

"A Personal Vision"

**Taken from the "Tribute to Academic Seniority 2021"
by the Royal Academy of Exact, Physical and Natural Sciences.**



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PRESENTATION

D. Pedro G^a Barreno was born in Madrid in 1943. He studied primary and secondary education at the Decroly School, located opposite his house. Although he wanted to be an airline pilot, getting a pilot's license C and the International Flight Card, a high school classmate convinced him to study medicine. He studied Medicine at the Complutense University of Madrid, simultaneously working as an intern at the Hospital Provincial -County Hospital- of Madrid, where he joined the Surgery service. During his undergraduate degree, and at the end of it, he made stays at a British university (Cardiff) and at an American university (Michigan State). After finishing his degree, he joined the Hospital Provincial of Madrid, already as a doctor attached to the Surgery service, making frequent visits to the MD Anderson Cancer Center, of the University of Texas, in Houston. Back in Spain, he presented his Doctoral Thesis in 1973, obtaining the Extraordinary Prize.

The motto of the Academy of Sciences is "observation and calculation". A great medical virtue is the excellent observation that doctors carry out when examining a patient. However, its level of calculation is usually improvable. This is not the case of Prof. G^a Barreno, since he met Prof. Ángel Martín Municio, coming with him to have extensive knowledge in Molecular Biology, which is Quantitative Biology. In the department of the UCM she also collaborated with Prof. Martín Municio, to carry out an important teaching task. Focusing on calculus, in the Department of Prof. Alberto Dou, in the Faculty of Mathematics of the UCM, she studied in the field of differential equations. Perhaps as a consequence of this training, she showed great interest in the relationship between engineering and medicine.

In 1981, Mr. Federico Mayor Zaragoza, Minister of Education and Science, inaugurated the Experimental Surgery Unit of the Hospital Gregorio Marañón, with Prof. G^a Barreno being its first head. This facility was a model for others that were later developed in other hospitals in Spain. In the construction of this Unit, he collaborated with Professor Eladio Viñuela, with whom he later had a professional relationship in a project related to African swine fever.

At the Hospital Gregorio Marañón, he carried out important management work as head of the Department of Medicine and Experimental Surgery, and later, as Director of the Hospital. Previously, and at that time, the Spanish Health had had a spectacular development, beginning that development under the direction of the Ministry of Health of D. Ernest Lluch, and in which the work of the "three Pedros", Aparicio, G^a Barreno and Sabando, was very deserving. On the other hand, Prof. G^a Barreno obtained the Chair of Physiopathology and Surgical Propaedeutics at the Faculty of Medicine of the Complutense University, in which he is now an ad honorem Professor.

One of the favorite phrases by D. Pedro G^a Barreno is that of Goethe, referring to not only having to know, but also having to do. Knowing is not enough, we must apply, and Mr. Pedro G^a Barreno has carried out pioneering and spectacular work on how to apply basic research, not only in public institutions but also in private ones. From the scientific direction of the Fundación Botín Science program, he led the first nationally coordinated biotechnology transfer project, fundamentally related to biomedicine, which gave rise to the creation of new companies. As a tribute and thanks to D. Pedro, the members of said project dedicated the book "Peace and Good" to him, in it are endearing articles, such as the one that serves as a prologue, written by Professor Margarita Salas.

Mr. Pedro G^a Barreno has published more than 100 works in the different areas in which he has developed his work. Fundamentally, his work in Surgery stands out. However, following what is indicated in Goethe's phrase, D. Pedro not only knows the theory of Surgery, but has also practiced it in various places, and even not very usual ones, such as bullfights, where he saved more than one leg of some of the bullfighters, gored by the bulls. Although some great works have been published in good magazines or newspapers, but with low circulation (it should be remembered that some of the best poems of D. Antonio Machado were published in the Diario Soriano "El Porvenir Castellano"), this is not the case of Prof. G^a Barreno. Among the works of D. Pedro G^a Barreno, in the area of Molecular Biology, two of them, excellent, were published in journals with the highest impact index such as *Science* or *PNAS*. In addition, D. Pedro has published very relevant books, related to philosophy, scientific thought or popularization, not popularization, scientific. His last book, he wrote it during the time of confinement, and I had the honor of reading chapter by chapter, as he wrote them, something that was appreciated in time of isolation.

In the words of Margarita Salas, Pedro G^a Barreno is a multifaceted man with an extensive culture, capable of delving into different topics, which is why when his activities are analyzed, these characteristics can be found. Pedro G^a Barreno worked on the physiological bases related to surgical processes. Necessary bases to understand two nosological entities,

such as hypovolemic shock and septic (or inflammatory) shock. He has also worked on the development of an artificial ventricle (heart) prototype to facilitate blood circulation, a work ahead of its time, since another prototype has recently been described, not very different from the one described by Prof. García Barreno, in the Duke University (NC, USA). He has carried out work in the development of clinical image analysis, studies carried out at the Hospital Gregorio Marañón. Additionally, he has performed epidemiological studies. Also, he has been a forerunner in Spain in the convergence between biomedicine, physical sciences and engineering. This activity has been developed, fundamentally, at the Carlos III University, where he has created a degree in medical sciences and biomedical engineering.

Mr. Pedro G^a Barreno has been acquiring a series of principles throughout his professional career, which he has summarized in phrases known as the Wisconsin Idea: «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». Hand in hand with this commitment, the pronouncement of Karl R. Popper: “We do not study topics, but problems”. David Weatherall's conclusions: «The growing importance of science and technology in medical-health care and the difficulty of the social, ethical and legal aspects that this implies, requires transversal cooperation or convergence of knowledge». Joseph L. Goldstein and Michael S. Brown referred to the clinical researcher as a bewitched, troubled, and bewildered species. In recent years, the concept of "creative destruction", popularized by the economist Joseph A. Schumpeter, has been revived in the field of health in view of its invasion by ICT. And the recommendation, already indicated, of Johann W. von Goethe. All this gave rise to three principles: to reinvigorate the intellectual foundation of academic medicine through the convergence of the different areas of knowledge, assimilating the thriving avalanche of technologies, to promote and facilitate collaborations and to encourage innovation and transfer of results.

Among Prof. G^a Barreno's distinctions are: Medal of Honor, Universidad Carlos III, Madrid. Library «Prof. Pedro García Barreno», Faculty of Medicine, Complutense University. Medal of the Department of Surgery, Faculty of Medicine, Univ. Complutense. «Tribute to Pedro García Barreno. Peace and good. Biomedicine in Spain and Pedro García Barreno», J. Ávila- J.J. Guinovart, M.T. Miras, ed., Madrid: Realigraf, 2010. Awards «Countess of Fenosa for Surgical Research», «Scientific Foundation of the Spanish Society Against Cancer», «Business to Innovation of the Union of Entrepreneurs-Chamber of Commerce», «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. Ortíz), Imperial College, London. Likewise, she is a member of different foreign Scientific Societies, examples are: Member of the Inter Academy Panel and Inter Academy Council Development Advisory Committee, Member of the Academia Europaeae – Barcelona Knowledge Hub.

To conclude, I would like to focus on a highly relevant aspect of Pedro G^a Barreno, his principles and his personality. From D. Pedro I learned the concept of bonhomie, something of which he is an example, although his level of ingenuity is low. It is also necessary to highlight his drive and energy in the development of his work, his fine sense of humor, and respect for the work of others. Finally, as indicated in a sentence of the book dedicated to him, due to his work at the Botín Foundation, D. Pedro G^a Barreno is a thorough, prudent and generous scientist who gives peace and enjoys doing good.

Prof. Jesús Ávila from Grado
Associate professor ad honorem of the CSIC
From the Royal Academy of Exact, Physical and Natural Sciences.

PEDRO R. GARCÍA BARRENO

Bene Scripsisti De Me, querido Jesús.

“Don't believe because you've heard it.
Do not believe because many rumor it.
Don't believe because you've read it.
Don't believe because the teachers say so.
Only after observation and analysis accept it.”
Siddhartha Gautama (Sakyamuni, the Buddha). 5th-4th century.

Aeschylus writes very early in his *Agamemnon*:

“The gods invite me to celebrate this moment
and for this I still have strength,
because they have allowed
a breath of persuasion,
vigor at an old age, to try to spin past songs”.

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

“In truth I consider that, in old age,
this is the most unfortunate, to feel that at that age you are importunate for others”.

But, 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 remove and what to put?”

And, furthermore, how? In *Los Complementarios*, Don Antonio, in a “soleá”, left his poetic creed:

“Dark, so that they attend;
clear as water, clear,
so that no one understands.”

In the 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 unravel the knots of my quipu. But...

“Follow the yellow brick road”.

A few references, accumulated over time, have accompanied all my activity. Johann W. von Goethe's recommendation:

“It is not enough to know, it must be applied.
It is not enough to want, it must be done”.

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

"I shall never be content until the beneficent influence of the University reaches every family of the state".

Bertrand Russell affirmed a few lines after concluding his *Essays on Education*:

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

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

"The importance of achieving global scientific literacy for future generations justifies universal public education in a free society."

The sentence of Karl R. Popper:

"We do not study topics, but problems; and the problems can cross the limits of any object of study or discipline [...]
We are students of problems, not of disciplines".

The concept of "creative destruction", today the 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 of current science.
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 know the established technology and the emerging groundbreaking techniques. This window contemplates from the pipette to the architecture and engineering of the structures and their management. Hence the projects on the treatment of severe clinical syndromes, epidemiological molecular screening, circulatory assistance systems and control console — BIOMED-CAM—, on medical image reconstruction algorithms —COVIRA: COmputer VIsion in RAdiology—, design and construction of a microscope for imaging molecular, my relationship with architecture and structural engineering studies —I co-direct the AIDHOS course (Hospital Architecture and Engineering Study)—, the stable 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). Later he would occupy the direction 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 complexity of the social and ethical factors associated [with its application], which will guide the ability to determine the future, require greater scientific preparation from all of us. Politicians must understand the rudiments of scientific evidence and society, as a whole, must be sufficiently informed to be able to participate in the debate of the complex repercussions that, continuously, derive from the advance of [scientific] research. This sensitivity towards knowledge must begin at school, where scientific training must occupy a relevant place".

I end this "appropriation" of other people's ideas in the hands of David Krakauer, president of the Santa Fe Institute. Defender of the fusion of ideas and approaches from initially disparate fields, beyond borders:

"The scientific opportunities that 'convergence' makes possible will make fundamental contributions in our future to provide creative solutions to the most difficult problems that threaten our society."

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

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

One of the latest communications from the Nobel Foundation says:

“The Nobel Prize in Physics 2021 was awarded ‘for groundbreaking contributions to our understanding of complex system’ [...]”.

Convergence enhances our ability to think beyond the paradigms in use and addresses the most diverse and complex situations from multiple perspectives instead of the prevailing monovision. 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 action potential.

In general terms, our higher education institutions remain entrenched in the organizational structures and bureaucratic practices of the past, making the concept of “university innovation” a new oxymoron. The academy must aspire to become a business organization, embedded in 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 the “advanced” research centers, of the “campuses of excellence”. There are people, no doubt; Not so the institutions.

Convergence—science-mathematics-technology and omniscopic (STEM extended: STEAM)—is a long-term company whose objective is the education and training of citizens and, of course, of professionals capable of formulating new questions to old topics to face problems still without resolving. For this it is necessary to break or ignore the limits of the disciplines; Only in this way will new paths of knowledge be opened 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 5 to 18 years old: oral and written expression and reading comprehension of complex texts; multilingualism; megahistory; science-technology/engineering-mathematics, and learning by doing and taking risks.

“Who has seen such strange dreams!”

Rosaura recites in *Life Is a Dream*.

All this leads, inevitably, to a “search without end”. José Saramago writes in *A Caverna*:

“Begin at the beginning. As if that beginning were the always visible end of a badly wound thread that you 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 held a smooth thread in our hands and continuous from which it has not been necessary to undo knots or unravel tangles, something impossible in the life of balls”.

The Belgian doctor, pedagogue and teacher Jean-Ovide Decroly (1871-1932) created in Brussels, in 1907, the *École de l'Ermirtage*, “the school for life through life” or “Decroly school”. In 1927, don Ladislao Palenzuela Negrete, established the Decroly School in Madrid, lay and private. One of the most important and significant pedagogical principles is to train children in the values and conditions to face the real world through the educational experience. Make education a pleasant and profitable task, understanding the peculiarities of each one. The tools: motivation in an environment of freedom.

In that environment, Ms. Mili Luengo woke up, there in nursery school and infants, the motivation. She first taught the meaning of signs—now she would say she was a pioneer of von Petzinger's work—, then the meaning of letters, words and, after that, reading. She also to write and, soon after, basic arithmetic rules. The only essential thing, along with playing with a button or a robot, that you have to teach a child; although most of them suffice themselves.

The Decrolyan alquitar distil, each and every day of the year, poetry, theater, a small orchestra, ballet—remember María Esparza, appointed in 1933 director of the ephemeral Ballet of the National Lyric Theater—, music theory and piano with María Cerrajería and the teacher Gordillo, sports—“use your hands, not your feet”— and nature. Also, chess (let me quote my great-uncle José Raúl Capablanca). And above all, for years, D. Felipe, teacher, gentle and kind. Fortunately

for us, he ended up taking refuge in the Decroly. There he taught everything, which he alternated writing Western novels like F. G. Rich. "They study all day," he commented, "they don't have time to think or understand." Serve the memory as a tribute made of admiration and longing. The Decroly School, the closest thing to a liberal school at that time, which knew how to incorporate a cast of teachers trained in the Normal and brilliant professors away from their chairs. Without leaving in the inkwell the carpentry located on "the opposite sidewalk" —like Gloria Trevi's song— to one of the school's headquarters, where you could spend hours admiring the mastery of that craftsman designer in wood; perhaps something premonitory to the admiration, years later, for the aforementioned Karl R. Popper.

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

"Fortune rules life, not wisdom."

They assert that no philosopher has ever said a more discouraging maxim.

The fortune that was random, because what I wanted to be was an aviator, channeled me to what Publio Virgilio Marón related in the twelfth book of *Aeneis*:

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

In my case, without a doubt, chance —friendship— and the need —justify my time— prevailed over vocation. The magic word was decisive, the open sesame of all the doors to which the teacher William Osler dedicated brainy lines: work. As well as curiosity: questions with no apparent answer to address the complex. Although there must have been something in the background, because of the things I did that are worthwhile, if any were worthwhile, there were three activities very early on: the "milkmaids" —an archaic version of SAMUR— who attended emergencies in Vallecas town, shifts on weekends at the Carabanchel Alto aid house and the surgery consultation of the Social Security "quota" at the San Blas "ambulatory". Something anecdotal, but pleasant, were the substitutions at the Solán de Cabras spa. Years later, quite a few, the presidency of the Unified Commission for "toxic syndrome" or the direction of the General Hospital [Gregorio Marañón University] of Madrid would arrive.

I also quietly tried to perform the general secretariat of the Institute of Spain for too many years. From 1996 to 2003, by Royal Decree, and elected from 2010 until two weeks ago. Do you remember the *Música Callada del Toreo*, by José Bergamín Gutiérrez? It ends with a sonnet by Rafael Alberti; the first triplet of it:

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

In this and other cases, I can use what was written years ago, in 2002 exactly, by Manuel Castellet, who was president of the Institute of Catalan Studies, referring to the Institute of Spain and its general secretary, in *Llengua, ciència i cultura. Crònica d'una passió matemàtica*:

"Amb l'Institut de Espanya o, més ben dit, amb el seu secretari general, hem mantingut una estreta i cordial col.laboració que ens ha permès, sense renunciar a res, beneficiar-nos de la seva posició, Gràcies, doncs".

For his part, the man from Cadiz who bore the surname of a dear friend, Malagan - ("Rafalo") -, who left just a few months to cross the Acherón, Cabeza de Vaca, victorious, wrote in *Naufragios* that:

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

The shipwreck happened as soon as it 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

formal studies to study the rest of the curriculum on my own. Stepping on the University only for memory exams. This translated into a rather low-profile, low-flying resume. I lived in the Hospital, in an improvised room in a forgotten hole, and I learned quiet art in the General de Madrid, today a Museum, from the hand of Amador Schüller, Pedro Gómez, and the nurses Sor Teodora and Sor Dominga and from Adela Sauras. This is how my link began, strengthened after winning an exam for boarding school and the support of those two teachers, with the current Hospital Gregorio Marañón and despite my continuous departures.

The heterodox formation in Medicine allowed other activities. Flight without motor in Somosierra, Monflorite and Ocaña; with motor in Grajera. I did internships with the University Air Force (MAU) as a medical second lieutenant at the Central Air Hospital and served a period of confinement at one of the Hispanic-American airspace control bases. The "Matador" base, in Villatobas. A technological oasis in the Mesa de Ocaña, north of La Mancha Toledana. There, in 1968, I perfected my English, I learned to play tennis with the priest of the squad stationed there. And most importantly, I accessed the leading ICTs of the time in a restricted environment of high strategic value. Over the years I took a diploma in "National Defense" at the Higher Center for National Defense Studies (CESEDEN). Years later the Ministry of Defense took me in for a long time. And, why not, the ASINJA annual interdisciplinary meetings.

From Villatobas to the Thoracic Center in Sully, Glamorgan, attached to Cardiff University, in Wales. Then the jewel of thoracic pathology. After some time, he returned 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 share a "Celta".

Seen the environment —among others, the "Celtas" were infumable—, let's see other environments. Medicine aside, in Chicago, I was a regular at Alberto Pedro Calderón's Mathematics department, and at Leon Max Lederman's Physics department, who would be awarded the Nobel Prize in Physics in 1988. In the latter, he attended the Quantum Physics for Poets seminar directed by Christopher Hill, frequent visitor. Then Michigan. Finally Spain. Priority the doctoral thesis. I was able to publish it thanks to a grant from the Spanish Boxing Federation; in return, to act as a promoter of the youngsters of the golden age of Spanish boxing. A previous application to the College of Physicians was rejected as it was not considered a necessary "tool" to practice the profession. However, I agreed to an experimental surgery attaché 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 a pioneer in the epigenetic mechanisms of cancer; in San Diego, the Department of Aerospace 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-direct the Science and Law Chair at Fundación Garrigues, and, above all, in Santa Fe, New Mexico, the Santa Fe Institute for the study of complexity. The SFI —sanctum sanctorum of complexity, without neglecting the marimba groups in Santa Fe square— allowed me to taste, albeit in small portions, the 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 the Los Alamos National Laboratory; to Jerry Sabloff president of the scientific commission of the Smithsonian, or to the writer and game designer Neal Stephenson. Already in plenary session and led by 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 the strong support of Krakauer:

“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 first swords in the world scientific field, the claim to implement a "franchise" of the Complexity Center, an exceptional project, was sent to limbo... computer science. Although with respected exceptions to which I must recognize their explicit support beyond mere commitment; I am referring, among others, to Fernando Ruíz.

A paragraph. To the heave of the quoted letter from Krakauer, the dark side of the person emerges, the one marked by the flag of vanity -wasn't it raised lines ago?-. I am referring to the letter from Professor Ursula Schäfer Lamb, distinguished historian at the University of Tucson, Arizona, specializing in Latin American History, regarding my text The Madrid Mathematical Academy of Phillip II:

“Your sending the article to me is one of the best things that has happened to me for a long time”.

Through the Santa Fe Institute, I also met three great mathematicians who disappeared in 2020: John Conway, co-creator of Game Life, who died of COVID-19; the subversive Freeman Dyson, a legendary mind, a translator from physics to mathematics, and Ronald Graham, promoter of combinatronics and Euler medal, whom I followed in San Diego hand in hand with Lasheras.

About the science-art dialogue, tensegrity with mathematicians Miguel de Guzmán and Robert Connelly, and Donald E. Ingber, cell biologist and bioengineer based at MIT dedicated to cytoarchitecture. My last supervised doctoral thesis referred to a tensegrity model of the spine and its implications in the treatment of congenital deformities. After breaking some barriers, two mathematicians and a structural engineer were part of the court. A nod to the motto of the Jixia Chinese Academy —coeval of the Platonic one back in the year 380 a. C.— “innovation by opposition”.

I cannot leave out Ángel Jordán Goñi, from Pamplona, Dean of the Carnegie Institute of Technology; pioneer in robotics. Not even the Biennial Meeting of the Philosophy of Science Association, to which I have belonged, in Philadelphia in 1982, with Bruce G. Buchanan —linguist, professor of Computer Science and Philosophy, then at Stanford, now at the University of Pittsburgh— or who is the same as AI and language. Both strengthened the experience initiated in Villatobas on creative evolution. And, of course, two bookstores: León Bookstore, a cocktail bar has been occupying its premises for decades, 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 1961 Bayreuth Festival: *Das Geisterschiff*, director Wolfgang Sawallisch; soprano Anja Silja performed the most captivating "Ballad of Senta" I have ever heard. I also present my birthday in 1985: St. Peter's Basilica, Herbert von Karajan, Vienna Philharmonic Orchestra, soprano Kathleen Battle, John Paul II officiates, Mozart's "Coronation Mass". In November of the following year, the cycle of Beethoven sonatas by Daniel Barenboim at the Real; or the violin solo of Beethoven's *Missa Solemnis Benedictus* by Thomas Brandis, concertmaster of the Berlin Philharmonic. How to forget! the concerts by 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 between, an advertisement in the severed Madrid newspaper gave news of the first Molecular Biology course being organized in Spain. It was directed by Ángel Martín Municio. The bonds were soon strengthened. In his department I messed around in the laboratory, I learned Biology, I immersed myself in Flamenco —Flamenco? Yes, from Flamenco— and I taught Molecular Physiopathology which, over the years, crystallized into a Chair. Ángel Martín Municio, then elected Academician since 1982 of the Royal Spanish Academy of which he would be, 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 D. Enrique Sánchez-Monge, a pioneer in plant transgenesis, and Mr. David Vázquez Martínez, the first Spaniard on the NATO Scientific Committee, presented my candidacy for a position as Academician of the Royal Academy of Exact, Physical and Natural Sciences in June of 1983, vacant due to the death of Mr. Florencio Bustinza Lachiondo, who in 1969 had proposed Mr. Ángel. I read the reception speech —The Exact, the Physical, the Natural, and the Medicine— 37 years and two days ago, under the presidency of Manuel Lora-Tamayo. Manuel García de Viedma e Hitos and Luis García Jodra sheltered me up to the podium.

At that time —in 1973, upon his return from the USA— he had organized and directed an unprecedented Course in a Hospital on "Advances in Biology". Among others, Alberto Dou spoke about "Limitations and logical possibilities of AI", or José García Santesmases who spoke about "Neural networks, shape recognition and learning systems".

I return to the friend. During his stay at the Rijks Universiteit, in Utrecht, Martín Municio trained as a Spanish Reader. Among the regulars Leo Elders, of the van Steyl missionary congregation, he Thomist —translated the entire Aquinian work into Japanese— and precursor of what is now known as "biblical Thomism". His countenance radiated serenity and calm. What Anticlea, washing Ulysses' feet, praises:

"The calm when speaking".

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

The meeting with Don Emilio Botín marked a change of course. The pitfalls of setting up a Howard Hughes Medical Institute-type program in Spain led me to repeatedly visit the United States. 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 or David Curiel, and, on the other hand, the opportunity to take a look at the sessions of the Science advisory group of the president of the USA. Among others, Shu Chien, doctor and engineer, of the few who belong to the three academies —Science, Engineering and Medicine— of the National Science Foundation that, years later, formed the commission together with Juan Carlos Lasheras, Antonio Artés and for whom this writes for the development of the Department of Aerospace Engineering and Engineering and Biomedical Sciences by initiative of the Rector of UC3M. Also with Ayala, I was one of the eight members of the IAP (the global network of science academies)-IAC (the InterAcademy Council) joint Development Advisory Committee. Then it would be the International Advisory Committee of the Barcelona Knowledge Hub of the Academia Europaea. Years before, he had served as General Secretary of the Spanish chapter of the International College of Surgeons.

The Fundación Botín Science Program marked a before and after in the future of Spanish Science; the book 28 Histories of Biomedical Science and Innovation in Spain collects it. I learned the trade of "scouting" investigators. Knowing them in their environment, participating in their seminars, a minimum follow-up of five years, did what they did in other environments keep them in this one?

Living organizations are fluid and mobile. As a general rule, I began my classes on Surgical Pathophysiology by telling my Complutense students that such a subject, at least, was not the most important. Think, yes it is. He added that he must have known first-hand because during all those years I was the only professor of this discipline in the entire Spanish University, and the situation, it seems, continues. However, it serves as an example of the prevailing confusion. Surgical or molecular pathophysiology, or general pathology, is a mere administrative unit with various names. We must motivate the emergence not of denominations but of innovative ideas on a solid formation. But there are no disciplines. There are only problems and the drive to solve them.

Ramon Gomis, respected and admired friend -clinician, researcher, teacher... and writer of prose and theater, Award for Creation Fundació Enciclopèdia Catalana-, comments:

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

The cost of the disciplinary approach is that it restricts the scope of our questions and misses many extradisciplinary ideas that contribute to the progress of the cultural whole. We are in a period of transscience or convergence of knowledge, an expression that recalls Goethe's Divan and that recognizes the value of approximation, of the synthesis of knowledge as an institutional priority, today through exponential technologies. Society and the Academy must wake up for the full implication of this reality. Big ideas are often characterized by considerable generality. The bigger the problems, the bigger the opportunities. The mission of the Academies is to find them. The Japanese NICT did; Just six months ago, it managed to transmit via the Internet at a speed of 319 terabits sc -1.

I am not in favor of fashions, whether they are opinionated or scientific. I assume instead that simplicity, not plainness, and clarity are values in themselves. Most of the fundamental ideas of science, as a rule, can be expressed in a language understandable to everyone. I question the proliferation of experts, because "the prudent surpasses the prophet", says the Bablí Talmud. 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 train, in his field, a totipotent citizen, stem cell type, 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 humanities, I received a warning from the University for «teaching not regulated». Nor is this attitude of rejection new. Back in the 1990s I organized some "General Colloquiums" in "my" Hospital; open debate on topics of general interest. The closed-minded environment saw to its demise within a couple of years.

To clinch 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 from Colophon:

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

Too bad, retirement came and the long-awaited disciplinary correction was left unfinished. Instead, I am imbued with Project Zero at Harvard's Graduate School of Education, and the Big History Project. It remains to be noted that with the help of Ángel we tried to start up one of the first private universities in this country; but the first with a different campus, an innovative, convergent curriculum. No faculties or departments; the big themes.

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

Above all this, language is the generator of tomorrow.

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

Baruch Spinoza in *Ethica Geometrico Ordine Demosrata* writes:

"Without it men and women would not be better than falling stones".

It is impossible to imagine being without discursive opening, without the potential to question. Science Begins in the Word headlines Bertha Gutiérrez. Perhaps for this reason, Antonio Colino López, Margarita Salas Falgueras and José Manuel Sánchez Ron supported my candidacy to apply for the vacancy due to the death of Domingo Ynduráin Muñoz, at the Royal Spanish Academy. I read my entrance speech -De Calderón y Cibercirugía-, on October 29, 2006. Francisco Brines Bañó and José Manuel Bleca Perdices sponsored my entrance. Victor Garcia 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, led by Ángel Martín Municio, recently appointed deputy director and Fernando Lázaro Carreter, director of the Royal Institution since the previous year. At that time the Academy wanted to "computerize". With the collaboration of a then doctoral student in medicine and telecommunications engineering, we tackled the task.

This linguistic impulse stimulated me to find some new word that would describe part of the situation in my profession. "Numeromics" -the DLE does not include it... yet- describes numerous people who form large waiting lists, which the System intends to swallow by attending to this multitude of users in the greatest number and in the shortest possible time, without taking into account the considerable human resources and technicians for it. A word that has found its place in the great omics family: genomics, epigenomics, proteomics...numerical.

In the context of this large family, -omics, a term I cherish on a daily basis is "culturomics"; neither, yet, in the DLE. The original word -culturomics- first appeared in the seminal article by Erez Lieberman -whom I came into contact with via SFI- and Jean-Baptiste Michel, along with eleven variegated contributors and The Google Books Team, published in Science magazine 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 managed corpus was made up of 500 billion (x 10⁹: m M) words; in English (361mM), French (45mM), Spanish (45mM), German (37mM), Russian (35mM), Chinese (13mM), and Hebrew (2mM). This cloud computing involves at least virtual reality, artificial intelligence and big data. Lines back, I indicated my encounter with AI and language during the meeting of the Association for the Philosophy of Science in Philadelphia, in 1982. Recall at this point the course of 1973, at the Hospital; There was already talk of AI. In 2015 I joined, representing the Institute of Spain, the Committee of Experts for the Promotion of the Natural Language Industry (Secretariat of State for Telecommunications and for the Information Society. Ministry of Industry, Energy and Tourism).

He had already fine-tuned the first weapons with the ill-fated *Enciclopedia Hispánica*, a kind of «propædia», by Espasa-Calpe. An attempt to connect the totality of available knowledge; chosen a word to reach the farthest, apparently unrelated, following a logical path. At the Frankfurt Book Fair, back in 1991, Espasa received an international distinction for an exhibition, presented by the writer of this, in relation to the neuronal universe. Also, remember the encounter with the Pirahã language and the work of the linguist Daniel L. Everett during my stay in Medellín through the Caro y Cuervo Institute; or the direction for years of the ARBOR magazine of the CSIC.

A paragraph. Years ago, I had contacted Óscar González Quevedo Bruzan, the Jesuit "Father Quevedo" who introduced the *Isso non ecziste* in parapsychology. He had settled in Brazil in the 1950s. Together with him I tried to create a "traditional medicine" unit that, as expected, did not prosper. He died without seeing him in Belo Horizonte.

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

Therefore, we must decide. Mark Twain or Niels Bohr or..., the authorship is not clear, commented:
"Predictions are very difficult to make, especially when dealing with the future".

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

"I have seen the future and its 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 return to the beginning. Memories, which are names and situations. It was worth it.

I conclude from the hand of D. Antonio:

"The adjective and the noun,
backwaters of clean water,
they are accidents of the verb
in lyrical grammar,
of today that will be tomorrow,
the Yesterday that is Still".

But "tomorrow is always late," Federico Mayor titled.

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

Peace and Good.

Curriculum vitae

[resumen]

Pedro R. García Barreno.

Madrid, 23 octubre 1943. Casado (Manuela Diez Lorenzo); dos hijos (Alberto y Ricardo), una hija (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 North American University of Michigan State & Wayne State (Detroit Receiving Hospital, Detroit) and Texas (MD Anderson Cancer Center, Houston). Biochemistry and Molecular Biology, Faculty of Chemical Sciences and Differential Equations, Faculty of Mathematics, Complutense University. Electron microscopy, National Center for Microbiology. Preclinical studies of Veterinary Medicine, Faculty of Veterinary Medicine, Complutense University. Music theory and piano studies, and flight (international card). Diploma in National Defense from the CESEDEN-High Defense Staff, in Medical Informatics from the Institute of Informatics of the former Ministry of Education and Science, and in Direction and Management of R&D from the School of Higher Public Function of the National Institute of Public Administration. Master in Business Administration (M.B.A.), Instituto de Empresa, Madrid.

Actual position

Honorary Professor (2017-2022), Complutense University of Madrid. Delegate of the Rector of the Carlos III University of Madrid for «Engineering and Biomedical Sciences». Full member of the Royal Academy of Exact, Physical and Natural Sciences (1984, medal number 11) and of the Royal Spanish Academy (2006, seat «a») of which he is Secretary (January 2022). Supernumerary academic of the Royal Academy of Doctors of Spain. Honorary Academician of the Royal Academy of Sciences, Fine Arts and Noble Arts of Córdoba. Corresponding Academician of the Royal Academy of Medicine of Galicia and the Academy of Medical Sciences of Bilbao. Scientific adviser of the “Botín” Foundation. Co-director – Francisco J. Ayala, Science & Law Chair, Fundación Garrigues. President, Advisory Committee of Arquímea group. Member, International Advisory Committee, Academia Europaea / Barcelona Knowledge Hub (BKH). Fellow Member, InterAmerican Medical and Health Association.

Positions held

Emeritus Professor, Complutense University (2014-2017). He ran the Chair of Surgical Physiopathology and Propaedeutics 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 Physiopathology in the Department of Biochemistry and Molecular Biology of the Faculties Chemistry and Biology, from the Complutense University. Visiting professor in the Department of Mathematical Analysis of the Complutense Faculty of Mathematics. Senior consultant and Head of Department at the Hospital General Universitario Gregorio Marañón in Madrid, of which he was the Medical Director, Deputy Director of Research and Clinical Head of

General Surgery. Category C for the use of animals for experimentation and other scientific purposes. External professor, Master in Science & Law, National University of Distance Education. Delegate of the Rector of the University of Cantabria for "Singular Projects". He held the positions of Director of the National Plan for the Prevention of Disabilities, President of the National Commission for Toxic Syndrome and Director of the Military Health Unit of the Ministry of Defense. Vice President, Scientific Research Ethics Committee, Community of Madrid. General Secretary 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 Botín Foundation Science Program. Patron of the "Vodafone" Foundation. Patron of the "Antonio de Nebrija" University. Member of the Scientific Advisory Board of the Center for Biomedical Technology (CTB), Polytechnic University of Madrid. Member of the academic councils of the Foundation for Research on Law and Business (FIDE), and of 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 at 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 ARBOR magazine of the CSIC. Member of the Committee of Experts for the Promotion of the Natural Language Industry (Secretariat of State for Telecommunications and for the Information Society. Ministry of Industry, Energy and Tourism). Chair, Clinical Translation & Innovation Committee, Institute for Bioengineering of Catalonia (IBEC). Head of the Surgical Team (General Surgery) of the Social Security, and Numerary Physician of the Municipal Charity of Madrid. Medical Ensign, Central Hospital of the Air Force.

Distinctions.

Medal of Honor, Carlos III University of Madrid. Library «Prof. Pedro García Barreno», Faculty of Medicine, Complutense University. Medal of the Department of Surgery, Faculty of Medicine, Univ. Complutense. «Tribute to Pedro García Barreno. Peace and good. Biomedicine in Spain and Pedro García Barreno», J. Ávila, J.J. Guinovart, M.T. Miras, ed., Madrid: Realigraf, 2010. "Countess of Fenosa for Surgical Research", "Scientific Foundation of the Spanish Society Against Cancer" and "Business Innovation Award of the Union of Entrepreneurs-Chamber of Commerce". Tribute to "Academic Seniority 2021", Institute of Spain. 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. Ortíz), 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 Studies of Education, Technology and Education, Interdisciplinary José de Acosta (ASINJA) and Medical -Cybernetics. Honorary Member of the Spanish Association of Technical Specialists in Scientific Photography. From the international ALDEEU (Association of Spanish Graduates and Doctors in the USA), American Association for the Advancement of Science, American Society of Zoologists-Comparative Physiology & Biochemistry, Animal Behavior 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), Philosophy of Science Association (USA), Royal Society of Medicine (Lond., UK), 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 bases of the disease. The doctoral thesis focused on shock situations; a serious clinical picture; its inflammatory variant is still associated with >50% mortality. The works published during the second half of the 1970s and the first half of the 1980s provided data that helped define and understand the condition as two differentiated 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 amount of the dose has been reviewed, the administration of corticosteroids in states of inflammatory shock is current and fully admitted (Crit. Care, 2017). The standard treatment of seriously ill patients with COVID-19 includes the administration of steroidal anti-inflammatory drugs. Starting in the early 1990s, interest focused on the study of first-line biosensors —leukocytes— of the various aggressions it suffers on a daily basis, as well as response systems —stress proteins (HSPs: Heat shock proteins)—which allow an early diagnosis of the injury. The genetic classification of individuals —molecular epidemiology— is essential to predict their resistance or predisposition to suffer from different common pathologies, such as the common cold or atherosclerosis. These works were recognized by the foundations of the Spanish Association Against Cancer and the Countess of Fenosa-Barrié de la Maza.

Mechanical circulatory assistance. Approached from a surgical perspective, it had various experiments on isolated organs as background, which were later taken up again. It began in 1982 as support for the Hospital's Cardiac Surgery Service: the incorporation of circulatory assistance devices into the clinic. The initial objective was the design and development of a control console prototype for a commercial artificial ventricle. Given the favorable results achieved and the difficulty of access to such technology in our environment, the line of research was expanded towards 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 SA ®) and extramural collaboration in the field of fluid mechanics (Fundamental Physics Department, UNED) and biomedical materials (Inst. Plastic Materials, CSIC), the construction of a complete electro-mechanical circulatory assistance system. The "BCM Project (Biomed-Comunidad de Madrid)" incorporated a new concept —"false atrium"—, not used until then in devices of this class and which basically consists of incorporating a compliance chamber in the cannula of entrance to the ventricle; this facilitates its filling and decreases hemolysis, the main limiting factor of artificial circulation. After overcoming the requirements —the group accepted the conditions of the FDA (Food & Drug Administration) of the USA as there are no approved Spanish or European regulations— in computational models, test bench and after more than one hundred experiences with sheep, acute and chronic diseases, authorization was requested from the Ministry of Health for the clinical trial. Such a trial consisted of ten human implantations. The first intervention in a patient was carried out on July 1, 1989, ending the clinical trial in December 1991 with a favorable result. From that moment and once the development phase was completed, the company involved in the project from the beginning took charge of the industrial manufacturing process and the marketing of the device and the control console. The objective of the artificial

ventricle—single or double—is to guarantee cardiac function for periods between hours and a maximum of two months, pending access to a heart transplant. Sometimes, the rest imposed on the heart muscle by mechanical assistance manages to reverse heart failure, displacing the transplant.

Medical image. Based on the first works of clinical surgical research—angiography of the splanchnic portal venous system through catheterization of the umbilical vein and external omphalo-saphenous shunt—a third topic of work is oriented towards research on medical imaging techniques, both for the development of new technologies and processing methods as well as their practical application. The research, organized in 1994, has a markedly multidisciplinary and multicenter character, and facilitates a strong connection with clinical reality, which allows guiding the choice of work topics based on real needs derived from patient care. A powerful research team was created and consolidated, making 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 (University Hospitals of Utrecht, Tübingen and the Catholic University of Louvain, Heidelberg Cancer Research Center and the Institute of Cancer Research of the Royal Marsden Hospital) and academic (University of Hamburg Computer Science, University of Sheffield AI Vision Research, Technical University Aachen, University of Genova Institute of Computer Science and Computer Vision Research Group Utrecht). The project, named COVIRA (COmputer VIsion in Radiology) was the first attempt, of which there is evidence, to incorporate expert systems for the recognition and segmentation of medical images. The project, very advanced for its time and the result of its great scientific repercussion, was, exceptionally, extended in the third Framework Program. In the course of the project, techniques were developed, pioneers in the image process, which are now consolidated. Subsequently, alliances were established with SUINSA® (Madrid). Areas of interest: a) Magnetic resonance imaging. b) Multimodality image integration. c) Quantification of functional cardiac images by tissue Doppler technique (DTI) or using intravascular echo-enhancing contrast agents. Several algorithms and computer tools have been developed that have given rise to technology transfer contracts with the manufacturer ACUSON® in the USA. d) Telemedicine: Participation in several European projects on Telemedicine. In 2002, it developed a teleradiology station called Telra, the object of a technology transfer contract with the company SUINSA®. e) High resolution image in laboratory animals. High-resolution PET and CT molecular imaging systems have been developed and transferred to industry (Suinsa-General Electric). As a curiosity to comment that 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 2004 Innovation Award from the Union of Entrepreneurs of the Chamber of Commerce and Industry.

Epidemiological investigation. 1982. From the Presidency of the National Plan for Toxic Syndrome due to denatured oil, new techniques were developed to try to determine the xenobiotic causing it, in addition to promoting epidemiological surveillance in Spain. 1985. The direction of the National Plan for the Prevention of Subnormality demanded the assembly of massive microanalytical techniques that culminated in the coverage of 98.5% of newborns and allowed the controlled entities to be expanded 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, to develop a susceptibility map. To this should be added the work indicated in the first section on molecular epidemiology.

Continuing Education. 1993. First master's degree in Spain in “laparoscopic techniques” (Med. Cir. Exper. Hospital Gral. Madrid – UCM Dept. Surgery). Editions: 1993, 1994, 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 minipigs corresponding to three homozygous strains for three specific antigens of the major histocompatibility complex. This forced the construction of an animal facility on the land of Monte de Valdelatas under the auspices of the Provincial Council of Madrid. The result of the collaboration with the CBM was the involvement 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 for the animals located there and the possibility of accessing selected surpluses for experimental research.

Convergence: STEAM (Science, Technology, Engineering, Arts, Mathematics). In 2000, from the direction of the Science Program of the Botín Foundation, launch of the first coordinated project, at the national level, of biotechnology transfer that led to the creation of companies and a venture capital fund. Reference: Program of the Howard Hughes Foundation, USA. 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 Department that, at present, requires for its I entered one of the higher 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, USA 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: “The repermeabilization of the umbilical vein as a means 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”, *Proceedings 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 [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 subject ten years after its publication]. “Tensegrity. Architecture, Art and Biology”, *Live Architecture* 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 uses 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 last one: “Reliability of the technique for calculating the acceptable level of results in multiple choice tests”, *Medical Education* 2017; 18(1):61-66.

Books (selection).

Science in Your Hands, Madrid: Espasa Calpe, S.A., 2000. *Fifty Years of DNA. The Double Helix*, Madrid: Espasa Calpe, S.A., 2003. *Introduction to the Study of Experimental Medicine. Claude Bernard*, Barcelona: Critique-Classics of Science and Technology, 2005. *The Legacy of Hippocrates. The Great Topics of Medicine*, Madrid: Espasa Calpe, S.A., 2008. *Paths of Knowledge, V. Physiopathology Topics*, Madrid: PRGB, S.L., 2013. *COVID-19 Meditations*. March 2020-March 2021, Madrid: PRGB, S.L., 2021.

Summary.

Hospital career: 5 / 5. Teaching career: 4 / 5. Six-year research period: 6 / 6.



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