

"A personal vision"



Pedro R. García Barreno
(c. May 2022)

A handwritten signature in blue ink, appearing to read "Pedro R. García Barreno".

"Don't believe because you heard it.
Don't believe it because many rumor it.
Do not believe because you have read it.
Don't believe because the teachers say so.
Only after observation and analysis, accept it."

Siddhartha Gautama (Sakyamuni, *the Buddha*). V-IV century B.C.

Aeschylus writes very early in his *Agamemnon*:

"I am summoned by the gods to celebrate this moment.
and I still have the strength to do so,
as they have allowed
a breath of persuasion,
vigor at an already old age, to try to spin past songs".

Although Cicero, in *On Old Age*, puts in the mouth of Caecilius:

"I truly consider that, in old age,
This is the most unhappy thing, to feel that at that age you are a nuisance to others".

More, like Hugh Lofting's dilemma in *Doctor Dolittle's Zoo*, a character inspired by the Scottish surgeon John Hunter (1728-1793), father of the experimental approach to medicine:

"What to take out and what to put in?".

And, moreover, how? In *Los Complementarios*, don Antonio, in a soleá he left his poetic credo:

"Obscure, so that they attend;
crystal clear,
so that no one understands".

In memory of Álvaro Mutis:

"When gratitude is so absolute, words are superfluous."

Still, "Thank you before I go," wrote Walt Whitman.

Emulating a quipucamayoc I will try to untangle the knots of my quipu. But...

"*Follow the yellow brick road*".

A few references, accumulated over time, have accompanied my entire activity. The recommendation of Johann W. von Goethe:

"It is not enough to know, you must apply. It is not enough to want, you must do".

The Wisconsin Idea, which Charles R. van Hise, President of the University, included in an address to the Press Association in February 1905:

"I will never be satisfied until the beneficial influence of the University reaches every family in the state. This is my ideal of a public university. It is not an abstract concept; it is the commitment that knowledge can and should have a practical impact on the needs, problems and aspirations of society."

Bertrand Russell stated a few lines before concluding his *Essays on Education* :

"A generation educated in freedom will have broader and bolder hopes than we had. It is not we, but the free men and women we form, who can contemplate a new world. A thousand fears obstruct the road to freedom."

That summarized *Project 2061*, released by the *American Association for the Advancement of Science* (AAAS) in 1985:

"The significance of achieving global scientific literacy [of the Nation] for future generations justifies universal public education in a free society."

Karl R. Popper's sentence:

"*We do not study issues, but problems*; and problems can cross the boundaries of any object of study or discipline [...] We are scholars of *problems*, not disciplines."

The concept of "creative destruction," today 5G universe or exponential technology —convergence of AI, robotics, *big data* and virtual reality—, is included in the philosophy of *Janelia Farm-Howard Hughes Institute of Medicine* (HHIM):

"How to solve the most convoluted problems in science today.
Breaking all the rules" .

Joseph L. Goldstein, in his article on the origin and prevention of PAIDS (*Paralyzed Academic Investigator's Disease Syndrome*), insisted on the need to foster "technical courage" or the need to be aware of established technology and emerging breakthrough techniques. This window looks from the pipette to the architecture and engineering of structures and their management. Hence the projects on treatment of severe clinical syndromes, epidemiological molecular screening, circulatory assistance systems and command console —BIOMED-CAM—, on medical image reconstruction algorithms —COVIRA: *Computer Vision in Radiology*—, design and construction of a microscope for molecular imaging, my relationship with architectural and engineering studies of structures —codirected the AIDHOS course ("Architecture and Engineering Study Of HOSpitals")—, the animal house for housing minipigs with defined haplotypes donated by Prof. David Sachs of the *National Institutes of Health*, USA. or the master's degree in business administration (MBA, Instituto de Empresa). He later became director of the "National Plan for the Prevention of Handicaps".

Remember David Weatherall, *Regius Professor* of Medicine at Oxford:

"The increasingly important role of science and the complicated social and ethical factors associated [with its application], which will guide the ability to determine the future, demand greater scientific preparedness from all of us. Policymakers must understand the rudiments of scientific evidence, and society as a whole must be sufficiently informed to be able to participate in the discussion of the complex implications that continually arise from the advancement of [scientific] research. This sensitivity to knowledge must begin at school, where scientific education must occupy a relevant place".

I end this "appropriation" of other people's ideas with David Krakauer, president of the *Santa Fe Institute*. An advocate of the fusion of ideas and approaches from fields that are in principle disparate, across borders:

"The scientific opportunities enabled by "convergence" will make fundamental contributions as we move forward to provide creative solutions to the most difficult problems that threaten our society."

Apologies, I just remembered the closing of the moving salutatory address of the *Master of Gonville and Caius College*, Cambridge, in *Chariots of Fire*:

"Do not allow any powers of persuasion to discourage you in your task."

One of the Nobel Foundation's latest communiqués states:

"*The Nobel Prize in Physics 2021 was awarded "for ground breaking contributions to our understanding of complex system" [...] "*

Convergence enhances our ability to think beyond the usual paradigms and approaches the most diverse and complex situations from multiple perspectives instead of the prevailing mono-view. Convergence between life sciences and physical sciences - physics, chemistry, materials science, computer science and mathematics - offers the opportunity for new creative thinking and production strategies that will stimulate innovation, economic development and the solution of social problems and demands. It will only be necessary to realize its potential for action.

Generally speaking, our institutions of higher education remain entrenched in organizational structures and bureaucratic practices of the past, making the concept of "university innovation" a new oxymoron. The academy must aspire to become an entrepreneurial organization, imbued with society, where intellectual fusion is an unequivocal aspiration. The reconceptualization of the university as an academic enterprise requires a series of adjustments that must be addressed in small steps: from a modest degree of its own to the entire curriculum. If primary and secondary education have become obsolete, higher education is not far behind. Innovative knowledge has escaped from the traditional university, which is what we have; faculties and departments have been overwhelmed, and the same can be said of "advanced" research centers, of "campuses of excellence". There are people, undoubtedly, but not institutions.

Convergence — science-mathematics-technology and omniscopic (STEM extended: STEAM)— is a long-term enterprise whose goal is the education and training of citizens and, of course, of professionals capable of elaborating new questions to old issues to face as yet unsolved problems.

This requires breaking or ignoring disciplinary boundaries; only then will new paths of knowledge open up in distinctive learning environments. In short, broad, flexible minds that, regardless of the specialization of their daily work, are capable of tackling complex problems in a global world. This is based on a curricular revolution—a conceptual continuum—from ages five to 18: oral and written expression and reading comprehension of complex texts; multilingualism; mega-history; science-technology/engineering-mathematics; and learning by doing and risk-taking. The ambitious Plan began in 1985 with *Science for All Americans. Project 2061*. A 65-year project: it began when Halley's comet visited us for the last time; it will continue when it reminds us of its presence again in 2061.

"Who has seen such strange dreams!", recites Rosaura in *La Vida Es Sueño*.

All this leads, irremediably, to a "search without end". José Saramago writes in *A Caverna*:

"To start at the beginning. As if that beginning were the always visible end of a badly wound thread, which we just have to pull and keep pulling to reach the other end, the end, and as if between the first and the second, we had had in our hands a smooth and continuous thread from which it has not been necessary to undo knots or untangle tangles, something impossible in the life of the tangles".

The Belgian physician, pedagogue and teacher Jean-Ovide Decroly (1871-1932) created in Brussels, in 1907, the *École de l'Ermirtagé*, "the school for life through life" or "Decroly school". In 1927, Don Ladislao Palenzuela Negrete established the private, secular Decroly School in Madrid. One of the most important and significant pedagogical principles is to train children in the values and conditions to face the real world through educational experience. To make education a pleasant and rewarding task by understanding the peculiarities of each one. The tools: motivation in an atmosphere of freedom.

In that environment, St. Mili Luengo awakened, back in nursery and kindergarten, the motivation. She taught first the meaning of the signs—now I would say that she was a pioneer of von Petzinger's work, then the meaning of letters, the meaning of words and, after that, how to read. Also to write and, soon after that, basic arithmetic rules. The only essential thing, next to playing with a sheet metal or a robot, that a child has to be taught; although most of them are self-sufficient.

The alquitara decrolyana alambicaba, each and every day of the year, poetry, theater, a small orchestra, ballet—recordar María Esparza, appointed in 1933 director of the ephemeral Ballet del Teatro Lírico Nacional—, solfeggio and piano with María Cerrajería and maestro Gordillo, sports—"use your hands, not your feet"—and nature. Also chess (allow me to quote my great uncle José Raúl Capablanca). And above all this, for years, D. Felipe, master, gentle and kind. Fortunately for us, he ended up taking refuge in the Decroly. There he taught everything, which he alternated writing Western novels as F. G. Rich. "They study all day long—commented— they have no time to think or understand". Let the memory serve as a tribute made of admiration and longing. The Decroly School, the closest thing to a liberal school at that time, which was able to incorporate a cast of teachers trained at the Normal and brilliant professors away from their professorships. Not to mention the carpentry shop located on "the sidewalk across the street"—as Gloria Trevi's song says about one of the school's headquarters, where one could spend hours admiring the mastery of that artisan wood designer; perhaps something premonitory to the admiration, years later, for the

aforementioned Karl R. Popper. The years elaborated a change in the names of the Madrid street map. As soon as I crossed the street where I live, I noticed that the identifying sign read: Calle de Max Aub, a writer about whom a distinguished teacher had told us at school. The next street, to finish, has on the sign the name of Ángela Figuera Aymerich, a writer who cultivated children's literature and the so-called uprooted poetry, and teacher in the initial stage, 1931, of my school, the Decroly.

Once school is over, what did I do and what did I stop doing. Theophrastus in his *Callisthenes* includes the maxim:

"Fortune governs life, not wisdom." It is said that no philosopher has ever said the most discouraging maxim.

Fortune, which was chance, because what I wanted to be was an aviator, led me to what Publius Virgil Maron recounted in the twelfth book of *Aeneis*:

"He preferred to know the virtues of herbs and the uses of medicine, and to practice this art quietly and without glory."

In my case, without a doubt, chance —amistad— and necessity —justify my time— prevailed over vocation. Decisive was the magic word, the open sesame of all doors to which the master William Osler dedicated brainy lines: work. As much as curiosity: questions without apparent answers to tackle the complex. Although there must have been something at the bottom, because of the things I did that were worthwhile, if any deserved it, were three activities very early on: the "milkmaids" —an archaic version of SAMUR— that attended the emergencies in Vallecas village, the guards on weekends at the aid house in Carabanchel alto and the surgery consultation of the "quota" of the Social Security in the "ambulatory" of San Blas. Something anecdotal, but pleasant, were the substitutes at the Solán de Cabras spa. Years later, many years later, he would become president of the Unified Commission for the "toxic syndrome" and director of the Hospital General [Gregorio Marañón University] in Madrid.

I also quietly tried to serve as secretary general of the Instituto de España for too many years. From 1996 to 2003, by Royal Decree, and elected from 2010 until two weeks ago. Do you remember *Música Callada del Toreo*, by José Bergamín Gutiérrez? It ends with a sonnet by Rafael Alberti; his first tercet:

"A prodigious magical sense,
a quiet reminder in the ear
and a feeling that I see in my eyes without seeing".

In this and other cases, I can draw on what was written years ago, in 2002 to be exact, by Manuel Castellet, who was president of the Institut d'Estudis Catalans, in reference to the Instituto de España and its general secretary, in *Llengua, ciència i cultura. Crònica d'una passió matemàtica*:
"We have maintained a close and cordial collaboration with the Institute of Spain, or rather, with its general secretary, which has allowed us, without renouncing anything, to benefit from its position.

For his part, the Cadiz native who bore the surname of a dear friend from Malaga — ("Rafalo") —, who left just a few months to cross the Aqueron victorious, Cabeza de Vaca, wrote in *Naufragios (Shipwrecks)* that:

"On that island they wanted to make me a physicist without examining me or asking for any accreditation, because there they cure illnesses by blowing on the patient, and with that blow and their hands they expel the evil".

The shipwreck happened as soon as I started. In the second year, actually the first year of Medicine, at the Complutense faculty, after a clash with a later esteemed professor of Anatomy, I abandoned my formal studies to study the rest of the curriculum "on my own". I only set foot in the University for the memoristic exams. This resulted in a rather low-profile, low-flying curriculum. I lived in the Hospital, in an improvised room in a forgotten alcove, and I learned the quiet art in the General de Madrid, today a Museum -years later I coincided with the "reformer", the beloved D. Antonio Fernández de Alba, in the RAE-, under the guidance of Amador Schüller, Pedro Gómez, and the nurses Sister Teodora and Sister Dominga and Adela Sauras. Thus began my relationship, strengthened after winning a competitive examination to become a boarding student and the support of those two teachers, with what is now the Gregorio Marañón Hospital, despite my continuous departures.

Heterodox training in medicine allowed other activities. I flew without engine in Somosierra, Monflorite and Ocaña; with engine in Grajera. I did the University Air Militia (MAU) internship as a medical ensign in the Central Air Hospital and served a confinement in one of the Spanish-American airspace control bases. The "Matador" base, in Villatobas. A technological oasis in the Mesa de Ocaña, north of the Mancha Toledana. There, in 1968, I perfected my English, learned to play tennis with the priest of the squadron stationed there. And most importantly, I gained access to the cutting-edge ICTs of the time in a restricted environment of high strategic value. Over the years, I took a diploma course in "National Defense" at the Superior Center for National Defense Studies (CESEDEN). Years later, the Ministry of Defense welcomed me for a long period. And, why not, the annual interdisciplinary meetings of ASINJA.

From Villatobas to the *Thoracic Centre* in Sully, Glamorgan, attached to Cardiff University in Wales. Then the jewel of thoracic pathology. After some time, back to Spain. At that time if you wanted to do thoracic surgery you had to find a way to go to La Paz, with "the Marquis". I had the opportunity to assist Christiaan Neethling Barnard in the heart transplant he performed on a dog in that Department of Surgery. At the end, we shared a "Celta".

Given the environment —among others, the "Celts" were unbearable—, to see other environments. Medicine aside, in Chicago, I was a regular at the Mathematics Department of Alberto Pedro Calderón, and the Physics Department of Leon Max Lederman, who would be awarded the Nobel Prize in Physics in 1988. In the latter, to the *Quantum Physics for Poets* seminar led by Christopher Hill, a frequent visitor. Then Michigan. Finally Spain. Priority, the doctoral thesis. I was able to publish it thanks to a scholarship from the Spanish Boxing Federation; in exchange, to work as a promoter of the youngsters of the golden age of Spanish boxing. A previous application to the College of Physicians was rejected because it was not considered a "tool" necessary to practice the profession. Nevertheless, I was awarded an assistantship in experimental surgery at the Autonomous University of Barcelona.

The comings and goings continued. In London, *Imperial College* and the Mathematics Department of Eduardo Ortiz; in Houston, the *MD Anderson Cancer Center* with Frederick Becker, head of the *Department of Molecular Pathology* and pioneer in the epigenetic mechanisms of cancer; in San Diego, the *Department of Aerospace Engineering-Jacobs School of Engineering* of Juan Carlos Lasheras, a dear friend who passed away a few months ago; in Berkeley, Paul Feyerabend and epistemological anarchism; in Irvine, evolutionary biology with Francisco José Ayala, another close friend for many, many years, with whom I co-directed the Chair of Science and Law of the Garrigues Foundation - I was able to learn about the *President's Committee of Advisors on Science and Technology* (PCAST) from him; and, above all, in Santa Fe, New Mexico, the *Santa Fe Institute for the study of complexity*. The SFI —sanctasanctórum of complexity, not to mention the *marimba* groups in *Santa Fe square*— allowed me to taste, albeit in small portions, the now elderly George Cowan, first president of the *Santa Fe Institute* and a central figure in transdisciplinary science; Ellen Goldberg and Robert Eisenstein, both directors of the *National Science Foundation*; Geoffrey West, founder of the high-energy physics group at *Los Alamos National Laboratory*; Jerry Sabloff chairman of the *Smithsonian Science Commission*; or writer and game designer Neal Stephenson. I must not forget one of the co-founders of the sanctum sanctorum, Murray Gell-Mann, winner of the 1969 Nobel Prize in Physics, a frequent visitor to Spain. Murray was a decisive factor in the future CSIC-INTA Astrobiology Center. Once I was fully involved and with the help of Ricard Solé, I was able to contact the current president, David Krakauer, also director of the *Wisconsin Institute for Discovery*, promoter of the convergence of knowledge, *Big History* and the *InterPlanetary Project*.

As in many other initiatives, on this occasion and despite Krakauer's strong support:

"This is a very strong letter of support for your new initiative relating to the creation of the Institute Comillas of Complexity. It is one of the most exciting and necessary proposals that I have read in a long time",

The extensive writing begins, and numerous leading figures in the world scientific field, the pretension of implanting a "franchise" of the Center of Complexity, an exceptional project, was sent to limbo... computer science. Although with respected exceptions to whom I must acknowledge their explicit support beyond mere commitment; I am referring, among others, to Fernando Ruíz.

An aside. In the wake of Krakauer's letter, the dark side of the person emerges, the one marked by the flag of vanity -was it not raised a few lines ago? I am referring to the letter from Professor Ursula Schäfer Lamb, distinguished historian at the University of Tucson, in Arizona, specialized in Latin American History, in relation to my text *The Madrid Mathematical Academy of Phillip II*:

*"Your sending the article to me is one the best things that has happened to me for a long time.
time".*

Through the *Santa Fe Institute (Parallax)* I also met three great mathematicians who disappeared in 2020: John Conway, co-creator of *Game Life*; the subversive Freeman Dyson, a legendary mind,

a translator from physics to mathematics; and Ronald Graham, the driving force behind combinatronics and Euler medalist, whom I followed in San Diego with Lasheras.

Regarding the science-art dialogue, tensegrity with mathematicians Miguel de Guzman and Robert Connelly, and Donald E. Ingber, cell biologist and bioengineer at MIT dedicated to cytoarchitecture. My last directed doctoral thesis concerned a model of spinal tensegrity and its implications for the treatment of congenital deformities. After breaking down some barriers, two mathematicians and a structural engineer were part of the tribunal. A nod to the motto of the Chinese Jixia Academy —coetaneous to the Platonic Academy back in 380 B.C.— "innovation by opposition".

I cannot leave out the Pamplona-born Ángel Jordán Goñi, Dean of the *Carnegie Institute of Technology*, a pioneer in robotics. Nor the *Biennial Meeting of the Philosophy of Science Association*, to which I belonged, in Philadelphia in 1982, with Bruce G. Buchanan —linguist, Professor of Computer Science and Philosophy, then at Stanford, today at the University of Pittsburgh— or what is the same as AI and language. Both entrenched the experience started in Villatobas on creative evolution. And of course two bookstores: Librería León, since lustrums ago a cocktail bar occupies its premises, in Madrid, and the *Seminary Co-Op Bookstore* on *University Avenue*, in Chicago, which is still a bookstore.

Nor ignore those moments of which I can say: I was there! Musical Youth. The indelible memory of the Bayreuth Festival 1961: *Das Geisterschiff*, conductor Wolfgang Sawallisch; the soprano Anja Silja performed the most captivating "Ballade of Senta" I have ever heard. Also, present on my name day in 1985: St. Peter's Basilica, Herbert von Karajan, Vienna Philharmonic Orchestra, soprano Kathleen Battle, officiated by John Paul II, Mozart's "Coronation Mass". In November of the following year, the cycle of Beethoven's sonatas by Daniel Barenboim at the Real; or the violin solo of the *Benedictus* of Beethoven's *Missa Solemnis* by Thomas Brandis, *concertmaster* of the Berlin Philharmonic. How can we forget! the concerts of Francis Chapelet and Antonio Rodríguez Baciero with the organ of the Collegiate Church of Covarrubias, after the obligatory stop at Silos for matins. Without leaving the compositions of Antonio Vivaldi *Gloria* or *Juditha triumphans devicta Holofernis babrbarie*, *Sacrum militare oratorium*.

In the meantime, an advertisement in the Madrid newspaper, which had been closed, gave news of the first Molecular Biology course to be organized in Spain. It was directed by Ángel Martín Municio. Soon the ties were tightened. In his department I fiddled in the laboratory, I learned biology, I soaked in Flamenco —¿Flamenco? Yes, of Flamenco— and I taught Molecular Physiopathology which, over the years, crystallized into a Chair. Ángel Martín Municio, then an elected Academician since 1982 of the Royal Spanish Academy of which he would become, in 1992, its first vice-director, vice-president of the *European Language Resources Association* and first Spaniard in the *European Molecular Biology Organization* (EMBO), together with Mr. Enrique Sánchez-Monge, a pioneer in plant transgenesis, and Mr. David Vázquez Martínez, the first Spanish member of the EMBO, and Mr. David Vázquez Martínez, the first Spanish member of the EMBO. David Vázquez Martínez, first Spaniard in the Scientific Committee of NATO, presented my candidacy for the position of Full Academician of the Royal Academy of Exact, Physical and Natural Sciences in June 1983, vacant due to the death of Mr. Florencio Bustinza Lachiondo, who in 1969 had proposed Mr. Ángel. I read the reception speech —*Lo Exacto, lo*

Físico, lo Natural, y la Medicina— 37 years and two days ago, under the presidency of Manuel Lora-Tamayo. Manuel García de Viedma e Hitos and Luis García Jodra tucked me up to the podium.

At that time —in 1973, on his return from the USA — he had organized and directed an unpublished course in a Hospital on "Advances in Biology". Among others, Alberto Dou spoke on "Limitations and Logical Possibilities of AI", or José García Santesmases who spoke on "Neural Networks, Shape Recognition and Learning Systems".

Back to my friend. During his stay at the *Rijks Universiteit* in Utrecht, Martin Municio worked as a Spanish Reader. Among the regulars was Leo Elders, of the van Steyl congregation of missionaries, a Thomist who translated into Japanese the whole of Aquinas' work and a precursor of what is now known as "biblical Thomism". His countenance radiated serenity and calm. What Anticlea, washing Ulysses' feet, praises:

"Calmness in speaking".

The same spirit I found in the Madrasa or University of Sankore, the first University in the world, in Timbuktu or *Tin Budt*, the city of the 300 saints. On the other side of the world, the Austral University of Chile, in Valdivia, with the sad memory of its double fire in the laboratories.

The meeting with Don Emilio Botín meant a change of course. The obstacles to setting up a *Howard Hughes Medical Institute-type* program in Spain led me to make repeated visits to the USA. The generosity of Francisco José Ayala allowed me, on the one hand, to meet the patriarchs of gene therapy: Theodore Friedman, the "father" of the revolutionary therapy, Helen Blau and David Curiel, and, on the other, the opportunity to attend the sessions of the US President's Science Advisory Group. Among others to Shu Chien, doctor and engineer, one of the few who belong to the three academies —Sciences, Engineering and Medicine— of the *National Science Foundation* who, years later, formed the commission along with Juan Carlos Lasheras -already mentioned-, Antonio Artés and who writes this for the development of the Department of Aerospace Engineering and Biomedical Engineering and Sciences at the initiative of the then Rector of the UC3M, Daniel Peña. I was also one of the eight members of the *IAP (the global network of science academies)-IAC (the InterAcademy Council) joint Development Advisory Committee*. Later I became a member of the *International Advisory Committee* of the *Barcelona Knowledge Hub* of the *Academia Europaea*. Years before, he was the Secretary General of the Spanish chapter of the *International College of Surgeons*.

The Botín Foundation's Science Program marked a before and after in the evolution of Spanish science; the book *28 Historias de Ciencia e Innovación Biomédica en España (28 Stories of Biomedical Science and Innovation in Spain)* describes it. I learned the job of "scouting" researchers. Getting to know them in their environment, participating in their seminars, a minimum follow-up of five years, did they maintain what they did in other environments in this one, what did they do and do? In short, evaluate people, not scales.

Living organizations are fluid and mobile. As a rule, I used to start my classes on Surgical Pathophysiology by telling my Complutense students that this subject, at least, was not the most important one. Thinking is. I added that I must have known this firsthand because during all those years I was the only professor of this discipline in the entire Spanish University, and the situation, apparently, continues. However, it serves as an example of the prevailing confusion. Surgical or molecular pathophysiology, or general pathology, are a mere administrative unit with several names. We should encourage the emergence not of names but of innovative ideas based on solid training. But there are no disciplines. There are only problems and the drive to solve them. On the first day, the teacher informed the students that the program had been explained. Attendance was voluntary. Recommendation: acquire *The Meaning of Physics*, by Don Carlos Sánchez del Río; when you have assimilated it, not before, you will be welcome. Read it. UCM students have another no less enriching opportunity: on the campus of the University City they can freely attend Mathematics, Physics and Chemistry, Biology, Law... and listen to, meet, and get to know teachers and students who are worthwhile.

Ramon Gomis, respected and admired friend — clinician, researcher, teacher... and writer of prose and theater, Premi a la Creació Fundació Enciclopèdia Catalana —, comments:

"One specializes when one goes deeper, when one wants to know more, never as a refuge to obviate global knowledge, the one that goes from word to number, from idea to image, from science to art."

The cost of the disciplinary approach is that it restricts the scope of our questions and many extra-disciplinary ideas that contribute to the progress of the cultural whole are lost. We are in a period of transience or convergence of knowledge, an expression that recalls Goethe's *Divan* and recognizes the value of approximation, of the synthesis of knowledge as an institutional priority, today through exponential technologies. Society and academia must wake up to the full involvement of this reality. Great ideas are often characterized by considerable generality. The greater the problems, the greater the opportunities. The mission of the Academies is to find them. Numerous institutions - unfortunately all outside our borders - have done so. Some were unknown only a few years ago.

I am not in favor of fashions, be they of opinion or scientific. I assume instead that simplicity, not simplicity, and clarity are values in themselves. Most of the fundamental ideas of science, as a rule, can be expressed in a language understandable to all. I question the proliferation of experts, for "the prudent surpasses the prophet," says the *Talmud Babli*. Also, Einstein's phrase: "Everything should be made as simple as possible, but not simpler". Excessive respect for the specialist destroys the republic of knowledge, the rationalist tradition, and science itself. The COVID universe is a sample.

When I suggested, already as a university professor, that the basic philosophy of medical or any other university education and training should be directed, following the philosophy of Johns Hopkins — and Decroly —, not to create a cardiologist, a lawyer, an engineer....but to form, in their field, a totipotent, stem-cell type citizen, sufficiently well prepared —including practice [in the case of Medicine, Health Centers]— and with an open mind to be able to face the complex problems of the real world —risk culture—, or that the new curriculum must prepare people for the demands and responsibilities of a new era of knowledge in science, mathematics, engineering and the

humanities, I received a warning from the University for "unregulated teaching." Nor is this attitude of rejection new. Back in the 1990s I organized in "my" Hospital some "General Colloquiums"; open debate on topics of general interest. The closed-minded environment ensured their disappearance within a couple of years.

Riveting with the words of J. P. Kennedy in *Adventures in the Obvious*:

"I believe that the challenge to the universities is not to graduate students for survival in the technological world of today but to educate students for a meaningful life in the ethical world of tomorrow. There might be doubt if there is to be life tomorrow with the technology and ethics of today".

Remembering Xenophanes of Colophon:

"As for the certain truth, no human knows it and none will ever know it. It is all a web of conjecture."

Alas, retirement came and the longed-for disciplinary correction was left unfinished. Instead, I am immersed in *Project Zero* of *Harvard's Graduate School of Education*, and in the *Big History Project*. It is worth mentioning that, hand in hand with Angel, we tried to launch, on two occasions, one of the first private universities in this country; with a different campus, an innovative, convergent curriculum. No *de facto* faculties, no departments; the big issues. Failure was assured. Also, the attempt to put together a *Metapedia*. An attempt to connect the totality of the available knowledge; chosen a word to reach the farthest one, apparently unrelated, following a logical path. At the Frankfurt Book Fair, back in 1991, Espasa received an international distinction for an exhibition, presented by this writer, related to the neuronal universe.

The pattern we observe in the evolution of the so-called scientific disciplines is what the late Buckminster Fuller characterized as "accelerated acceleration," which implies that new ideas appear faster than the possibility of response through reorganization of studies and departments.

Above all, language is the generator of tomorrow.

"Our lives depend on the ability to express hope, to entrust to conditional sentences and futures our active dreams of change, progress and liberation. More precisely —continues George Steiner—, of all the evolutionary tools toward survival, the most important is the ability to handle the future tenses of the verb."

"Without it —for Baruch Spinoza in *Ethica Geometrico Ordine Demonstrata*— men and women would be no better than falling stones."

It is impossible to imagine being without discursive openness, without the potential to question. *Science Begins in the Word* is the title of Bertha Gutiérrez. Perhaps for this reason, Antonio Colino López, Margarita Salas Falgueras and José Manuel Sánchez Ron supported my candidacy to opt for the vacancy due to the death of Domingo Ynduráin Muñoz, in the Royal Spanish Academy. I read my acceptance speech —*De Calderón y Cibercirugía*—, on October 29, 2006. Francisco

Brines Bañó and José Manuel Blecua Perdices sponsored my entry. Víctor García de la Concha presided. Ten days ago I was elected Secretary of the Royal Institution.

My relationship with the RAE, however, dates back to 1992, with Ángel Martín Municio, recently appointed vice-director and Fernando Lázaro Carreter, director of the Royal Institution since the previous year. At that time the Academy wanted to "computerize" itself. With the collaboration of a then doctoral student in medicine and telecommunications engineering, we undertook the task. An important multinational company thwarted the attempt.

This linguistic impulse stimulated me to find a new word to describe part of the situation in my profession. "Numeromics" —the DLE does not include it... still— describes numerous people who form large waiting lists, which the System intends to gobble up by attending to that crowd of users in the largest possible number and in the shortest possible time, without taking into account the substantial human and technical resources to do so. A word that has found its place in the great *omics* family: *genomics*, *epigenomics*, *proteomics*... *numeromics*.

In the context of this large family, *-omics*, a term I cherish daily is "culturomics"; also not, as yet, in the DLE. The original word —*culturomics*— first appeared in the seminal article by Erez Lieberman —with whom I came into contact through SFI— and Jean-Baptiste Michel, along with eleven motley contributors and *The Google Books Team*, published in the journal *Science*, in January 2011:

"Culturomics is the application of high-throughput data collection and analysis to the study of human culture. Culturomics' extends the boundaries of rigorous quantitative inquiry to a wide array of new phenomena spanning the social sciences and the humanities".

The corpus handled consisted of 500 billion ($\times 10^9$: m M) words; in English (361 m M), French (45 m M), Spanish (45 m M), German (37 m M), Russian (35 m M), Chinese (13 m M) and Hebrew (2 m M). This cloud computing involves, at least, virtual reality, artificial intelligence and big data. I indicated, lines back, my encounter with AI and language during the meeting of the Philosophy of Science Association in Philadelphia in 1982. Recall at this point the 1973 course, at the Hospital; AI was already discussed there. In 2015 I joined, on behalf of the Institute of Spain, the Committee of Experts for the Promotion of the Natural Language Industry (Secretary of State for Telecommunications and for the Information Society. Ministry of Industry, Energy and Tourism).

Also, remember the encounter with the *Pirahā* language and the work of linguist Daniel L. Everett during my stay in Medellin - a project funded by the Community of Madrid with the aim of studying certain conditions of the Amazonian ethnic groups - through the Caro y Cuervo Institute; or the direction for years of the journal *ARBOR* of the CSIC.

An aside. Years ago I had contacted Óscar González Quevedo Bruzan, the Jesuit "Father Quevedo" who implanted the *Isso non ecziste* in parapsychology. He had established himself in Brazil in the 50's. From his hand I tried to create a unit of "traditional medicines" which, as expected, did not prosper. He died without seeing it in Belo Horizonte.

Paolo Rossi comments that the gestation in Europe of the first scientific societies and academies, outside the sphere of the universities and far from ecclesiastical control, involved at least three fundamental ideas: to organize and coordinate ideas; to make the relations between the culture of mechanics and technicians and that of theoreticians and scientists stable and fruitful; and to communicate the results of research, of knowledge in general, to the widest possible public. A vision that must be defended, again, at all costs: Academies are *not* an appendix, a continuation of university departments. Academy and University must collaborate, cooperate, understand each other, but their mission is different in different fields. If we appeal to taxonomy, Academy and University are different realms. The Academy is not the last link in the university chain. Moreover, not everything is and should be Academia.

So we must decide. Mark Twain or Niels Bohr or..., the authorship is not clear, he said:

"Predictions are very difficult to make, especially when than deal with the future."

We have two options. The sentence of who reached the baseball *Hall of Fame* and ended up in poetry, Dan Quisenberry:

"I have seen the future and it's just like the present, only longer".

Or the reflection of Frank Rhodes, Rector of Rectors:

"The future has always been different, and it becomes less and less like the present or the past".

It remains to go back to the beginning. The memories, which are names and situations. It was worth it.

I conclude by the hand of Mr. Antonio:

"The adjective and the noun,
backwaters of clean water,
are accidents of the verb

in lyric grammar,
of the Today that will be Tomorrow,
the Yesterday that is Still".

But "*tomorrow is always late*," headlined Federico Mayor.

Tomorrow is always too late to enjoy our children
—Alberto, Ricardo and Marta— and grandchildren —Iván, Nadia and Maya—,
in each of its stages, for as long as we last,
right, Nela?

PEACE and GOOD.

*The present narrative concludes on October 8, 2022.
On that day, a wound occurred that will take time to heal or,
most likely to become chronic.
Alberto did not have the opportunity to say goodbye.
I long for the hope of the arrival of reassuring oblivion.
That's not entirely true either!
The wound is the place where we are condemned to live.*

I close this sorrowful recollection by transcribing the words of my grandson Ivan:

*"I could put a thousand and one good things about this very special man in my life,
but I would fall very, very short.
I only ask You to take care of him and help him to find the way to You,
Like him, he guided me through such difficult times and throughout my life,
to find and achieve everything I set my mind to,
I will never stop being Van Van.
Rest in Peace, Tito."*

Curriculum vitae
[abstract] [abstract]

Pedro R. García Barreno.

Madrid, October 23, 1943. Married (Manuela Diez Lorenzo); two sons (Alberto and Ricardo), one daughter (Marta).

Training.

Primary and secondary education at Colegio Decroly, Madrid. Bachelor, Degree and Doctor (Extraordinary Award, 1973) in Medicine from the Complutense University of Madrid. Specialist in Surgery (Ministry of Education and Science). *Educational Council for Foreign Medical Graduates Award* (USA). Trained at the Provincial Hospital of Madrid, and at the hospitals of the English University of *Cardiff (Sully Hospital-Thoracic Centre, Sully, Glamorgan)* and the North American Universities of *Michigan State & Wayne State (Detroit Receiving Hospital, Detroit)* and Texas (*MD Anderson Cancer Center, Houston*). Ongoing connection with the *Department of Mechanical and Aerospace Engineering (MAE)* at the *Jacobs School of Engineering, UCSD*. Biochemistry and Molecular Biology, Faculty of Chemical Sciences and Differential Equations, Faculty of Mathematics, Universidad Complutense. Electron Microscopy, National Center of Microbiology. Preclinical Veterinary Studies, Faculty of Veterinary Medicine, Complutense University. Studies of solfeggio and piano, and flying (international license). Diploma in National Defense from CESEDEN-Alto Estado Mayor de la Defensa, in Medical Informatics from the Instituto de Informática del que fuea Ministerio de Educación y Ciencia, and in Direction and Management of I+D from the Escuela de la Función Pública Superior del Instituto Nacional de la Administración Pública. Master in Business Administration (M.B.A.), Instituto de Empresa, Madrid.

Current position.

Numerary Academician of the Royal Academy of Exact, Physical and Natural Sciences (1984, medal no. 11), and of the Royal Spanish Academy (2006, chair "a") of which he is Secretary (January 2022). Honorary Member of the Royal Academy of Sciences, Fine Arts and Noble Arts of Córdoba. Corresponding Academician of the Royal Academy of Medicine of Galicia and of the Academy of Medical Sciences of Bilbao. Member of the Colegio Libre de Eméritos and of the Academic Council of FIDE. Supernumerary Academician of the Royal Academy of Doctors of Spain. Representative of the RAE in the Council of Culture of the Community of Madrid. Of the Chair of Spanish and Hispanic Studies of the Universities of the Community of Madrid. Of the Council of University Quality.

Positions held.

Honorary Professor (2017-2021), Universidad Complutense de Madrid. Professor Emeritus, Universidad Complutense (2014-2017). He held the Chair of Surgical Pathophysiology and Propedeutics at the Complutense University of Madrid, after serving as Associate Professor of Experimental Surgery at the Autonomous University of Barcelona, and as Professor in charge of Molecular Pathophysiology in the Department of Biochemistry and Molecular Biology of the Faculties of Chemistry and Biology, Complutense University. Visiting Professor in the Department of Mathematical Analysis of the Faculty of Mathematics Complutense. Senior Consultant and Head of Department at the Hospital General Universitario Gregorio Marañón in

Madrid, where he was Medical Director, Deputy Director of Research and Clinical Head of General Surgery. Category C for the use of animals for experimental and other scientific purposes. External Professor, Master in Science & Law, Universidad Nacional de Educación a Distancia. Delegate of the Rector of Universidad Carlos III de Madrid for "Engineering and Biomedical Sciences". Delegate of the Rector of the University of Cantabria for "Singular Projects". Director of the National Plan for the Prevention of Handicaps, President of the National Commission for the Toxic Syndrome and Director of the Military Health Unit of the Ministry of Defense. Vice-President, Scientific Research Ethics Committee, Community of Madrid. Secretary General of the Institute of Spain (1994-2002; 2010-2021). *Fellow, Academia Scientiarum et Artium Europaea. Member, Development Advisory Committee (DAC) of the International Academy Panel (IAP, the global network of science academies) and the InterAcademy Council (IAC). Member, Board of Directors, Center for the Scientific Study of Creativity: Literature, Arts and Science, University of California.* Director and coordinator of the Science Program of the Botín Foundation. Trustee of the "Vodafone" Foundation. Trustee of the "Antonio de Nebrija" University. Member of the Scientific Advisory Board of the Center for Biomedical Technology (CTB), Polytechnic University of Madrid, and the Duques de Soria Foundation. Member of the Scientific Council of the ONCE Foundation. Co-director of the Master's Degree in Hospital Architecture and Engineering, CEU University. Director of the Science-Technology Forum of the Center for Public Policy and Government Studies of the University of Alcalá de Henares. Director of the CSIC journal ARBOR. Member of the Committee of Experts for the Promotion of the Natural Language Industry (Secretary of State for Telecommunications and the Information Society. Ministry of Industry, Energy and Tourism). Co-Director- Garrigues Foundation - Science & Law Chair. *Chair, Clinical Translation & Innovation Committee, Institute for Bioengineering of Catalonia (IBEC).* Scientific Advisor of the "Botín" Foundation. Chairman, Science and Technology Advisory Committee, *Arquímea group. Member, International Advisory Committee, Academia Europaea / Barcelona Knowledge Hub (BKH). Fellow Member, InterAmerican Medical and Health Association.* Head of Surgical Team (General Surgery) of the Social Security, and Numerary Doctor of the Beneficencia Municipal de Madrid. Medical Ensign, Central Hospital of the Spanish Air Force.

Distinctions.

Medal of Honor, Carlos III University of Madrid. Library "Prof. Pedro García Barreno", Faculty of Medicine, Univ. Complutense. Medal of the Department of Surgery, Faculty of Medicine, Univ. Complutense. "Tribute to Pedro García Barreno. Peace and Good. La Biomedicina en España y Pedro García Barreno", J. Ávila, J.J. Guinovart, M.T. Miras, ed., Madrid: Realigraf, 2010. Awards "Condesa de Fenosa de Investigación Quirúrgica", "Fundación Científica de la Sociedad Española Contra el Cáncer" and "Empresarial a la Innovación de la Unión de Empresarios-Cámara de Comercio". Tribute to the "Academic Seniority 2021", Instituto de España. *Honorary Degree, ESERP School of Business and Social Sciences. Distinguished Degree, European Doctors & Doctor Honoris Council. "Certificate of Merit for Distinguished Service to the Community — Dictionary of International Biography" and "Community Leaders of the World Award-The American Biographical Institute". Guest Lecturer, Department of Mathematics (Prof. Eduardo L. Ortiz), Imperial College, London.*

Scientific societies.

Member of the Spanish Scientific Societies of Angiology, Biochemistry and Molecular Biology, Surgery, Philosophy, Surgical Research, Internal Medicine, Pedagogy, Psychology and of the Spanish Associations of Education, Technology and Education Studies, Interdisciplinary José de Acosta (ASINJA) and Medical-Cybernetics. Honorary Member of the Spanish Association of Technical Specialists in Scientific Photography. Member of the international ALDEEU (Association of Spanish Graduates and Doctors in the USA), American Association for the Advancement of Scientific Photography.), *American Association for the Advancement of Science*, *American Society of Zoologists-Comparative Physiology & Biochemistry*, *Animal Behaviour Society* (USA), *Cell Stress Society* (USA), *European Biomedical Research Association* (founding member), *European Shock Society*, *European Society for Surgical Research*, *International College of Surgeons* (of which he was Secretary of the Spanish section), *Leukocyte Biology* (USA), *Phylosophy of Science Association* (USA), *Royal Society of Medicine* (London, U.K.), *Shock Society* (USA), *Phylosophy of Science Association* (USA), U.K.), *Shock Society* (USA, only Spanish member), *Society for General Microbiology* (USA), *Society for Health and Human Values* (USA), *Society of Social Studies of Science* (USA), *The International Association for Human Relations Laboratory Training*, *The New York Academy of Sciences*, *Wellcome Institute for the History of Medicine*.

Work topics.

Pathophysiological basis of the disease. The doctoral thesis focused on *shock* situations; a severe clinical picture; its inflammatory variant is still accompanied by >50% mortality. Papers published during the second half of the 1970s and the first half of the 1980s provided data that helped to delimit and understand the condition as two distinct nosological entities (hypovolemic *shock* and septic or inflammatory *shock*, today SIRS) and opened up new therapeutic strategies: pharmacological administration of corticosteroids to high-risk patients. Although the dosage level has been revised, the administration of corticosteroids in inflammatory *shock* states is current and fully admitted (*Crit. Care*, 2017). Standard treatment of critically ill patients for COVID-19 includes administration of steroidal anti-inflammatory drugs. From the early 1990s, interest focused on the study of first-line biosensors -leukocytes- of the various aggressions suffered on a daily basis, as well as response systems -stress proteins (HSPs: *Heat shock proteins*)- that allow early diagnosis of the injury. The genetic classification of individuals - molecular epidemiology - is essential to predict their resistance or predisposition to suffer different common pathologies, such as the common cold or atherosclerosis. This work was recognized by the Spanish Association Against Cancer and the Condesa de Fenosa-Barrié de la Maza Foundations.

Mechanical circulatory assistance. Approached from a surgical perspective, it was preceded by several experiments on isolated organs that were later taken up again. It began in 1982 as a support to the Cardiac Surgery Service of the Hospital: the incorporation of circulatory assistance devices to the clinic. The initial objective was the design and development of a prototype control console for a commercial artificial ventricle. In view of the favorable results obtained and the difficulty of access to such technology in our environment, the line of research was extended to the design and development of our own artificial cardiac ventricle and its mechanical drive and electronic control systems. After the alliance with a company (*Biomed S.A.* ®) and extramural collaboration in the field of fluid mechanics (Dep. Fundamental Physics, UNED) and biomedical materials (Inst. Plastic Materials, CSIC), the construction of a complete electro-mechanical system for circulatory assistance was undertaken. The "BCM Project (Biomed-Comunidad de Madrid)" incorporated a

new concept - "false atrium"-, not used until then in devices of this type, which basically consists of incorporating a *compliance* chamber in the ventricular entry cannula; this facilitates filling of the ventricle and reduces hemolysis, the main limiting factor of artificial circulation. After overcoming the requirements - the group assumed the conditions of the FDA (*Food & Drug Administration*) of the USA, as there were no approved Spanish or European regulations - in computational models, test bench and after more than one hundred experiences with sheep, both acute and chronic, authorization was requested from the Ministry of Health for the clinical trial. This trial consisted of ten implantations in humans. The first intervention in a patient was carried out on July 1, 1989, and the clinical trial ended in December 1991 with a favorable result. Once the development phase was completed, the company involved in the project from the beginning took over the industrial manufacturing process and the commercialization of the device and the control console. The purpose of the artificial ventricle - single or double - is to guarantee cardiac function for periods ranging from a few hours to a maximum of two months, while waiting for a heart transplant. Sometimes, the rest imposed on the cardiac muscle by mechanical assistance manages to reverse the heart failure, displacing the transplant.

Medical imaging. On the basis of the first clinical surgical research work - angiography of the splanchnic portal venous system by means of umbilical vein catheterization and external omphalo-saphenous shunt - a third work topic is oriented towards research on medical imaging techniques, both the development of new technologies and processing methods and their practical application. The research, organized in 1994, has a markedly multidisciplinary and multicenter character, and facilitates a strong connection with clinical reality, allowing the choice of work topics to be oriented on the basis of real needs derived from patient care. A strong research team was created and consolidated, which made its debut by participating in a major European research project, AIM (*Advanced Informatics in Medicine*), together with a formidable cast of industrial partners (*Philips Medical Systems*, project leader, *Siemens Medical Group*, *IBM UK Scientific Center*), clinical partners (University Hospitals of Utrecht, Tübingen and the University of Tübingen), and clinical partners (University Hospitals of Utrecht, University Hospitals of Tübingen and the Catholic University of Leuven, *Heidelberg Cancer Research Center* and the *Institute of Cancer Research* at the *Royal Marsden Hospital*) and academics (*University of Hamburg Computer Science*, *University of Sheffield AI Vision Research*, *Technical University Aachen*, *University of Genoa Institute of Computer Science and Computer Vision Research Group Utrecht*). The project, named COVIRA (*COmputer VISION in RAdiology*) was the first attempt, on record, to incorporate expert systems for the recognition and segmentation of medical images. The project, very advanced for the time and the result of its great scientific impact, was, exceptionally, extended in the third Framework Program. During the course of the project, pioneering techniques in image processing were developed, which are now consolidated. Subsequently, partnerships were established with SUINSA® (Madrid). Areas of interest: a) Magnetic resonance imaging. b) Multimodality image integration. c) Quantification of cardiac functional images by tissue Doppler technique (DTI) or using intravascular contrast agents ecopotentiators. Several algorithms and software tools have been developed, which have resulted in technology transfer contracts to the manufacturer ACUSON® in the USA. d) Telemedicine: Participation in several European projects on Telemedicine. In 2002, it developed a teleradiology station called *Telra*, which was the subject of a technology transfer contract to the company SUINSA®. e) High resolution imaging in laboratory animals. High resolution PET and CT molecular imaging systems have been developed and transferred to industry (Suinsa-*General Electric*). As a curiosity, the first commercialized device was acquired by Johns Hopkins University. All this work —unprecedented in our

environment— in the field of medical imaging has been recognized with the *Innovation Award 2004* of the Union of Businessmen of the Chamber of Commerce and Industry.

Epidemiologic research. 1982. From the Presidency of the National Plan for the Denatured Oil Toxic Syndrome, novel techniques were developed to try to determine the causative xenobiotic, as well as to strengthen epidemiological surveillance in Spain. 1985. The direction of the National Plan for the Prevention of Subnormality required the assembly of massive microanalytical techniques that culminated in the coverage of 98.5 % of newborns and allowed the number of controlled entities to be increased from 2 to 19. 1989. On the occasion of the V Centenary of the Discovery, an ambitious plan was developed to study the HLA-gene polymorphism in the populations of Latin America, including certain ethnic groups, in order to draw up a susceptibility map. To this should be added the work mentioned in the first section on molecular epidemiology.

Continuing education. 1993. First Master in Spain in "laparoscopic techniques" (Med. Cir. Exper. Hospital Gral. Madrid - Dept. Surgery UCM). Editions: 1993, 1994, 1995, 1995, 1996, 1997 and 1998. 2009. Master in "hospital architecture: design, organization and management", 2009-2015 CEU-AIDHOS.

Laboratory animals. 1979. Donation, by Prof. David H. Sachs of the *National Institutes of Health-USA*, of three pairs of mini-pigs corresponding to three homozygous strains for three specific antigens of the major histocompatibility complex. This led to the construction of an animal facility on the grounds of Monte de Valdelatas under the auspices of the Diputación Provincial de Madrid. As a result of the collaboration with the CBM, we became involved in the project, directed by Prof. Eladio Viñuela, on African swine fever. It was an initial nucleus that provided animals to other laboratories in the country. 1983. Agreement with the Madrid Zoo for the purpose of surgical care of the animals located there and the possibility of accessing selected surplus animals for experimental research.

Convergence: STEAM (Science, Technology, Engineering, Arts, Mathematics). In 2000, from the direction of the Botín Foundation's Science Program, launching of the first nationally coordinated biotechnology transfer project, which led to the creation of companies and a venture capital fund. Reference: *Howard Hughes Foundation* Program, U.S.A. In 2009, entrusted by the Rector of the Univ. Carlos III to develop a Degree in Medical Sciences and Biomedical Engineering in an Aerospace Engineering Dept. which, at present, requires for admission one of the highest cut-off marks. In 2015, co-direction of the Science-Law program, FIDE-Garrigues Foundation. In 2016, commissioned by the President of the Autonomous Community of Cantabria and the Rector of the Univ. Cantabria to develop a Center for the study of Complex Systems. Referent: *Santa Fe Institute* (SFI), New Mexico, U.S.A. Letter of support from Prof. David Krakauer, President and *William H. Miller Professor of Complex Systems* of the Santa Fe Institute: "a very strong letter of support for your new initiative".

Publications (selection).

The first: "Repermeabilization of the umbilical vein as a route of exploration and treatment", *Hospital General* (Madrid) 1970; 10: 417-424 [...]. "Metabolic response in shock," *Surgery Gynecology & Obstetrics* 1978; 146: 182-190. "Pulmonary lung and surfactant lipid biosynthesis in dogs under septic and hypovolemic shock syndromes", *International Journal of Biochemistry* 1979; 10: 91-6. "The microviscosity of liver plasma membranes of rats fed with oleoylanilide", *Biochemical Journal* 1984; 218: 125-9. "Rapid stimulation of diacylglycerol production in *Xenopus* oocytes by microinjection of *H-ras* p21", *Science* 1987; 238: 533-6. "Endothelial cell growth factor and ionophore A23187 stimulation of production of inositol phosphates in porcine

aorta endothelial cells," *Proceeding of the National Academy of Sciences USA* 1988; 85: 659-63. "Normal biochemistry values in baboons (*Papio C. Cinocephalus*) ", *Comp. Biochem. Physiol* 1990; 96 B (4): 647-9 [was cited by T.E. Starzl in his publication on the first human-baboon xenotransplantation]. "Development and clinical assay of the BCM ventricular assist device," *Artificial Organs* 1994; 18: 484-9. "Simulated surgery on computed tomography and magnetic resonance images: an aid for intraoperative radiotherapy", *Computer Aided Surgery* 1997; 2: 333-9. "Allais phenomena and completeness of preferences", *Economic and Environmental Risk and Uncertainty. New models and methods, Theory and Decision Library. Series B: Mathematical and statistical methods*, 35: 245-256, 1997. "The Madrid Mathematical Academy of Philip II," *Bolletino di Storia delle Scienze Matematiche* 2000; 20: 87-188. "Research and Surgery", *Act Urol Esp* 2008; 32 (1): 3-23 [selected by *BioMedLib* ® as the first of the *Top 10* articles published on the same topic after ten years of its publication]. "Tensegrity. Architecture, Art and Biology." *Arquitectura Viva* 2009; 125: 19-31. "Extracellular heat shock protein 70 (HSPA1A) and classical vascular risk factors in a general population", *Cell stress and Chaperones* 2010; 15 (6): 929-937. "Mathematically gifted adolescent use more extensive and more bilateral areas of the fronto-parietal network than controls during executive functioning and fluid reasoning tasks", *NeuroImage* 2011; 57: 281-92 [...]. The latest: "Scoliosis induced by costotransversectomy in minipigs model", *Medicinski Glasnik* 2019, 16 (2): 157-163.

Books (selection).

La Ciencia en Tus Manos, Madrid: Espasa Calpe, S.A., 2000. *Fifty Years of DNA. La Doble Hélice*, Madrid: Espasa Calpe, S.A., 2003. *Introduction to the Study of Experimental Medicine. Claude Bernard*, Barcelona: Crítica-Clásicos de la Ciencia y la Tecnología, 2005. *The Legacy of Hippocrates. Los Grandes Temas de la Medicina*, Madrid: Espasa Calpe, S.A., 2008. *Sendas de Conocimiento, V. Temas de Fisiopatología*, Madrid: PRGB, S.L., 2013. *Meditations COVID-19. March 2020-March 2021*, Madrid: PRGB, S.L., 2021. *Teaching to Be*, Madrid: PRGB, 2024. *Angel Martin Municio. First Centenary*, Madrid: Colegio Libre de Eméritos, 2024.

Summary.

Hospital career: 5 / 5. Teaching career: 4 / 5. Researcher career: 6 / 6.

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