses; the use of physical instruments in a Biology lab does not make it a Biophysics one ... The ideas are more important than the methodology itself ... There are people for whom physical intuitions come naturally, they can formulate a problem in physical terms, recognize physical relationships when they appear, and finally express results in physical terms ... , but if a physicist is not capable of developing a biological approach to a problem, is not curious about the processes, mechanisms and vital functions ... , and simply considers Biology as a branch of Physics ... , this physicist does not have a good future in Biophysics”.

In the Barcelona meeting, a number of areas were suggested to be part of Biophysics: Molecular Biophysics, Biophysics of cells and tissues, of radiation, of processes of communication and control, mathematical and physiological Biophysics. Molecular Biophysics included the study of the macromolecules that played important roles in Biology, understood in a broad sense, including their relations with small molecules and the systems formed by biopolymer assemblies. Llopis concluded that in Spain, only the so-called Molecular Biophysics had an acceptable level of development, especially in CSIC centers, and that the debate on the contents of Molecular Biophysics should serve as a basis for further discussion of the relationships between Biophysics, other branches of science, and industry.

After the Barcelona event (including preparative meetings in Madrid), and a subsequent one in Valencia, the Biophysics Group did not survive. The Spanish Biophysical community was perhaps too small and/or immature at the time.

4. The Spanish National Committee for Biophysics and IUPAB

In Spain, the National Committees were collegiate bodies of experts established by the Ministry of Education and Science to promote and convey Spanish participation in the Scientific Unions, Committees and International Programs. The Spanish Biophysics

Committee had as specific missions to represent Spain in the IUPAB Assemblies and to analyze (and eventually vote) the matters that were dealt with in those assemblies, as well as to convey the information emanating from this International Union to all Spanish biophysicists.

The Spanish Biophysics Committee at IUPAB was created on 25 March 1981 through an agreement by CSIC for Spain to adhere to the IUPAB, naming a Committee on June 3, 1981, with Juan A. Subirana as Chairman and Armando Albert as Secretary. Spain was accepted as an IUPAB member in its 7th congress (Mexico City, August 1981). Four years later, in 1985, the CSIC appointed a new Biophysics Committee, again chaired by Juan A. Subirana, and with José L. Carrascosa as Secretary. This was the Committee that put forward and effectively helped in the formation of the Spanish Biophysical Society (see below).

As of that date, the Spanish Committee of IUPAB was fundamentally in charge of its true objective: to represent Spain before the IUPAB. The activities of the Committee passed through many different stages, not so much by the will of its members, but by the varying degrees of interest that the successive Ministries of Education and Science showed in the National Committees and their representation in international institutions.

In 2004, the Ministry created the ICSU National Commission, as the collegiate body of representatives of the different National Committees. ICSU's function was to coordinate the actions of the various Committees. Within this new framework the Spanish Ministry of Innovation appointed a new Spanish Committee for Biophysics, chaired by José L. Carrascosa, who continued serving as Chairman for the next decade.

The new operating framework of the committees integrated in ICSU made it possible to invigorate international representation activities, facilitating the presence of community representatives of Spanish biophysicists in the executive committees of international organizations such as IUPAB itself, or EBSA. In addition, it teamed with the *Sociedad de Biofísica de España* (SBE), whose president Alicia Alonso (2006–2010) reshaped the SBE interactions with IUPAB and the Ibero-American societies. The fruits of this combined activity included the 2010 Spanish-Portuguese conference in Zaragoza, the Ibero-American congress in Búzios (Brazil) in 2009, as well as various workshops and international and national meetings. The Spanish committee of IUPAB used to hold a minimum of two annual meetings since its re-foundation in 2004, although at present, it is undergoing one of its Government-induced lethargy periods.

A remarkable event for Spanish Biophysics was the 2017 election of Juan Carmelo Gomez-Fernández, former President of our Society, as Secretary General of IUPAB. Unfortunately, the untimely death (2022) of our colleague blunted his time of brilliant service to the International Union.

5. The Spanish Biophysical Society (*Sociedad de Biofísica de España*, SBE)

As mentioned above, the 1985 Spanish Biophysics Committee agreed at its first meeting, on 10 September 1985, to create a Spanish Society of Biophysics, for which intensive work during 1985 and 1986 was required. Several of its members (Subirana, Cortijo, Goñi) used their frequent scientific activities in several European countries (England, Germany, France, Italy) to get first-hand knowledge of the problems of their Biophysical Societies and prepare a report for the Committee. A draft of the Statutes of the new Society was prepared, and it was agreed to hold a Constituent Congress in Sitges, near Barcelona, on 1–4 October 1986, under the name Spanish Biophysics Meeting. In this meeting, the steps were made for the creation of the new Society, and a Steering Committee was appointed, constituted by most of the members of the Organizing Committee. Finally, on 19 January 1987, the SBE was registered in the Registry of Associations of the Ministry of the Interior with the number 69,930. The number of Society members has grown from 80 in 1987 to about 300 in 2022.

When the Society was created, it was ensured that everyone involved with Biophysics would be welcome within the SBE and could present his/her results in our congresses,

hoping (as it soon happened) that the very dynamics of the events would take all of us to a situation analogous to that of our international colleagues. The Society was initially structured in an open way but around three large groups, which reflected not only the investigations carried out in Spain, but also the evolution in the international scene. Those three main subjects were Structural Biophysics, Biomembrane Channels, and Membrane Structure. The initial groups of physiologists and structuralists had quickly understood during the years of mutual communication within the Biophysics Committee that they needed each other. When, in the mid-eighties, the group that was researching biological membranes joined the National Committee, it was clearly perceived that the mutual interaction between the three groups would produce synergistic effects in our investigations, as in fact did happen. Other groups of biophysicists, such as theoreticians or those working on irreversible processes, have continued to have their niche within the Society, despite being a minority in Spain.

SBE has always intended (and successfully so) to establish friendly relationships with the other learned societies in Spain. In fact, most of the founding partners, and even of the current ones, often belong to two or three of the related scientific Societies, such as the ones devoted to Biochemistry and Molecular Biology, to Cellular Biology, Crystallography, Physiology, etc. This is probably so because of the peculiar interdisciplinarity of Biophysics.

Perhaps the main activity of SBE has been the organization of successful congresses, well attended by both Spanish and foreign biophysicists. As an example, the most recent one, held jointly with the Portuguese Biophysical Society, took place in Bilbao (Spain) in June 2022. Over 200 delegates attended the meeting. From the first formal congress, held in Valladolid in 1987, 10 congresses were held on a more or less biennial basis until 2010. From then on, at the initiative of the then President J.C. Gómez-Fernández, congresses are held annually.

SBE Congresses are also a good opportunity for international networking, both at the institutional and personal level. From 1989 (Seville) joint meetings with the Portuguese society have been held, the Bilbao one in 2022 being the eighth in the Iberian series. Moreover, again from 1989, some congresses have also included the Ibero-American societies. The 10th Ibero-American Congress took place in Castellón, Spain, in 2018. In 1987 and 1990, two Spanish-Soviet Biophysical Congresses were held, in Granada and Kiev, respectively. In 2003, Alicante (Spain) was the venue of the joint IV European Biophysics Congress (EBSA) and VIII SBE Congress.

SBE Prizes and Awards are also important elements in catalyzing the scientific activity of members, particularly of the younger ones. The oldest one is the Bruker Award that was accorded to Rafael Picorel in 1998 and is still awarded annually, under the name “Manuel Rico–Bruker”, in remembrance of the distinguished NMR specialist and SBE member. Two other prizes, namely ‘E. PÉREZ PAYA–SBE 40’, and ‘ANTALGENICS–SBE 33’ are awarded annually to the younger members of the Society.

6. Three International Friends: Wüthrich, Bailey, Chapman

Neither Spanish Biophysics nor SEB were alone in the scientific world. From their early stages, they had the good fortune of being supported by wise and powerful scientists, of which only three will be mentioned here, namely Kurt Wüthrich, Peter Bailey, and Dennis Chapman.

Born in Aarberg, Switzerland, in 1938, Kurt Wüthrich has been one of the most important biophysicists of his generation. He was awarded the Nobel Prize in Chemistry in 2002 for “his development of nuclear magnetic resonance spectroscopy for determining the three-dimensional structure of biological macromolecules in solution”. Wüthrich was Secretary General of IUPAB at the time of the incorporation of Spain to this International Union. He describes the event as follows:

“In the spring of 1981, during my tenure of the office of Secretary General of IUPAB, I received an application for membership in IUPAB by a Spanish National Committee for Biophysics. At a meeting of the Council of IUPAB in Mexico City on 22 August 1981, this

application was approved for presentation to an Extraordinary General Assembly of IUPAB on 26 August 1981. The protocol of this General Assembly includes:

‘3. Admission of new Adhering Bodies. Spain was unanimously admitted as a new adhering body of IUPAB.’

At the immediately following 8th General Assembly of IUPAB in Mexico City, and at the 9th General Assembly of IUPAB in Bristol, UK, on 1 August 1984, Spain was represented as a National Member of category III by Prof. J. A. Subirana. This was the start of lasting fruitful cooperation between the Spanish Biophysics community and IUPAB.”

In a contribution to the book *“Veinticinco años de la Sociedad de Biofísica de España (1986–2011)”* [1], he went on writing: “On a personal level, I greatly enjoyed the interactions with my colleagues in Spain, who subsequently founded the Spanish Biophysical Society, with Prof. J. A. Subirana as its first President. I have fond memories of a series of Biophysics Meetings in Sitges, with the inaugural meeting in 1986 leading to the aforementioned start of the Spanish Biophysical Society. Today it gives me great pleasure to extend my best wishes to the Society on the occasion of its 25th Anniversary.

On the level of scientific interactions, the contacts with the Spanish biophysical and biochemical communities resulted in highly fruitful collaborations during the years following the start of the Spanish Biophysical Society. For example, postdoctoral appointments and shorter academic visits in my laboratory at the ETH Zürich by Drs. B. Celda, J. Vendrell and F. X. Avilés, all of whom subsequently made remarkable careers in Spain.”

In the aforementioned book [1], the distinguished British biophysicist Peter Bailey writes:

“As a member of the EBSA executive from its first days, I have enjoyed a rewarding friendship and collaboration with members of the Spanish Biophysical Society since its own inception in 1986. Hence I have witnessed its growth and development as the national society representing a common interest in what has now become the truly ubiquitous subject of biophysics. Looking back on the growth of EBSA to its present membership of more than 20 societies, it is satisfying to note on this 25th anniversary that the Spanish biophysical community was amongst the first of the new adherents to EBSA, bringing together an existing range of biophysical interests and expertise under the present title of the Spanish Biophysical Society. I would like to acknowledge the leadership that helped to create the Spanish Biophysical Society at that time (President: Juan Antonio Subirana, Secretary: José López Carrascosa, Officers: Manuel Cortijo, José García de la Torre, Fernando Giráldez, Félix M. Goñi, José López Barneo, Esteve Padrós and Antonio Ruiz Marcos). In doing so, and in their immediate involvement with EBSA, they gave a strong lead to the other societies who have subsequently joined the Association.”

A sympathetic note on Dennis Chapman and his relationship with Spanish Biophysics was also written by Peter Bailey in the same book [1]:

“I believe my first attendance at a meeting of the Society was in December 1990 at the Complutense University in Madrid, where I was delighted to find that the invited opening lecture was delivered by Professor Dennis Chapman from Royal Free Hospital, London, while I gave the closing lecture. Dennis had formerly been the Chairman of the British Biophysical Society, and was internationally recognised for his work in NMR and the variety of his biophysical applications of lipid systems, leading to the successful establishment of the commercial company Biocompatibles, plc. I have to confess that, until that occasion in Madrid, I was unaware of the considerable number of scientific visitors that Dennis had hosted from Spain, studying under his supervision and engaging in active research collaborations (Alicia Alonso, Javier Alvarez, Manuel Cortijo, Juan Carmelo Gómez Fernández, José González, Félix M. Goñi, Josefa Liboria Segovia, Miquel Pons, José Luis Rodríguez Arrondo, María Ángeles Urbaneja, Carmen Villaverde, José Villalaín, etc.). It was very clear at the meeting, from the warmth of his reception by members of the Society, and the respect for and appreciation of his scientific achievements, that he enjoyed a very special personal relationship with the members of the Society. He was in fact the first honorary member of the Spanish Biophysical Society.”

7. The Teaching of Undergraduate Biophysics in Spain

An essential part of any scientific activity is its teaching at the undergraduate level. Post-graduate education in any subject is a near-impossibility in the absence of adequately trained undergraduates. 'Biofísica' was included as a subject in the 1st year syllabus in many Spanish medical schools from the late 1960s. However, this was misleading, because the course contents were, invariably, General Physics without any particular biological flavor to it. Moreover, in the late sixties, a course on Biophysics, whose contents was mainly radiation biology, was offered as a part of the Chemistry degree at the Madrid Complutensis University. This course was later re-structured by F. Montero and F. Morán, with contents based on Irreversible Thermodynamics and Theoretical Biophysics, in agreement with the teachers' research experience. Perhaps the first course on Biophysics in the contemporary sense offered in Spain was taught by F.M. Goñi at the Bilbao Faculty of Science from 1975–1976 onwards. The contents were Thermodynamics, Membrane Transport, and Spectroscopy. The students were final-year biologists, in a curriculum devised by Eduardo Cadenas, whose contents were more chemical and molecular than traditionally biological. This course laid the foundations on which 'Instituto Biofísica' was build.

Biophysical education at the undergraduate level did not make much progress until degrees in Biochemistry were authorized by the Spanish Ministry of Education and implemented by many universities in the late 1990s. In the structure of these degrees, Biophysics appeared for the first time as a compulsory subject, and their contents included Thermodynamics, Membrane Transport, Molecular Electrophysiology, Dynamic Models of Biological Systems, and Bioenergetics (Spectroscopy being included in a separate, methodological course). The situation remains virtually unchanged to this day, and the level of biophysical education of our undergraduates is one of the few bright beacons in the otherwise grim panorama of Spanish science.

8. Epilogue: Time and Memory

Those of us who had the opportunity to participate in the initial meetings of Sitges (1986) and Valladolid (1987) have excellent memories of them. Even the author of these lines, who does not suffer, not even remotely, from Diogenes syndrome, has kept in his office the abstract books of those conferences (Figures 1 and 2). I have looked at them again, after many years and . . . how modest they seem to me, and how poorly they resist comparison with the book of abstracts of Bilbao, the last one we have! Here the "past objective" comes face to face with the "past as a memory", with the total defeat of the latter. It is not that those congresses were bad, they were in fact magnificent; however, biophysics, and us with it, is much improved. This is another type of mirage due to selective memory. As a result of the fact that "in our opinion/any time past/was better" (*a nuestro parescer/cualquiere tiempo pasado/fue mejor*, Jorge Manrique, ca. 1476), we do not clearly perceive the magnitude of our progress. It is one paradox of life, we beautify our memories so much that we are not aware of the current improvements and so, what is initially something positive (the ability to forget past mistakes and wrongdoings) leads us to the pessimism of not perceiving progress. Let us try a slightly more objective view on Spanish Biophysics in our days, let us acknowledge the enormous progress of science and the scientific community that have changed beyond recognition from the times of the 1969 Barcelona meeting.



Figure 1. The 1986 and 2022 announcing posters of the Sitges and Bilbao meetings.



Figure 2. The 1986 and current logos of the *Sociedad Biofísica de España*/Spanish Biophysical Society.

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